



NANDHA POLYTECHNIC COLLEGE

Erode - 52



Nandha Polytechnic College
வெள்ளி விழா ஆண்டு

Approved by AICTE, New Delhi, DOTE, Chennai. | Phone: 73737 14477



Tech Campus



Courses Offered

- Diploma in Agricultural Engineering
- Diploma in Automobile Engineering
- Diploma in Civil Engineering
- Diploma in Computer Engineering
- Diploma in Electronics & Communication Engineering
- Diploma in Electrical & Electronics Engineering
- Diploma in Mechanical Engineering
- Diploma in Petrochemical Engineering

10th

Model Q&A

Maths

Science

Social Science

www.nandhapolytechnic.org

Our College Placement Details (2023 - 24)

Placement Details (Date wise)

Date	Company	Offers
15-Nov-23	SPIC INDIA PVT LDT	4
13-Dec-23	BIRLA PAINTS, CHENNAI	4
22-Jan-24	Brakes India Ltd	58
25-Jan-24	ORCHID PHARMA	7
30-Jan-24	AQUA SUB	34
01-Feb-24	NS INSTRUMENT	25
05-Feb-24	SANMAR GROUP	4
03-Feb-24	PALLAVAA GROUP	17
12-Feb-24	TVS, CHENNAI	47
14-Feb-24	ROYAL ENFIELD, CHENNAI	60
15-Feb-24	NOKIA, CHENNAI	64
16-Feb-24	L&T, COIMBATORE	9
22-Feb-24	HYUNDAI, CHENNAI	31
08-Mar-24	ART AQUA TECHNOLOGIES, Tirupur	12
11-Mar-24	TAFE ACCESS LTD(TAL)	20
01-Mar-24	FOXCONN TECHNOLOGIES PLTD	5
01-Mar-24	JUST DIAL	4
07-Mar-24	PIONEER IN DIGITAL SURVEY	12



Diploma Award Ceremony



First Place in State Level



Volley Ball Winner (South India)



Our Renowned Alumni @

2004 Batch



ARUN K ANURAK
Engineer in Petrovietnam, FPSO, Vietnam.
Salary : 104 Lakhs per Annum

2008 Batch



MOHANRAJ P
2008, Capgemini, USA
Salary : 50 Lakhs per Annum

2010 Batch



MELBIN TOM
2021, BMW, Abudhabi Motors
10.2 Lakhs P/A

2009 Batch



RAVI PALANI
Design Engineer,
Salary : 16 Lakhs Per Annum

Nandha Scholarship for 2025-26 Academic Year based on the following criteria

- 10th / 12th Marks Basis
- Blood relation studied in Nandha Student
- Family Background
- Single parent
- Free education for SC/ST Students
- Sports achievements





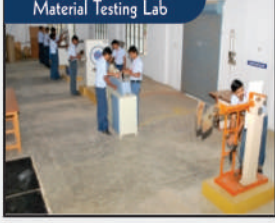
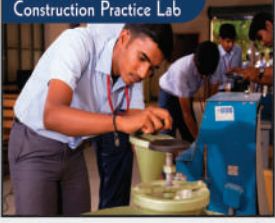
நந்தா பாலிடெக்னிக் கல்லூரி

கட்டிட பொறியியல் துறை
(CIVIL ENGINEERING)



Nandha Polytechnic College
வெள்ளி விழா ஆண்டு

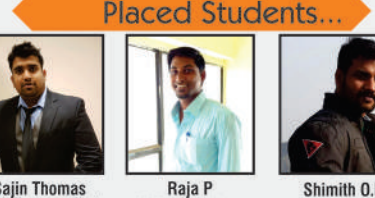
சீவில் துறை ஆய்வகங்கள்



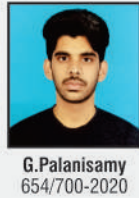
Highest Salary **3.6**
Lakhs Per Annum

396
Placement Offers
in
24
Companies

எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில



M. Prakash
689/700 - 2017



S. Mukilan
691/700 - 2018



Sajin Thomas
2012, Transport Dept,
Newyork, USA
(7.2 Crores P/A)



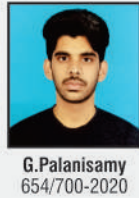
Raja P
2012, IOT, Gujarat
(6.5 Lakhs P/A)



Shimith O.P
2012, Careworks Foundation
Bangalore (6.5 Lakhs P/A)



D. Girishkumar
641/700 - 2019



G. Palanisamy
654/700-2020



Jaslu Rahman
2015, Building Contractor
(5.5 Lakhs P/A)



Sawan Kumar Razak
2017, PWD, Chennai
(5 Lakhs P/A)



Nandha Kumar A
2012, Green Infrass
Erode (3.2 Lakhs P/A)

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- IOT, Gujarat
- L&T, Chennai
- Renaatus Projects Pvt Ltd
- URC Constructions, Chennai.
- Tata Builders
- RCCL, Chennai
- Careworks Foundation, Bangalore
- Venkateswara Constructions
- Tambaram.
- Green Infrastructures
- Teemage Precast



நந்தா ஏன்?

- நந்தா பாலிடெக்னிக் கல்லூரியில் படித்து முடித்தவுடன் தகுதிக்கேற்ற 100% வேலை வாய்ப்பு
- நந்தா பொறியியல் கல்லூரியில் படிக்க முன்னுரிமை



நந்தா பாலிடெக்னிக் கல்லூரி



தானியங்கி பொறியியல் துறை (AUTOMOBILE ENGINEERING)

Establishment in - 2004 (18 Batch Passed Out)

ஆட்வொமைபல் ஆய்வகங்கள்



Highest Salary **3.6**
Lakhs Per Annum

396
Placement Offers
in
24
Companies

எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில

Private

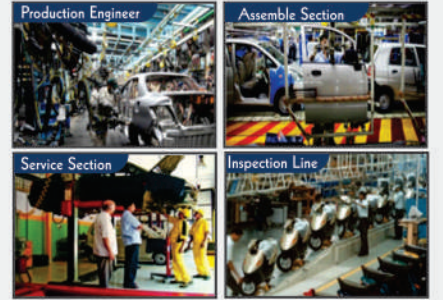
- E - VEHICLE INDUSTRIES
- SPARES AND TOOLS
- HYUNDAI
- ROYAL ENFIELD
- BRAKES INDIA P LTD
- TVS
- ROOTS
- ROBERT BOSCH
- GENERAL AUTOMOBILE
- GENERAL MECHANICAL

Government

- TNPSC(Diploma)
- TNSTC
- RTO
- RAILWAYS
- DEFENCE
- NAVY
- AIRWAYS

OTHERS

- WHEEL BALANCING
- WHEEL ALIGNMENT
- BODYSHOP WORK
- 2 & 3 WHEELER SERVICING
- LIGHT VEHICLE SERVICING
- AUTOMOBILE DESIGNING



Academic Topper...



Dharanidharan. G
676/700 - 2021



Shankarvel. S
696/700 - 2021



Tamilselvan P. R
678/700 - 2022



Sivaprakash N
680/700 - 2023

Placed Students...



Felix Raja R
2013, N.S Instruments, Chennai
5.5 Lakhs P/A



Manikandan D
2015, Titanium, Bangalore
6 Lakhs P/A



Ashok Kumar G
2015, Royal Enfield, Chennai
4.2 Lakhs P/A



Aravinth C
2018, Hyundai, Chennai
2.8 Lakhs P/A



Melbin Tom
2021, BMW,Abudhabi Motors
10.2 Lakhs P/A



Mathivanan P
2022, Brakes India, Chennai
2.5 Lakhs P/A



Moulishankar M
2018, Brakes India, Chennai
2.5 Lakhs P/A



Satheshkumar .K
2018, Brakes India, Chennai
2.5 Lakhs P/A



R. Arun kumar
2020, Hyundai, Chennai
2.5 Lakhs P/A



N. Mathivathanan
2020, Hyundai, Chennai
2.5 Lakhs P/A



Bharani M
2022, Royal Enfield, Chennai
2.5 Lakhs P/A



Sundar A
2022, Apollo Tyres, Chennai
3 Lakhs P/A

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- Indian Oil, Mumbai
- Ford, Chennai
- Hyundai, Chennai
- Royal Enfield, Chennai
- Lucas TVS, Chennai
- Sundram Fasteners, Chennai
- Brakes India, Chennai
- Essar Steel, Gujarat
- Larsen & Toubro, Coimbatore
- Apollo Tyres, Chennai
- L.G.B, Coimbatore
- L.M.W, Coimbatore



நந்தா ஏன்?

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நந்தா

பாலிடெக்னிக் கல்லூரி



Nandha Polytechnic College
வெள்ளி விழா ஆண்டு

DME

இயந்திரவியல் பொறியியல் துறை

(MECHANICAL ENGINEERING)

Establishment in 1998 (24 Batches - Passed Out)

மெக்கானிக்கல் துறையின் சிறப்பம்சங்கள்...



Industrial Visit



Department Tour



Our Students Won
First Prize in Table Tennis

Highest Salary **3.6**
Lakhs Per Annum



எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில

வாரிய தேர்வில் மாநில அளவில் சாதனை புரிந்த மாணவர்கள் சிலர்

Private

- Production Technician
- Maintenance Technician
- Quality Control Inspector
- Design Technician
- Sales Engineer
- Service Engineer
- Oil and Gas Industries
- Mining Industries
- Manufacturing Industries
- Power Generation

Government

- TNPSC
- TNEB
- TNSTC
- Tamilnadu Fire & Rescue service
- BHEL, Trichy
- RRB(Technical)
- Chennai Metro Rail Corporation
- NAVY(Technical)
- TNPL(Technical)

OTHER

- CAD Design (Autocad,SolidWorks, Autodesk Inventor)
- Finite Element Analysis (ANSYS, Abaqus)
- Computational Fluid Dynamics (OpenFOAM, Fluent)
- Robotics and Mechatronics
- Aerospace Engineering
- Automotive Engineering
- Biomechanical Engineering
- Energy Systems



Kalaiselvan .C
592/600 - 2009



Sudhakaran .D
596/600-2012



Jayachandran .M
689/700- 2016



Jeeva M
689/700-2020

மத்திய மற்றும் மாநில அரசு துறையில் பணியாற்றும் எங்கள் மாணவர்கள்...

Renowned Alumnus



Prem kumar A
Station Controller
Chennai Metro Rail Corporation,



Saravanan S
deputy engineer
BHEL,Trichy



Vijayakumar P
Loco Pilot
Southern Railways



Premnath .E
2009, Denholm Steel,
Abu Dhabi (9 Lakhs P/A)



Biju B
2010, Essar Steels, Gujarat
(5 Lakhs P/A)



Yogarajan S
2012, Brakes India, Chennai
(7.5 Lakhs P/A)



Dilipkumar .K
2014, L & T CBE
(4.5 Lakhs P/A)



S. Sankar
2015, Royal Enfield, Chennai 2017,
Royal Enfield, Chennai
(4.5 Lakhs P/A)



Nandha Kumar .S
2017, Royal Enfield, Chennai
(2.5 Lakhs P/A)



Parthipan A
Deputy Engineer
TNSTC,karur



Deepak R
Fireman
Tamilnadu Fire &
Rescue service



Subash D
Record Assistant
Taluk Office, Dharapuram



Hariprasath .M
2018, Essar Steels, Gujarat2019.Saint-Gobain, Chennai
(2.5 Lakhs P/A)



Nandhakumar .S
(2.5Lakhs P/A)



Dineshkumar.S
2020,Hyundai, Chennai2022,Tuticorin Alkali Chemicals, 2023.Hyundai Motors,
(2.5 Lakhs P/A)



Shanmuga Sundar Raja G
(2.3 Lakhs P/A)



Dhanayendhira prabhu P
2023.Hyundai Motors,
(2.5 Lakhs P/A)



Kishore v
2024,Aditya Brila,
(3.3 Lakhs P/A)

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- Spic, Tuticorin.
- Royal Enfield, Chennai
- Brakes India. Pvt. Ltd, Chennai
- Hyundai, Chennai
- Lucas TVS, Chennai
- Saint Gobain, Erode
- Turbo energy Pvt LTD, Chennai
- Aditya Birla Group, Chennai
- NS Instruments India pvt ltd
- Schneider Electricals, Chennai



Why DME @ Nandha

- படித்து முடித்தவுடன் தகுதிக்கேற்ற 100% வேலை வாய்ப்பு
- பாடத்திட்டத்துடன் வேலைவாய்ப்பு திறன்களை வழங்குதல்
- உயர்தர ஆய்வக வசதிகளுடன் செய்முறை பயிற்சி



நந்தா பாலிடெக்னிக் கல்லூரி



வேளாண்மைப் பொறியியல் துறை
(AGRICULTURAL ENGINEERING)
Establishment in - 2021

வேளாண்மை துறை ஆய்வகங்கள்

உழுவோம்! உயர்வோம்!



Highest Salary **3.6**
Lakhs Per Annum

396
Placement Offers
in
24
Companies

மாணவர்களின் களப்பயிற்சி



Academic Topper...

Placed Students...



பாடப்பிரிவின் சிறப்பம்சங்கள்

வேலைவாய்ப்புகள்

1. வேளாண் பயிர் உற்பத்தி (Crop production)
2. நில அளவீடு, வேளாண் நிலத்தை செம்மைப்படுத்துதல். (Surveying & Levelling)
3. மண் மற்றும் நீர் மேலாண்மை (Land & Water Management)
4. புதிய நீர் பாசனத் தொழில்நுட்பம் (New Irrigation Methods)
5. விவசாய கருவிகளை கையாளுதல் மற்றும் உற்பத்தி (Crop Tool Handling Methods & Maintenance)
6. அறுவடையில் புதிய யுக்திகளையும், தொழில்நுட்பங்களையும் கையாளுதல் (Farm Machinery)
7. உணவுப்பொருட்களை பதப்படுத்துதல் மற்றும் மேலாண்மை (Food Processing)
8. மின்சார வாகன தொழில்நுட்பம் (E vehicle Technology)

1. ராசி சீட்ஸ்
2. ஜெயின் Irrigation
3. ரூட்ஸ் Irrigation
4. அக்ரோ கார்ப்ஸ் இந்தியா விமிடிட்
5. மகேந்திரா & மகேந்திரா விமிடிட்.
6. TAFE விமிடிட்
7. KUBOTA விமிடிட்.
8. Sugar Factory
9. Food Processing Industries

- ▲ வேளாண் கள அலுவலர்
- ▲ உணவு பதப்படுத்துதல்
- ▲ வாங்கிகளின் வேளாண் கடன் அதிகாரி
- ▲ நீர்பாசனத்துறை
- ▲ வேளாண் கருவி தயாரிப்பு நிறுவனங்கள் (டிராக்டர், சொட்டுநீர்கருவிகள், அறுவடை இயந்திரங்கள்)
- ▲ இயந்திரவியல் துறை சார்ந்த வேலைகள்





நந்தா

பாலிடெக்னிக் கல்லூரி



மின்னியல் மற்றும் மின்னணுவியல் துறை (ELECTRICAL & ELECTRONICS ENGINEERING)

Establishment in 1998 (24 Batches - Passed Out)

எலக்ட்ரிக்ஸ் துறை ஆய்வகங்கள்



Electrical Lab



Control of Machines Lab



Electronics Lab

Highest Salary **3.6**
Lakhs Per Annum



எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில

Private

- SIEMENS
- ABB & L&T
- SCHNEIDER
- ELECTRIC
- ZOHO
- BANKING
- ROBERT BOSCH
- ALSTOM
- TEXTILE INDUSTRIES
- GENERAL ELECTRIC

Government

- TNPSC(Diploma)
- TNEB(TA & JE)
- PWD (AE Electrical)
- RRB(Technical)
- BSNL(JTO)
- INDIAN
- NAVY(Technical)
- POWER PLANTS
- TNPL(Technical)
- NALCO

Electrical Auditing

- Electrical C-LICENSE
- ELECTRICAL INSPECTOR
- ENERGY AUDITOR
- ENERGY MANAGEMENT & AUDIT



Placement Status

Academic Year	2023-2024	2022-2023	2021-2022
No. of Students Placed	35	30	41
Total No. of offers	142	54	71
Single Offers	35	20	31
Multiple offers	107	10	10

Academic Toppers...



Ajay S
"O" Grade - 2024



Jana Bharathi R
"O" Grade - 2023



Vijay M
"A++" Grade - 2024



Arunachalam S
635/700- 2024



Basanth J
685/700- 2023



Karthickraja M
700/700- 2022

Renowned Alumnus



Boopathi P
2011, Emirates Global Aluminium, Dubai
(17.4 Lakhs P/A)



Vijayakumar S
2010, Apollo Tyres, Chennai
(11 lakhs P/A)



Suhail Bascha A
2011, Complete Care, Dubai
(9.6 lakhs P/A)



Vijaya Prasanth K.S
2011, IBM, Bangalore
(6 lakhs P/A)



Arunkumar VS
2012, Baker Hughes, Chennai
(16 lakhs P/A)



Thatchinamoorthi R
2014, Libyan Iron and Steel Company, Libya
(18 lakhs P/A)



Rajasri K
2015, TNEB Bhavani
3.5 Lakhs P/A



Eldo Basil
2017, Orman Refineries
(11.2 lakhs P/A)



Nandha Kumar R
2016, Johnson Elevator, Delhi
(4.4 lakhs P/A)



Harirajan V
2018, Performance Chemiserve Limited
(8 lakhs P/A)



Gopinath S
2022, Birla Opus Chennai
(3.6 lakhs P/A)



Shalini M
2023, ALSTOM Coimbatore
(3 Lakhs P/A)

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- Birla Opus Paints, Cheyyar.
- SPIC, Tuticorin.
- TAC Fertilisers Ltd, Tuticorin.
- NS Instruments India Pvt Ltd, Chennai.
- Saint Gobain, Perundurai.
- Schneider Electric India Pvt Ltd, Chennai.
- Hyundai Motors India Limited, Chennai.
- Royal Enfield, Chennai.
- Apollo Tyres, Chennai.
- ALSTOM, Coimbatore.



Why EEE @ Nandha

- படித்து முடித்தவுடன் தகுதிக்கேற்ற 100% வேலை வாய்ப்பு
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- உயர்தர ஆய்வக வசதிகளுடன் செய்முறை பயிற்சி



நந்தா

பாலிடெக்னிக் கல்லூரி



மின்னணுவியல் மற்றும் தொலைதொடர்பியல்
பொறியியல் துறை

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Establishment in 2002 (20 Batches - Passed Out)

எலக்ட்ரானிக்ஸ் ஆய்வகங்கள்



Highest Salary **3.6**
Lakhs Per Annum



எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில

Private

- CENTUM ELECTRONICS
- SIEMENS
- SCHNEIDER ELECTRIC
- ZOHO
- ROBERT BOSCH
- ALSTOM ELECTRONICS
- TATA ELECTRONICS
- GENERAL NETWORKING

Government

- TNPSC(Diploma)
- TNEB(TA & JE)
- PWD (AE Electrical)
- RRB(Technical)
- BSNL(JTO)
- ISRO
- NAVY(Technical)
- TNPL(Technical)

Others

- VLSI
- EMBEDDED
- PCB DESIGNING
- CIRCUIT TROUBLE SHOOT
- HARDWARE SERVICE
- MOBILE SERVICE



Academic Topper...



RAMYA M 673 / 700 - 2021
VARSHINI A 679 / 700 - 2022



GOKUL S 671 / 700 - 2023
HARIHARAN S 671 / 700 - 2023

Placed Students...



Thamarai Selvi K
2021, Brakes India, Chennai, 3.40 Lakhs P/A



Ezhilarasan R
2020, Nokia, Chennai, 3.55 Lakhs P/A



Namira N
2020, Nokia, Chennai, 3.55 Lakhs P/A



Ramachandiran K
2020, TVS Training & Services, Chennai, 4.10 Lakhs P/A



Kaviraja B
2020, Hyperband Chennai, 4.42 Lakhs P/A



Ponraj P
2023, Centum Electronics, Bangalore, 2.95 Lakhs P/A



Santhosh B
2023, Centum Electronics, Bangalore, 2.5 Lakhs P/A



Manoj R
2022, Turbo Energy Ltd, Chennai, 2.95 Lakhs P/A



Deepika B
2022, Apollo Tyres, Chennai, 2.18 Lakhs P/A



Ajith A
2022, Royal Enfield, Chennai, 2.91 Lakhs P/A



Keerthana S
2022, Brakes India, Chennai, 3.12 Lakhs P/A



Harini S
2021, Brakes India, Chennai, 3.40 Lakhs P/A



Prasanya K
2023, Brakes India, Chennai, 2.12 Lakhs P/A



Vigneshraj V
2023, Royal Enfield, Chennai, 2.12 Lakhs P/A

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- HCL INFOSYSTEM LTD
- TCS, CHENNAI
- CTS, BANGALORE
- APOLLO TYRES
- SCHNEIDER INDIA PVT. LTD
- EUREKA FORBES
- BRAKES INDIA PRIVATE LIMITED
- DELTA TECHNOLOGIES
- COOPER BUSSMAN PVT LTD
- AVALON TECHNOLOGIES
- ROYAL ENFIELD
- LUCAS TVS



நந்தா ஏன்?

- நந்தா பாலிடெக்னிக் கல்லூரியில் படித்து முடித்தவுடன் தகுதிக்கேற்ற 100% வேலை வாய்ப்பு
- நந்தா பொறியியல் கல்லூரியில் படிக்க முன்னுரிமை



நந்தா பாலிடெக்னிக் கல்லூரி



கணினி பொறியியல் துறை (COMPUTER ENGINEERING)

Establishment in 2001 (21 Batches - Passed Out)

கணினி ஆய்வகங்கள்



Highest Salary **3.6**
Lakhs Per Annum

396
Placement Offers
in
24
Companies

எங்களது துறை சார்ந்த வேலை வாய்ப்புகள் சில

Private

- AWAST SOFTWARE
- CAPGEMINI
- TECH MAHINDRA
- ZOHO
- TATA CONSULTANCY SERVICES
- DELL
- HCL
- GENERAL NETWORKING

Government

- TNPSC(Diploma)
- BANKING
- CO OPERATIVE EXAM
- JEWEL APPRISAL
- ISRO
- TNPL
- INDIAN POSTAL
- BHEL

Others

- HARDWARE AND SERVICEING
- VIDEO/AUDIO EDITING
- GRAPHIC DESIGNER
- WEB DESIGNER
- 2D/3D ANIMATION
- HARDWARE SERVICE



Academic Topper...



Asha Devi K S
691 /700 - 2019



Madhumitha S
700/700 - 2021



Dharshini S
700/700 - 2021



Irshad.K
693 /700 - 2016



Madhu Bala .R
698 /700 - 2018



Jameela S
698 /700 - 2018

Placed Students...



Mohanraj P
2008, Caggemini, USA
50 Lakhs P/A



Bharathkumar R
2008, CTS, Chennai
10 Lakhs P/A



Ramamoorthy.P
2008, Saama Technologies
P Ltd, 18Lakhs P/A



Devakanth R
2009, Nuwan Tech
Chennai 8Lakhs P/A



Praveen E
2010, Radian Info Sys
CBE 5.2 Lakhs P/A



Shahad
2013, Actor & Director
Kerala



Pradeep D
2009, IBM, Chennai
5.5 Lakhs P/A



Asoahvarman
2009, CTS, Bangalore
6.5 Lakhs P/A



Suresh B
2010, Accenture, Chennai
5 Lakhs P/A



Suganya R
2010, Wireless Startup
Chennai 4.5 Lakhs P/A



Venkatesh .T.A
2016, Wipro, Bangalore
4 Lakhs P/A



Dhamodhiran J
2022, Avasoft, Chennai
3 Lakhs P/A

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- Tech Mahindra
- TCS
- Schneider Electric India Private Ltd
- Cognizant Technical Solutions.
- Lucas TVS
- Wipro Technologies
- ZOHO
- Capgemini



நந்தா ஏன்?

- நந்தா பாலிடெக்னிக் கல்லூரியில் படித்து முடித்தவுடன் தகுதிக்கேற்ற 100% வேலை வாய்ப்பு
- நந்தா பொறியியல் கல்லூரியில் படிக்க முன்னுரிமை



நந்தா

பாலிடெக்னிக் கல்லூரி

பெட்ரோகெமிக்கல் பொறியியல் துறை

(PETROCHEMICAL ENGINEERING)

Establishment in 1998 (24 Batches - Passed Out)



Nandha Polytechnic College
வெள்ளி விழா ஆண்டு

Petrochemical Engineering Laboratories



Highest Salary **3.6**
Lakhs Per Annum

396
Placement Offers
in
24
Companies

Private

- Anjan drugs pvt ltd
- Aditya Birla Group
- Sanmar groups
- SPIC
- Orchid pharmaceutical P Ltd
- Manali petrochemical P ltd
- Saint globin

Government

- Chennai Petroleum Corporation ltd
- Hindustan Petroleum Corporation ltd
- Bharat Petroleum Corporation ltd
- Indian Petrochemicals Corporation ltd
- Tamilnadu cement corporation ltd
- Madras fertilizer limited
- Tamilnadu medial product corporation ltd

Others

- Oil and Gas industry
- Speciality chemical industry
- Drug and pharmaceutical industry
- Plastic and polymer industry
- Paint and cement industry



Academic Toppers



KISHORE.B
555/600 - 2024



B.SRINATH
527/600 - 2024



JEGANATHAN.V
512/600 - 2024



RAJADURAI T
510/600 - 2024



Javith .H
2002, Qatar Gas,
Qatar / 48 Lakhs P/A



Kali Raj
2003, Petrofac International Ltd,
Qatar / 63 Lakhs P/A



Krishnaraj
2003, OSGTL,
Qatar / 54 Lakhs P/A



Arun K. Anurak
2004, Petrovietnam Fpso,
Vietnam / 1.44 Crore P/A



Mahesh A
2013, SPIC, Tuticorin
9 lakhs P/A



Sabarinathan.R
Melito, Qatar
15 Lakhs P/A



Rajadurai G
2024, SPIC
Tuticorin /2.5 lakhs P/A



Kabilan S
2024, SPIC
Tuticorin /2.5 lakhs P/A



Anbhazhagan Rajendran
2005, Satorp,
Saudi Arabia / 40.2 Lakhs P/A



Kamalraji R
2005, KNPC,
Kuwait/ 30 Lakhs P/A



Sivashankar.K
2010, Aditya Birla paints,
Chennai/ 8 Lakhs P/A



Krishnakumar S
2011, CPCL,
Chennai/ 10 Lakhs P/A



Mohammad Aslam M
2022, Chemplast Sanmar
Hosur/3.2 lakhs P/A



Mohammad Aslam M
2022, Chemplast Sanmar
Hosur/3.2 lakhs P/A



Mohammad Aslam M
2024, Chemplast Sanmar
Hosur/3.2 lakhs P/A



Ramachandran P
2024, SPIC
Tuticorin /2.5 lakhs P/A

Placed Students...

தொடர்ச்சியாக நம் மாணவர்களை தேர்வு செய்யும் நிறுவனங்களில் சில...

- Schlumberger Asia Pacific Ltd, Middle East
- Trans Ocean India Ltd, Mumbai.
- Nayara Energy Ltd, Gujarat
- Nippon Steels Ltd, Surat
- Adithya Birla paints Ltd, Chennai
- Southern Petrochemical Industries Corporation Ltd, Tuticorin
- Thirumalai Chemicals Ltd, Ranipet.
- Manali Petrochemicals Ltd, Chennai
- Chemplast Sanmar, Hosur
- Saint Gobain Ltd, Shriperumbudur
- Asian Paints Ltd, Chennai
- Sanvira Bio Science, Hydrabad
- Orchid Chemicals & Pharmaceuticals Ltd, Chennai
- Biocon India Ltd, Bengaluru
- Apotex Pharmaceuticals Ltd, Bengaluru
- IMC Ltd, Mumbai.
- TANFAC, Cuddalure
- Tuticorin Alkali and Chemicals (TAC) Ltd, Tuticorin



நந்தா ஏன்?

- நந்தா பாலிடெக்னிக் கல்லூரியில் படித்து முடித்தவுடன் தகுதிக் கேற்ற 100% வேலை வாய்ப்பு
- நந்தா பொறியியல் கல்லூரியில் படிக்க முன்னுரிமை



NANDHA



POLYTECHNIC COLLEGE

Erode – 52.

Ph: 73737 14477

www.nandhapolytechnic.org

10th Standard Slow Learners Guide

-
- ❖ **MATHEMATICS**
 - ❖ **SCIENCE**
 - ❖ **SOCIAL SCIENCE**
-

1. Relations and Functions

2 Marks

1. If $A \times B = \{(3, 2), (3, 4), (5, 2), (5, 4)\}$ then find A and B.

Solution:

$A \times B = \{(3, 2), (3, 4), (5, 2), (5, 4)\}$ then

$A = \{ \text{Set of all first coordinates of elements of } A \times B \} \therefore A = \{3, 5\}$

$B = \{ \text{Set of all second coordinates of elements of } A \times B \} \therefore B = \{2, 4\}$

Thus $A = \{3, 5\}$ and $B = \{2, 4\}$

2. Find $A \times B$, $A \times A$ and $B \times A$

i) $A = \{2, -2, 3\}$ and $B = \{1, -4\}$

ii) $A = B = \{p, q\}$

iii) $A = \{m, n\}$; $B = \{f\}$

Solution:

- i. $A \times B = \{2, -2, 3\} \times \{1, -4\}$
 $= \{(2, 1), (2, -4), (-2, 1), (-2, -4), (3, 1), (3, -4)\}$

$A \times A = \{2, -2, 3\} \times \{2, -2, 3\}$
 $= \{(2, 2), (2, -2), (2, 3), (-2, 2), (-2, -2), (-2, 3), (3, 2), (3, -2), (3, 3)\}$

$B \times A = \{1, -4\} \times \{2, -2, 3\}$
 $= \{(1, 2), (1, -2), (1, 3), (-4, 2), (-4, -2), (-4, 3)\}$

- ii. Given $A = B = \{p, q\}$

$A \times B = \{p, q\} \times \{p, q\}$
 $= \{(p, p), (p, q), (q, p), (q, q)\}$

$A \times A = \{p, q\} \times \{p, q\}$
 $= \{(p, p), (p, q), (q, p), (q, q)\}$

$B \times A = \{p, q\} \times \{p, q\}$
 $= \{(p, p), (p, q), (q, p), (q, q)\}$

- iii. $A = \{m, n\}$, $B = \emptyset$

$A \times B = \{(m, n) \times \emptyset\} = \{ \}$

$A \times A = \{(m, n) \} \times \{m, n\}$
 $= \{(m, m), (m, n), (n, m), (n, n)\}$

$B \times A = \{ \} \times \{m, n\} = \{ \}$

3. Let $A = \{1, 2, 3\}$ and $B = \{x \mid x \text{ is a prime number less than } 10\}$. Find $A \times B$ and $B \times A$.

Solution:

$A = \{1, 2, 3\}$ $B = \{2, 3, 5, 7\}$

$A \times B = \{1, 2, 3\} \times \{2, 3, 5, 7\}$
 $= \{(1, 2), (1, 3), (1, 5), (1, 7), (2, 2), (2, 3), (2, 5), (2, 7), (3, 2), (3, 3), (3, 5), (3, 7)\}$

$B \times A = \{2, 3, 5, 7\} \times \{1, 2, 3\}$
 $= \{(2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3), (5, 1), (5, 2), (5, 3), (7, 1), (7, 2), (7, 3)\}$

4. If $B \times A = \{(-2, 3), (-2, 4), (0, 3), (0, 4), (3, 3), (3, 4)\}$ find A and B.

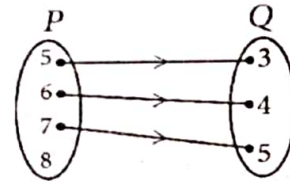
Solution:

$A = \{ \text{Set of all second coordinates of elements of } B \times A \} \therefore A = \{3, 4\}$

$B = \{ \text{Set of all first coordinates of elements of } B \times A \} \therefore B = \{-2, 0, 3\}$

Thus, $A = \{3, 4\}$ $B = \{-2, 0, 3\}$

5. The arrow diagram shows a relationship between the sets P and Q. Write the relation in



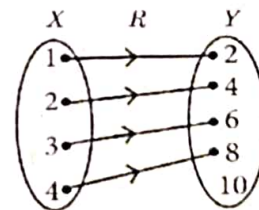
- (i) Set builder form (ii) Roster form
 (iii) What is the domain and range of R.

Solution:

- i. Set builder form of $R = \{(x, y) \mid y = x - 2, x \in P, y \in Q\}$
- ii. Roster form $R = \{(5, 3), (6, 4), (7, 5)\}$
- iii. Domain of $R = \{5, 6, 7\}$ and range of $R = \{3, 4, 5\}$

6. Let $X = \{1, 2, 3, 4\}$ and $Y = \{2, 4, 6, 8, 10\}$ and $R = \{(1, 2), (2, 4), (3, 6), (4, 8)\}$. Show that R is a function and find its domain, co-domain and range?

Solution:



Pictorial representation of R is given diagram, From the diagram, we see that for each $x \in X$, there exists only one $y \in Y$.

Thus all elements in X have only one image in Y.

Therefore R is a function.

Domain $X = \{1, 2, 3, 4\}$

Co-domain $Y = \{2, 4, 6, 8, 10\}$

Range of $f = \{2, 4, 6, 8\}$

7. Let $A = \{1, 2, 3, 4, \dots, 45\}$ and R be the relation defined as "is square of a number" on A . Write R as a subset of $A \times A$. Also, find the domain and range of R .

Solution:

$$A = \{1, 2, 3, \dots, 45\}$$

$$R = \{(1, 1), (2, 4), (3, 9), (4, 16), (5, 25), (6, 36)\}$$

$$R \subset (A \times A)$$

$$\therefore \text{Domain of } R = \{1, 2, 3, 4, 5, 6\}$$

$$\text{Range of } R = \{1, 4, 9, 16, 25, 36\}$$

8. A Relation R is given by the set $\{(x, y) / y = x + 3, x \in \{0, 1, 2, 3, 4, 5\}\}$. Determine its domain and range.

Solution:

$$x = \{0, 1, 2, 3, 4, 5\}$$

$$f(x) = y = x + 3$$

$$f(0) = 3; \quad f(1) = 4; \quad f(2) = 5;$$

$$f(3) = 6; \quad f(4) = 7; \quad f(5) = 8$$

$$\therefore R = \{(0, 3), (1, 4), (2, 5), (3, 6), (4, 7), (5, 8)\}$$

$$\text{Domain of } R = \{0, 1, 2, 3, 4, 5\}$$

$$\text{Range of } R = \{3, 4, 5, 6, 7, 8\}$$

9. Given the function $f: x \rightarrow x^2 - 5x + 6$, evaluate (i) $f(-1)$ (ii) $f(2a)$ (iii) $f(2)$ (iv) $f(x-1)$

Solution:

$$\text{Given: } f: x \rightarrow x^2 - 5x + 6$$

$$\Rightarrow f(x) = x^2 - 5x + 6$$

i. $f(-1) = (-1)^2 - 5(-1) + 6$
 $= 1 + 5 + 6$
 $= 12$

ii. $f(2a) = (2a)^2 - 5(2a) + 6$
 $= 4a^2 - 10a + 6$

iii. $f(2) = (2)^2 - 5(2) + 6$
 $= 4 - 10 + 6$
 $= 0$

iv. $f(x-1) = (x-1)^2 - 5(x-1) + 6$
 $= x^2 - 2x + 1 - 5x + 5 + 6$
 $= x^2 - 7x + 12$

10. A function f is defined by $f(x) = 3 - 2x$. Find x such that $f(x^2) = (f(x))^2$.

Solution:

$$f(x) = 3 - 2x$$

$$f(x^2) = [f(x)]^2$$

$$3 - 2x^2 = [3 - 2x]^2$$

$$\Rightarrow 3 - 2x^2 = 9 + 4x^2 - 12x$$

$$3 - 2x^2 - 9 - 4x^2 + 12x = 0$$

$$\Rightarrow -6x^2 + 12x - 6 = 0 \div -6$$

$$x^2 - 2x + 1 = 0$$

$$x - (1)(x - 1) = 0 \quad x = 1, 1$$

11. Let $A = \{1, 2, 3, 4\}$ and $B = \mathbb{N}$. Let $f: A \rightarrow B$ be defined by $f(x) = x^3$ then, (i) find the range of f (ii) identify the type of function.

Solution:

$$A = \{1, 2, 3, 4\}, B = \mathbb{N}$$

$$f: A \rightarrow B, f(x) = x^3$$

$$f(1) = (1)^3 = 1; \quad f(2) = (2)^3 = 8;$$

$$f(3) = (3)^3 = 27; \quad f(4) = (4)^3 = 64$$

i) Range of $f = \{1, 8, 27, 64\}$

ii) It is one-one and into function.

5 Marks

1. If $A = \{1, 3, 5\}$ and $B = \{2, 3\}$ then (i) find $A \times B$ and $B \times A$. (ii) Is $A \times B = B \times A$? If not why? (iii) Show that $n(A \times B) = n(B \times A) = n(A) \times n(B)$

Solution:

$$\text{Given that } A = \{1, 3, 5\} \text{ and } B = \{2, 3\}$$

i. $A \times B = \{1, 3, 5\} \times \{2, 3\}$
 $= \{(1, 2), (1, 3), (3, 2), (3, 3), (5, 2), (5, 3)\}$
.....(1)

$$B \times A = \{2, 3\} \times \{1, 3, 5\}$$

$$= \{(2, 1), (2, 3), (2, 5), (3, 1), (3, 3), (3, 5)\}$$
.....(2)

- ii. From (1) and (2) we conclude that $A \times B \neq B \times A$ as $(1, 2) \neq (2, 1)$ and $(1, 3) \neq (3, 1)$ etc

iii. $n(A) = 3; n(B) = 2$

From (1) and (2) we observe that,

$$n(A \times B) = n(B \times A) = 6;$$

We see that, $n(A) \times n(B) = 3 \times 2 = 6$

Thus, $n(A \times B) = n(B \times A) = n(A) \times n(B)$.

2. Let $A = \{x \in \mathbb{N} \mid 1 < x < 4\}$, $B = \{x \in \mathbb{W} \mid 0 \leq x < 2\}$ and $C = \{x \in \mathbb{N} \mid x < 3\}$. Then verify that (i) $A \times (B \cup C) = (A \times B) \cup (A \times C)$ (ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

Solution:

$$\text{Given } A = \{x \in \mathbb{N} \mid 1 < x < 4\} = \{2, 3\},$$

$$B = \{x \in \mathbb{W} \mid 0 \leq x < 2\} = \{0, 1\},$$

$$C = \{x \in \mathbb{N} \mid x < 3\} = \{1, 2\}$$

- i. $A \times (B \cup C) = (A \times B) \cup (A \times C)$
 $B \cup C = \{0, 1\} \cup \{1, 2\} = \{0, 1, 2\}$
 $A \times (B \cup C)$
 $= \{2, 3\} \times \{0, 1, 2\}$
 $= \{(2, 0), (2, 1), (2, 2), (3, 0), (3, 1), (3, 2)\}$
 (1)
- $A \times B = \{2, 3\} \times \{0, 1\}$
 $= \{(2, 0), (2, 1), (3, 0), (3, 1)\}$
 $A \times C = \{2, 3\} \times \{1, 2\}$
 $= \{(2, 1), (2, 2), (3, 1), (3, 2)\}$
 $(A \times B) \cup (A \times C)$
 $= \{(2, 0), (2, 1), (3, 0), (3, 1)\} \cup \{(2, 1), (2, 2), (3, 1), (3, 2)\}$
 $= \{(2, 0), (2, 1), (2, 2), (3, 0), (3, 1), (3, 2)\}$
 (2)
- From (1) = (2).
 $\therefore A \times (B \cup C) = (A \times B) \cup (A \times C)$ is verified.
- ii. $A \times (B \cap C) = (A \times B) \cap (A \times C)$
 $B \cap C = \{0, 1\} \cap \{1, 2\} = \{1\}$
 $A \times (B \cap C) = \{2, 3\} \times \{1\}$
 $= \{(2, 1), (3, 1)\}$ (1)
- $A \times B = \{2, 3\} \times \{0, 1\}$
 $= \{(2, 0), (2, 1), (3, 0), (3, 1)\}$
 $A \times C = \{2, 3\} \times \{1, 2\}$
 $= \{(2, 1), (2, 2), (3, 1), (3, 2)\}$
 $(A \times B) \cap (A \times C)$
 $= \{(2, 0), (2, 1), (3, 0), (3, 1)\} \cap \{(2, 1), (2, 2), (3, 1), (3, 2)\}$
 $= \{(2, 1), (3, 1)\}$ (2)
- (1) = (2)
 $\therefore A \times (B \cap C) = (A \times B) \cap (A \times C)$
 Hence it is Verified
3. If $A = \{5, 6\}$, $B = \{4, 5, 6\}$, $C = \{5, 6, 7\}$, Show that $A \times A = (B \times B) \cap (C \times C)$.
- Solution:**
 Given $A = \{5, 6\}$, $B = \{4, 5, 6\}$, $C = \{5, 6, 7\}$
 LHS:
 $A \times A = \{5, 6\} \times \{5, 6\}$
 $= \{(5, 5), (5, 6), (6, 5), (6, 6)\}$ (1)
- RHS = $(B \times B) \cap (C \times C)$
 $B \times B = \{4, 5, 6\} \times \{4, 5, 6\}$
 $= \{(4, 4), (4, 5), (4, 6), (5, 4), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)\}$
 $C \times C = \{5, 6, 7\} \times \{5, 6, 7\}$
 $= \{(5, 5), (5, 6), (5, 7), (6, 5), (6, 6), (6, 7), (7, 5), (7, 6), (7, 7)\}$

$$\therefore (B \times B) \cap (C \times C)$$

$$= \{(5, 5), (5, 6), (6, 5), (6, 6)\}$$
 (2)

\therefore From (1) and (2). LHS = RHS

4. Given $A = \{1, 2, 3\}$, $B = \{2, 3, 5\}$,
 $C = \{3, 4\}$ and $D = \{1, 3, 5\}$, check if
 $(A \cap C) \times (B \cap D) = (A \times B) \cap (C \times D)$ is true?

Solution:

$$A \cap C = \{1, 2, 3\} \cap \{3, 4\}$$

$$A \cap C = \{3\},$$

$$B \cap D = \{2, 3, 5\} \cap \{1, 3, 5\}$$

$$B \cap D = \{3, 5\}$$

$$(A \cap C) \times (B \cap D)$$

$$= \{3\} \times \{3, 5\} = \{(3, 3), (3, 5)\}$$
 (1)

$$A \times B = \{1, 2, 3\} \times \{2, 3, 5\}$$

$$= \{(1, 2), (1, 3), (1, 5), (2, 2), (2, 3), (2, 5), (3, 2), (3, 3), (3, 5)\}$$

$$C \times D = \{3, 4\} \times \{1, 3, 5\}$$

$$= \{(3, 1), (3, 3), (3, 5), (4, 1), (4, 3), (4, 5)\}$$

$$(A \times B) \cap (C \times D) = \{(3, 3), (3, 5)\}$$
 (2)

(1), (2) are equal.

$$\therefore (A \cap C) \times (B \cap D) = (A \times B) \cap (C \times D)$$

Hence it is verified.

5. Let $A = \{x \in W \mid x < 2\}$, $B = \{x \in N \mid 1 < x \leq 4\}$ and $C = \{3, 5\}$. Verify that
- (i) $A \times (B \cup C) = (A \times B) \cup (A \times C)$
 (ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$
 (iii) $(A \cup B) \times C = (A \times C) \cup (B \times C)$

Solution:

Given:

$$A = \{x \in W \mid x < 2\} \Rightarrow A = \{0, 1\}$$

$$B = \{x \in N \mid 1 < x \leq 4\}$$

$$\Rightarrow B = \{2, 3, 4\}; C = \{3, 5\}$$

- i. $A \times (B \cup C) = (A \times B) \cup (A \times C)$
 $B \cup C = \{2, 3, 4\} \cup \{3, 5\}$
 $B \cup C = \{2, 3, 4, 5\}$
 $A \times (B \cup C) = \{0, 1\} \times \{2, 3, 4, 5\}$
 $= \{(0, 2), (0, 3), (0, 4), (0, 5), (1, 2), (1, 3), (1, 4), (1, 5)\}$ (1)
- $A \times B = \{0, 1\} \times \{2, 3, 4\}$
 $= \{(0, 2), (0, 3), (0, 4), (1, 2), (1, 3), (1, 4)\}$
 $A \times C = \{0, 1\} \times \{3, 5\}$
 $= \{(0, 3), (0, 5), (1, 3), (1, 5)\}$
 $\therefore (A \times B) \cup (A \times C)$
 $= \{(0, 2), (0, 3), (0, 4), (0, 5), (1, 2), (1, 3), (1, 4), (1, 5)\}$ (2)
- $\therefore (1) = (2)$ Hence Verified.

ii. $A \times (B \cap C) = (A \times B) \cap (A \times C)$
 $B \cap C = \{2, 3, 4\} \cap \{3, 5\} = \{3\}$
 $A \times (B \cap C) = \{(0, 3), (1, 3)\}$ (1)
 $A \times B = \{0, 1\} \times \{2, 3, 4\}$
 $= \{(0, 2), (0, 3), (0, 4), (1, 2), (1, 3), (1, 4)\}$
 $A \times C = \{0, 1\} \times \{3, 5\}$
 $= \{(0, 3), (0, 5), (1, 3), (1, 5)\}$
 $\therefore (A \times B) \cap (A \times C) = \{(0, 3), (1, 3)\}$ (2)
 $\therefore (1) = (2)$. Hence Proved.

iii. $(A \cup B) \times C = (A \times C) \cup (B \times C)$
 $A \cup B = \{0, 1\} \cup \{2, 3, 4\}$
 $= \{0, 1, 2, 3, 4\}$
 $\therefore (A \cup B) \times C = \{0, 1, 2, 3, 4\} \times \{3, 5\}$
 $= \{(0, 3), (0, 5), (1, 3), (1, 5), (2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)\}$ (1)
 $A \times C = \{0, 1\} \times \{3, 5\}$
 $= \{(0, 3), (0, 5), (1, 3), (1, 5)\}$
 $B \times C = \{2, 3, 4\} \times \{3, 5\}$
 $= \{(2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)\}$
 $\therefore (A \times C) \cup (B \times C)$
 $= \{(0, 3), (0, 5), (1, 3), (1, 5), (2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)\}$ (2)
 \therefore From (1) and (2) LHS = RHS.

6. Let A = The set of all natural numbers less than 8, B = The set of all prime numbers less than 8, C = The set of even prime number. Verify that

(i) $(A \cap B) \times C = (A \times C) \cap (B \times C)$
(ii) $A \times (B - C) = (A \times B) - (A \times C)$

Solution:

Given $A = \{1, 2, 3, 4, 5, 6, 7\}$

$B = \{2, 3, 5, 7\}$ $C = \{2\}$

To verify $(A \cap B) \times C = (A \times C) \cap (B \times C)$

$A \cap B = \{1, 2, 3, 4, 5, 6, 7\} \cap \{2, 3, 5, 7\}$
 $= \{2, 3, 5, 7\}$

$(A \cap B) \times C = \{2, 3, 5, 7\} \times \{2\}$

$\therefore (A \cap B) \times C = \{(2, 2), (3, 2), (5, 2), (7, 2)\}$ (1)

$A \times C = \{1, 2, 3, 4, 5, 6, 7\} \times \{2\}$
 $= \{(1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (6, 2), (7, 2)\}$

$B \times C = \{2, 3, 5, 7\} \times \{2\}$
 $= \{(2, 2), (3, 2), (5, 2), (7, 2)\}$

$(A \times C) \cap (B \times C)$
 $= \{(2, 2), (3, 2), (5, 2), (7, 2)\}$ (2)

\therefore From (1) and (2), LHS = RHS

ii. To verify $A \times (B - C) = (A \times B) - (A \times C)$
 $B - C = \{2, 3, 5, 7\} - \{2\} = \{3, 5, 7\}$
 $A \times (B - C) = \{1, 2, 3, 4, 5, 6, 7\} \times \{3, 5, 7\}$
 $= \{(1, 3), (1, 5), (1, 7), (2, 3), (2, 5), (2, 7), (3, 3), (3, 5), (3, 7), (4, 3), (4, 5), (4, 7), (5, 3), (5, 5), (5, 7), (6, 3), (6, 5), (6, 7), (7, 3), (7, 5), (7, 7)\}$ (1)
 $A \times B = \{1, 2, 3, 4, 5, 6, 7\} \times \{2, 3, 5, 7\}$
 $= \{(1, 2), (1, 3), (1, 5), (1, 7), (2, 2), (2, 3), (2, 5), (2, 7), (3, 2), (3, 3), (3, 5), (3, 7), (4, 2), (4, 3), (4, 5), (4, 7), (5, 2), (5, 3), (5, 5), (5, 7), (6, 2), (6, 3), (6, 5), (6, 7), (7, 2), (7, 3), (7, 5), (7, 7)\}$
 $A \times C = \{1, 2, 3, 4, 5, 6, 7\} \times \{2\}$
 $= \{(1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (6, 2), (7, 2)\}$
 $(A \times B) - (A \times C)$
 $= \{(1, 3), (1, 5), (1, 7), (2, 3), (2, 5), (2, 7), (3, 3), (3, 5), (3, 7), (4, 3), (4, 5), (4, 7), (5, 3), (5, 5), (5, 7), (6, 3), (6, 5), (6, 7), (7, 3), (7, 5), (7, 7)\}$ (2)

(1), (2) are equal.

$\therefore A \times (B - C) = (A \times B) - (A \times C)$.

Hence it is verified.

7. Let A = {3, 4, 7, 8} and B = {1, 7, 10}. Which of the following sets are relations from A to B?

(i) $R_1 = \{(3, 7), (4, 7), (7, 10), (8, 1)\}$

(ii) $R_2 = \{(3, 1), (4, 12)\}$

(iii) $R_3 = \{(3, 7), (4, 10), (7, 7), (7, 8), (8, 11), (8, 7), (8, 10)\}$

Solution:

$A \times B = \{(3, 1), (3, 7), (3, 10), (4, 1), (4, 7), (4, 10), (7, 1), (7, 7), (7, 10), (8, 1), (8, 7), (8, 10)\}$

i. We note that, $R_1 \subseteq A \times B$.

Thus R_1 is a relation from A and B.

ii. Here $(4, 12) \in R_2$, but $(4, 12) \notin A \times B$.

So R_2 is not a relation from A to B.

iii. Here $(7, 8) \in R_3$, but $(7, 8) \notin A \times B$.

So R_3 is not a relation from A to B.

8. Let A = {1, 2, 3, 7} and B = {3, 0, -1, 7}, which of the following are relation from A to B?

(i) $R_1 = \{(2, 1), (7, 1)\}$ (ii) $R_2 = \{(-1, 1)\}$

(iii) $R_3 = \{(2, -1), (7, 7), (1, 3)\}$

(iv) $R_4 = \{(7, -1), (0, 3), (3, 3), (0, 7)\}$

Solution:

Given $A = \{1, 2, 3, 7\}$ and $B = \{3, 0, -1, 7\}$
 $\therefore A \times B$
 $= \{1, 2, 3, 7\} \times \{3, 0, -1, 7\}$
 $= \{(1, 3), (1, 0), (1, -1), (1, 7), (2, 3), (2, 0), (2, -1), (2, 7), (3, 3), (3, 0), (3, -1), (3, 7), (7, 3), (7, 0), (7, -1), (7, 7)\}$

- i. $R_1 = \{(2, 1), (7, 1)\}$, $(2, 1) \in R_1$
 but $(2, 1) \notin A \times B$
 $\therefore R_1$ is not a relation from A to B.
- ii. $R_2 = \{(-1, 1)\}$, $(-1, 1) \in R_2$
 but $(-1, 1) \notin A \times B$
 $\therefore R_2$ is not a relation from A to B.
- iii. $R_3 = \{(2, -1), (7, 7), (1, 3)\}$
 We note that $R_3 \subseteq A \times B$
 $\therefore R_3$ is a relation.
- iv. $R_4 = \{(7, -1), (0, 3), (3, 3), (0, 7)\}$, $(0, 3)$,
 $(0, 7) \in R_4$ but not in $A \times B$.
 $\therefore R_4$ is not a relation from A to B.

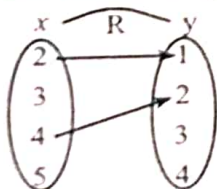
9. Represent each of the given relations by (a) an arrow diagram, (b) a graph and (c) a set in roster form, wherever possible.

- (i) $\{(x, y) | x = 2y, x \in \{2, 3, 4, 5\}, y \in \{1, 2, 3, 4\}\}$
- (ii) $\{(x, y) | y = x + 3, x, y \text{ are natural numbers } < 10\}$

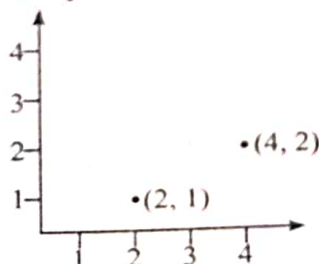
Solution:

- i. $\{(x, y) | x = 2y, x \in \{2, 3, 4, 5\}, y \in \{1, 2, 3, 4\}\}$
 $x = 2y$
 $f(x) = \frac{x}{2}; \quad f(2) = \frac{2}{2} = 1; \quad f(3) = \frac{3}{2};$
 $f(4) = \frac{4}{2} = 2; \quad f(5) = -$

a) An Arrow diagram



b) Graph



c) Roster Form

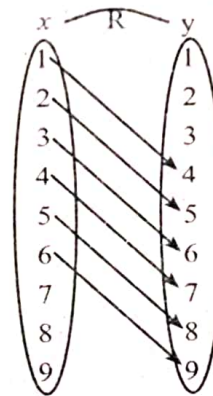
$\{(2, 1), (4, 2)\}$

- ii. $\{(x, y) | y = x + 3, x, y \text{ are natural numbers } < 10\}$

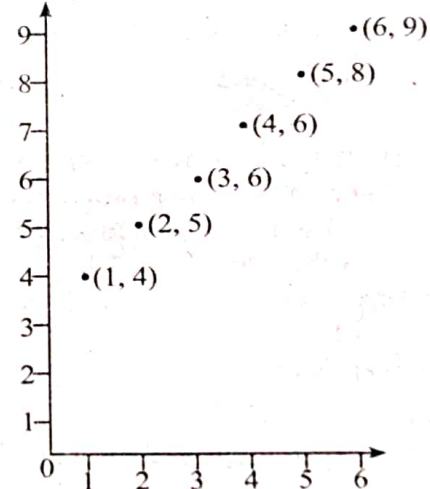
Solution:

$f(x) = x + 3;$
 $f(1) = 4; \quad f(2) = 5; \quad f(3) = 6;$
 $f(4) = 7; \quad f(5) = 8; \quad f(6) = 9$

a) An Arrow diagram



b) Graph



c) Roster Form

$\{(1, 4), (2, 5), (3, 6), (4, 7), (5, 8), (6, 9)\}$

10. A company has four categories of employees given by Assistants (A), Clerks (C), Managers (M) and an Executive Officer (E). The company provide ₹ 10,000, ₹ 25,000, ₹ 50,000 and ₹ 1,00,000 as salaries to the people who work in the categories A, C, M and E respectively. If A_1, A_2, A_3, A_4 and A_5 were Assistants; C_1, C_2, C_3, C_4 were Clerks; M_1, M_2, M_3 were managers and E_1, E_2 were Executive officers and if the relation R is defined by xRy , where x is the salary given to

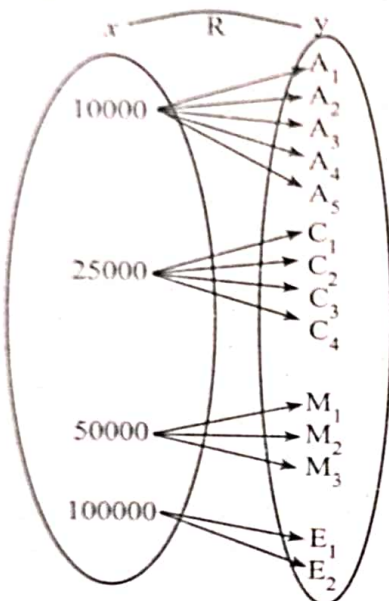
person y , express the relation R through an ordered pair and an arrow diagram.

Solution:

a) **Ordered Pair:**

$\{(10000, A_1), (10000, A_2), (10000, A_3), (10000, A_4), (10000, A_5), (25000, C_1), (25000, C_2), (25000, C_3), (25000, C_4), (50000, M_1), (50000, M_2), (50000, M_3), (100000, E_1), (100000, E_2)\}$

b) **Arrow Diagram:**



11. Let $A = \{1, 2, 3, 4\}$ and $B = \{2, 5, 8, 11, 14\}$ be two sets. Let $f: A \rightarrow B$ be a function given by $f(x) = 3x - 1$. Represent this function

(i) by arrow diagram

(ii) in a table form

(iii) as a set of ordered pairs

(iv) in a graphical form

Solution:

$A = \{1, 2, 3, 4\}, B = \{2, 5, 8, 11, 14\}$

$f(x) = 3x - 1$

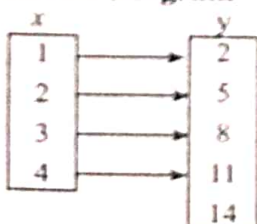
$f(1) = 3(1) - 1 = 3 - 1 = 2;$

$f(2) = 3(2) - 1 = 6 - 1 = 5$ $f(3) = 3(3) - 1 = 9 - 1 = 8;$

$f(4) = 3(4) - 1 = 12 - 1 = 11.$

$R = \{(1, 2), (2, 5), (3, 8), (4, 11)\}$

i) **Arrow Diagram**



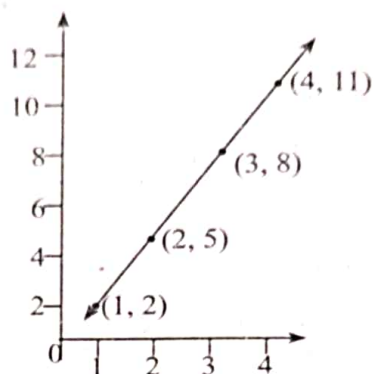
ii) **Table**

x	1	2	3	4
y	2	5	8	11

iii) **Set of Ordered pairs**

$\{(1, 2), (2, 5), (3, 8), (4, 11)\}$

iv) **Graphical Form**



12. Let f be a function $f: \mathbb{N} \rightarrow \mathbb{N}$ be defined by $f(x) = 3x + 2, x \in \mathbb{N}$

(i) Find the images of 1, 2, 3

(ii) Find the pre-images of 29, 53

(iii) Identify the type of function

Solution:

The function $f: \mathbb{N} \rightarrow \mathbb{N}$ be defined by $f(x) = 3x + 2$

i. If $x = 1, f(1) = 3(1) + 2 = 5$

If $x = 2, f(2) = 3(2) + 2 = 8;$ If $x = 3,$

$f(3) = 3(3) + 2 = 11$

The images of 1, 2, 3 are 5, 8, 11 respectively.

ii. If x is the pre-image of 29, then $f(x) = 29.$ Hence $3x + 2 = 29; 3x = 27 \Rightarrow x = 9.$

Similarly, if x is the pre-image of 53 then $f(x) = 53.$ Hence $3x + 2 = 53$

$3x = 53 - 2 \Rightarrow 3x = 51 \Rightarrow x = 17.$

Thus the pre-image of 29 and 53 are 9 and 17 respectively.

iii. Since different elements of \mathbb{N} have different images in the co-domain, the function f is one-one function. The co-domain of f is \mathbb{N} . But the range of $f = \{5, 8, 11, 14, 17, \dots\}$ is a proper subset of \mathbb{N} . Therefore f is not an onto function. That is, f is an into function. Thus f is one-one and into functions.

13. Let $f: A \rightarrow B$ be a function defined by

$f(x) = \frac{x}{2} - 1$ where $A = \{2, 4, 6, 10, 12\},$

$B = \{0, 1, 2, 4, 5, 9\}.$ Represent f by

- i) set of ordered pairs ii) a table
 iii) an arrow diagram iv) a graph

Solution:

Given $f(x) = \frac{x}{2} - 1$

$x = 2 \Rightarrow f(2) = 1 - 1 = 0$

$x = 4 \Rightarrow f(4) = 2 - 1 = 1$

$x = 6 \Rightarrow f(6) = 3 - 1 = 2$

$x = 10 \Rightarrow f(10) = 5 - 1 = 4$

$x = 12 \Rightarrow f(12) = 6 - 1 = 5$

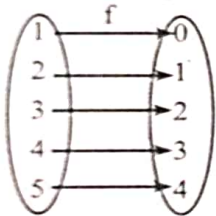
i) Set of Ordered Pairs:

$f = \{(2, 0), (4, 1), (6, 2), (10, 4), (12, 5)\}$

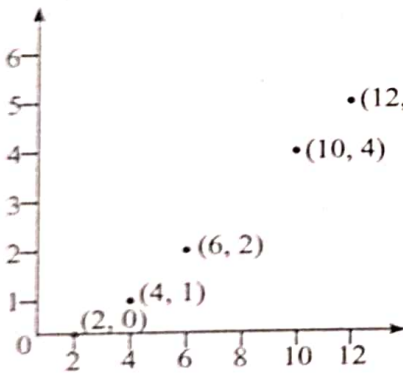
ii) Table

x	2	4	6	10	12
f(x)	0	1	2	4	5

iii) Arrow Diagram



iv) Graph



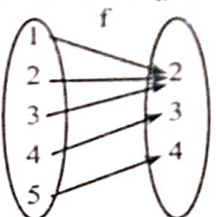
14. Represent the function

$f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$ through

- (i) an arrow diagram
 (ii) a table form
 (iii) a graph

Solution:

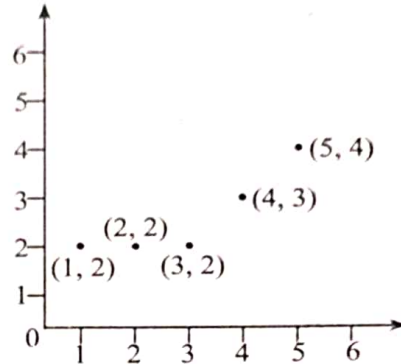
i) Arrow Diagram



ii) Table Form:

x	1	2	3	4	5
f(x)	2	2	2	3	4

iii) Graph



2. Numbers and Sequences

2 Marks

1. 'a' and 'b' are two positive integers such that $a^b \times b^a = 800$. Find 'a' and 'b'.

Solution:

$800 = a^b \times b^a$

2	800
2	400
2	200
2	100
2	50
5	25
	5

$800 = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$
 $= 2^5 \times 5^2$

$\therefore a = 2, b = 5$ (or) $a = 5, b = 2$

2. Find the HCF of 252525 and 363636.

Solution:

2	363636	5	252525
2	181818	5	50505
3	90909	3	10101
3	30303	7	3367
3	10101	13	481
7	3367	37	37
13	481		1
37	37		
	1		

$252525 = 3 \times 5^2 \times 7 \times 13 \times 37$

$$363636 = 2^3 \times 3^3 \times 7 \times 13 \times 37$$

H.C.F of 252525 and 363636

$$= 3 \times 7 \times 13 \times 37$$

$$= 10101.$$

3. If $13824 = 2^a \times 3^b$ then find a and b.

Solution:

$$\begin{array}{r} 2 \overline{) 13824} \\ 2 \overline{) 6912} \\ 2 \overline{) 3456} \\ 2 \overline{) 1728} \\ 2 \overline{) 864} \\ 2 \overline{) 432} \\ 2 \overline{) 216} \\ 2 \overline{) 108} \\ 2 \overline{) 54} \\ 3 \overline{) 27} \\ 3 \overline{) 9} \\ \underline{3} \end{array}$$

$$\Rightarrow 13824 = 2^9 \times 3^3$$

$$\therefore a = 9, b = 3$$

4. Find the LCM and HCF of 408 and 170 by applying the fundamental theorem of arithmetic.

Solution:

$$\begin{array}{r} 2 \overline{) 408} \quad 2 \overline{) 170} \\ 2 \overline{) 204} \quad 5 \overline{) 85} \\ 2 \overline{) 102} \quad \underline{17} \\ 3 \overline{) 51} \\ \underline{17} \end{array}$$

$$408 = 2^3 \times 3 \times 17$$

$$170 = 2 \times 5 \times 17$$

$$\text{H.C.F. of } 408 \text{ \& } 170 = 2 \times 17 = 34$$

$$\text{L.C.M. of } 408 \text{ \& } 170 = 2^3 \times 3 \times 5 \times 17 = 2040$$

5. The general term of a sequence is defined as

$$a_n = \begin{cases} n(n+3); & n \in N \text{ is odd} \\ n^2 + 1; & n \in N \text{ is even} \end{cases}$$

Find the eleventh and eighteenth terms.

Solution:

To find a_{11} , since 11 is odd,

we put $n = 11$ in

$$a_n = n(n+3)$$

Thus,

$$\text{the eleventh term } a_{11} = 11(11+3) = 154.$$

To find a_{18} , since 18 is even,

we put $n = 18$ in

$$a_n = n^2 + 1$$

Thus, the eighteenth term $a_{18} = 18^2 + 1 = 325$.

6. Find the indicated terms of the sequences whose n^{th} terms are given by

(i) $a_n = \frac{5n}{n+2}$; a_6 and a_{13}

(ii) $a_n = -(n^2 - 4)$; a_4 and a_{11}

Solution:

i. $a_n = \frac{5n}{n+2}$

$$a_6 = \frac{30}{8} = \frac{15}{4}; \quad a_{13} = \frac{65}{15} = \frac{13}{3}$$

ii. $a_n = -(n^2 - 4)$

$$a_4 = -(16 - 4) = -12;$$

$$a_{11} = -(121 - 4) = -117$$

7. Find a_8 and a_{15} whose n^{th} term is

$$a_n = \begin{cases} \frac{n^2 - 1}{n + 3} & ; n \text{ is even, } n \in N \\ \frac{n^2}{2n + 1} & ; n \text{ is odd, } n \in N \end{cases}$$

Solution:

To find a_8 here n is even, so $a_n = \frac{n^2 - 1}{n + 3}$

$$a_8 = \frac{64 - 1}{11} = \frac{63}{11}$$

To find a_{15} , here n is odd, so $a_n = \frac{n^2}{2n + 1}$

$$a_{15} = \frac{(15)^2}{30 + 1} = \frac{225}{31}$$

8. Find the 19th term of an A.P. $-11, -15, -19, \dots$

Solution:

General Form of an A.P. is $t_n = a + (n-1)d$

$$a = -11; d = -15 + 11 = -4; n = 19$$

$$t_{19} = -11 + 18(-4)$$

$$= -11 - 72$$

$$t_{19} = -83$$

9. Which term of an A.P. $16, 11, 6, 1, \dots$ is -54 ?

Solution:

$$n = \left(\frac{l - a}{d} \right) + 1$$

$$a = 16; d = 11 - 16 = -5; l = -54$$

$$n = \frac{-54 - 16}{-5} + 1 = \frac{-70}{-5} + 1$$

$$n = 14 + 1$$

$$n = 15$$

10. Find the middle term(s) of an A.P. 9, 15, 21, 27, ..., 183.

Solution:

$$a = 9, d = 6, l = 183$$

$$n = \left(\frac{l-a}{d} \right) + 1$$

$$= \frac{183-9}{6} + 1 = \frac{174}{6} + 1 = 29 + 1 = 30$$

∴ 15 and 16 are the middle terms.

$$t_n = a + (n-1)d$$

$$\begin{aligned} \therefore t_{15} &= a + 14d & t_{16} &= a + 15d \\ &= 9 + 14(6) & &= 9 + 15(6) \\ &= 9 + 84 & &= 9 + 90 \\ &= 93 & &= 99 \end{aligned}$$

∴ 93, 99 are the middle terms of A.P.

11. If $3 + k$, $18 - k$, $5k + 1$ are in A.P. then find k .

Solution:

$3 + k$, $18 - k$, $5k + 1$ is a A.P

$$t_2 - t_1 = t_3 - t_2$$

$$(18 - k) - (3 + k) = (5k + 1) - (18 - k)$$

$$15 - 2k = 6k - 17$$

$$-2k - 6k = -17 - 15$$

$$-8k = -32$$

$$k = 4$$

12. In a theatre, there are 20 seats in the front row and 30 rows were allotted. Each successive row contains two additional seats than its front row. How many seats are there in the last row?

Solution:

First Term, $a = 20$

Common Difference, $d = 2$

∴ Number of seats in the last row

$$= t_n = a + (n-1)d$$

$$t_{30} = a + 29d = 20 + 29(2) = 20 + 58 = 78$$

13. Write an A.P. whose first term is 20 and common difference is 8.

Solution:

First Term, $a = 20$;

Common Difference, $d = 8$

Arithmetic Progression is $a, a+d, a+3d, \dots$

In this case,

we get $20, 20 + 8, 20 + 2(8), 20 + 3(8), \dots$

So, the required A.P. is $20, 28, 36, 44, \dots$

14. Find the number of terms in the A.P. 3, 6, 9, 12, ..., 111.

Solution:

First term $a = 3$,

Common difference $d = 6 - 3 = 3$,

Last term, $l = 111$

We know that, $n = \left(\frac{l-a}{d} \right) + 1$

$$n = \left(\frac{111-3}{3} \right) + 1 = 37$$

Thus the A.P. contains 37 terms.

15. Write the first three terms of the G.P. whose first term and the common ratio are given below.

(i) $a = 6, r = 3$ (ii) $a = \sqrt{2}, r = \sqrt{2}$

(iii) $a = 1000, r = \frac{2}{5}$

Solution:

- i. General Form of an G.P. $\Rightarrow a, ar, ar^2, \dots$

$$a = 6, r = 3 \text{ G.P.} \Rightarrow 6, 6(3), 6(3)^2 \dots$$

$$\Rightarrow 6, 18, 54, \dots$$

- ii. G.P. $\Rightarrow a, ar, ar^2, \dots$

$$a = \sqrt{2}, r = \sqrt{2}$$

$$\text{G.P.} \Rightarrow \sqrt{2}, \sqrt{2} \sqrt{2}, \sqrt{2} (\sqrt{2})^2$$

$$\Rightarrow \sqrt{2}, 2, 2\sqrt{2}$$

- iii. G.P. $\Rightarrow a, ar, ar^2, \dots$

$$a = 1000, r = \frac{2}{5}$$

$$\text{G.P.} \Rightarrow 1000, 1000 \times \frac{2}{5}, 1000 \times \left(\frac{2}{5} \right)^2 \dots$$

$$\text{G.P.} \Rightarrow 1000, 400, 160, \dots$$

16. In a G.P. 729, 243, 81, ... find t_7 .

Solution:

$$t_n = ar^{n-1}$$

$$a = 729, r = \frac{243}{729} = \frac{1}{3}, n = 7$$

$$t_7 = 729 \times \left(\frac{1}{3} \right)^{7-1}$$

$$t_7 = 729 \times \left(\frac{1}{3} \right)^6$$

$$t_7 = 729 \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3}$$

17. Find x so that $x + 6$, $x + 12$ and $x + 15$ are consecutive terms of a Geometric Progression.

Solution:

Given $x + 6, x + 12$ and $x + 15$ are consecutive terms of a G.P.

$$\begin{aligned} \frac{t_2}{t_1} &= \frac{t_3}{t_2} \\ \frac{x+12}{x+6} &= \frac{x+15}{x+12} \\ (x+12)^2 &= (x+6)(x+15) \\ x^2 + 24x + 144 &= x^2 + 21x + 90 \\ 24x - 21x &= 90 - 144 \\ 3x &= -54 \\ x &= -\frac{54}{3} = -18 \end{aligned}$$

18. Find the number of terms in the following G.P.

(i) 4, 8, 16, ..., 8192?

(ii) $\frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \dots, \frac{1}{2187}$

Solution:

i. G.P. \Rightarrow 4, 8, 16, ..., 8192.

Here $a = 4, r = 2, t_n = 8192$

$$ar^{n-1} = t_n \Rightarrow 4(2)^{n-1} = 8192;$$

$$2^{n-1} = \frac{8192}{4} = 2048$$

$$2^{n-1} = 2^{11}; n-1 = 11$$

$$\Rightarrow n = 12$$

ii. G.P. $\Rightarrow \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \dots, \frac{1}{2187}$.

Here $a = \frac{1}{3}, r = \frac{1}{3}, t_n = \frac{1}{2187}$

$$\left(\frac{1}{3}\right) \left(\frac{1}{3}\right)^{n-1} = \frac{1}{2187}$$

$$\left(\frac{1}{3}\right)^{n-1} = \frac{1}{2187} \times 3$$

$$\left(\frac{1}{3}\right)^{n-1} = \frac{1}{729} = \left(\frac{1}{3}\right)^6;$$

$$n-1 = 6 \Rightarrow n = 7$$

19. In a G.P. the 9th term is 32805 and 6th term is 1215. Find the 12th term.

Solution:

From the given

$$t_9 = 32805 \Rightarrow ar^8 = 32805 \quad \dots (1)$$

$$t_6 = 1215 \Rightarrow ar^5 = 1215 \quad \dots (2)$$

$$(1) \div (2) \Rightarrow r^3 = 27 \Rightarrow r = 3$$

$$(2) \Rightarrow a(3)^5 = 1215 \Rightarrow a = 5$$

To find t_{12} ,

$$t_n = ar^{n-1}$$

$$t_{12} = (5)(3)^{11}$$

20. Find the first term of a G.P. in which $S_6 = 4095$ and $r = 4$.

Solution:

Common ratio, $= 4 > 1$,

Sum of first 6 terms $S_6 = 4095$

$$\text{Hence, } S_n = \frac{a(r^n - 1)}{r - 1} = 4095$$

$$r = 4, \frac{a(4^6 - 1)}{4 - 1} = 4095$$

$$\Rightarrow a \times \frac{4095}{3} = 4095$$

First term, $a = 3$.

21. Find the value of

$$1 + 2 + 3 + \dots + 50$$

Solution:

$$1 + 2 + 3 + \dots + 50$$

$$\text{Using } 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$

$$1 + 2 + 3 + \dots + 50 = \frac{50 \times (50+1)}{2} = 1275$$

22. Find the sum of the following series

$$1 + 2 + 3 + \dots + 60$$

Solution:

$$1 + 2 + 3 + \dots + 60 = \frac{n(n+1)}{2}$$

$$= \frac{60 \times 61}{2}$$

$$= 30 \times 61 = 1830$$

23. Find the sum of

(i) $1 + 3 + 5 + \dots$ to 40 terms

(ii) $2 + 4 + 6 + \dots$ 80

(iii) $1 + 3 + 5 + \dots + 55$

Solution:

i. $1 + 3 + 5 + \dots + n$ terms $= n^2$

$$1 + 3 + 5 + \dots + 40 \text{ terms} = (40)^2 = 1640$$

ii. $2 + 4 + 6 + \dots + 80$

$$= 2 [1 + 2 + 3 + \dots + 40]$$

$$= 2 \left[\frac{n(n+1)}{2} \right] = 40 \times 41 = 1640$$

iii. $1 + 3 + 5 + \dots + 55$

Here the number of terms is not given.

Now, we have to find the number of terms using the formula.

$$n = \frac{(55-1)}{2} + 1 = 28$$

Therefore,

$$1 + 3 + 5 + \dots + 55 = (28)^2 = 784$$

24. Find the sum of

(i) $1^2 + 2^2 + \dots + 19^2$

(ii) $5^2 + 10^2 + 15^2 + \dots + 105^2$

Solution:

i. $1^2 + 2^2 + \dots + 19^2$

$$= \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{19 \times (19+1)(2 \times 19+1)}{6}$$

$$= \frac{19 \times 20 \times 39}{6} = 2170$$

ii. $5^2 + 10^2 + 15^2 + \dots + 105^2$

$$= 5^2(1^2 + 2^2 + 3^2 + \dots + 21^2)$$

$$= 25 \times \frac{21 \times (21+1) \times (2 \times 21+1)}{6}$$

$$= 25 \times \frac{21 \times 22 \times 43}{6} = 82775$$

25. Find the sum of $1^3 + 2^3 + 3^3 + \dots + 16^3$

Solution:

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left[\frac{n(n+1)}{2} \right]^2$$

$$1^3 + 2^3 + 3^3 + \dots + 16^3 = \left[\frac{16 \times 17}{2} \right]^2$$

$$= [136]^2 = 18496$$

26. If $1 + 2 + 3 + \dots + n = 666$ then find n .

Solution:

$$1 + 2 + 3 + \dots + n = 666$$

$$\frac{n(n+1)}{2} = 666$$

$$n^2 + n = 1332$$

$$n^2 + n - 1332 = 0$$

$$(n - 36)(n + 37) = 0$$

$$n = -37 \text{ or } n = 36$$

But $n \neq -37$ (Since n is a natural number)

Hence $n = 36$.

27. If $1 + 2 + 3 + \dots + k = 325$, then find

$$1^3 + 2^3 + 3^3 + \dots + k^3.$$

Solution:

$$1 + 2 + 3 + \dots + k = \frac{k(k+1)}{2} = 325$$

$$1^3 + 2^3 + 3^3 + \dots + k^3$$

$$= \left[\frac{k(k+1)}{2} \right]^2 = (325)^2 = 105625$$

28. If $1^3 + 2^3 + 3^3 + \dots + k^3 = 44100$ then find $1 + 2 + 3 + \dots + k$.

Solution:

$$1^3 + 2^3 + 3^3 + \dots + k^3 = 44100 = \left[\frac{k(k+1)}{2} \right]^2$$

$$1 + 2 + 3 + \dots + k = \frac{k(k+1)}{2} = 210$$

29. How many terms of the series $1^3 + 2^3 + 3^3 + \dots$ should be taken to get the sum 14400?

Solution:

$$1^3 + 2^3 + 3^3 + \dots + k^3 = \left[\frac{k(k+1)}{2} \right]^2 = 14400$$

$$\Rightarrow \frac{k(k+1)}{2} = \sqrt{14400} = 120$$

$$k(k+1) = 240$$

$$k^2 + k - 240 = 0$$

$$(k - 15)(k + 16) = 0$$

$$k = +15 \text{ or } k = -16$$

k can't be negative

$$\therefore k = 15$$

5 Marks

1. If $p_1^{x_1} \times p_2^{x_2} \times p_3^{x_3} \times p_4^{x_4} = 113400$ where p_1, p_2, p_3, p_4 are primes in ascending order and x_1, x_2, x_3, x_4 are integers, find the value of p_1, p_2, p_3, p_4 and x_1, x_2, x_3, x_4

Solution:

2	113400
2	56700
2	28350
3	14175
3	4725
3	1575
3	525
5	175
5	35
7	7
1	

$$11340 = 2^3 \times 3^4 \times 5^2 \times 7^1$$

$$\therefore P_1 = 2, P_2 = 3, P_3 = 5, P_4 = 7$$

$$x_1 = 3, x_2 = 4, x_3 = 2, x_4 = 1$$

2. If $a_1 = 1, a_2 = 1$ and $a_n = 2a_{n-1} + a_{n-2}, n \geq 3, n \in \mathbb{N}$, then find the first six terms of the sequence.

Solution:

$$\text{Given } a_1 = a_2 = 1 \text{ and } a_n = 2a_{n-1} + a_{n-2}$$

$$a_3 = 2a_2 + a_1 = 2(1) + 1 = 3;$$

$$a_4 = 2a_3 + a_2 = 2(3) + 1 = 7$$

$$a_5 = 2a_4 + a_3 = 2(7) + 3 = 17;$$

$$a_6 = 2a_5 + a_4 = 2(17) + 7 = 41$$

3. Find x , y and z , given that the numbers x , 10 , y , 24 , z are in A.P.

Solution:

A.P. $\Rightarrow x, 10, y, 24, z$

$$\text{That is } y = \frac{10+24}{2} = \frac{34}{2} = 17$$

\therefore A.P. = $x, 10, 17, 24, z$

Here we know that $d = 17 - 10 = 7$

$$\therefore x = 10 - 7 = 3$$

$$z = 24 + 7 = 31$$

$$\therefore x = 3, y = 17, z = 31.$$

4. Find the sum to n terms of the series $5 + 55 + 555 + \dots$

Solution:

$$S_n = 5 + 55 + 555 + \dots + n \text{ terms}$$

$$= 5 [1 + 11 + 111 + \dots + n \text{ terms}]$$

$$= \frac{5}{9} [9 + 99 + 999 + \dots + n \text{ terms}]$$

$$= \frac{5}{9} [10 - 1 + 100 - 1 + 1000 - 1 + \dots + n \text{ terms}]$$

$$= \frac{5}{9} [(10 + 100 + 1000 + \dots) - (1 + 1 + 1 + \dots)]$$

$$= \frac{5}{9} \left[\frac{10(10^n - 1)}{9} - n \right]$$

$$= \frac{50}{81} \left[(10^n - 1) - \frac{5}{9}n \right]$$

5. Find the sum to n terms of the series
(i) $0.4 + 0.44 + 0.444 + \dots$ to n terms
(ii) $3 + 33 + 333 + \dots$ to n terms

Solution:

- i. $0.4 + 0.44 + 0.444 + \dots$ n terms

$$= \frac{4}{10} + \frac{44}{100} + \frac{444}{1000} + \dots n \text{ terms}$$

$$= 4 \left[\frac{1}{10} + \frac{11}{100} + \frac{111}{1000} + \dots n \text{ terms} \right]$$

$$= \frac{4}{9} \left[\frac{9}{10} + \frac{99}{100} + \frac{999}{1000} + \dots n \text{ terms} \right]$$

$$= \frac{4}{9} \left[\left(1 - \frac{1}{10}\right) + \left(1 - \frac{1}{100}\right) + \left(1 - \frac{1}{1000}\right) + \dots n \text{ terms} \right]$$

$$= \frac{4}{9} [(1+1+1+\dots n \text{ terms}) - \left(\frac{1}{10} + \frac{11}{100} + \frac{111}{1000} + \dots n \text{ terms} \right)]$$

$$= \frac{4}{9} \left[n - \frac{1}{10} \left[\frac{1 - \left(\frac{1}{10}\right)^n}{1 - \frac{1}{10}} \right] \right] = \frac{4}{9} \left[n - \frac{1}{9} \left(1 - \left(\frac{1}{10}\right)^n\right) \right]$$

- ii. $3 + 33 + 333 + \dots$ n

$$= 3(1 + 11 + 111 + \dots + n \text{ terms})$$

$$= \frac{3}{9} (9 + 99 + 999 + \dots + n \text{ terms})$$

$$= \frac{3}{9} ((10-1) + (100-1) + (1000-1) + \dots + n \text{ terms})$$

$$= \frac{3}{9} (10 + 100 + 1000 + \dots + n \text{ terms})$$

$$- (1 + 11 + 111 + \dots + n \text{ terms})$$

$$= \frac{3}{9} \left(10 \left(\frac{10^n - 1}{9} \right) - n \right)$$

$$= \frac{30}{81} (10n - 1) - \frac{3n}{9}$$

6. Find the sum of the Geometric series $3 + 6 + 12 + \dots + 1536$

Solution:

$$3 + 6 + 12 + \dots + 1536$$

$$a = 3, r = 2$$

$$t_n = 1536$$

$$ar^{n-1} = 1536$$

$$3(2)^{n-1} = 1536$$

$$3(2)^{n-1} = 3(2)^9$$

$$2^{n-1} = 2^9$$

$$n-1 = 9$$

$$\therefore n = 10$$

To find S_n ,

$$S_n = \frac{a(r^n - 1)}{r - 1} \Rightarrow S_{10} = \frac{3(2^{10} - 1)}{2 - 1} = 3(1023) = 3069$$

7. Find the value of $16 + 17 + 18 + \dots + 75$

Solution:

$$16 + 17 + 18 + \dots + 75$$

$$= (1 + 2 + 3 + \dots + 75) - (1 + 2 + 3 + \dots + 15)$$

$$= \frac{75(75+1)}{2} - \frac{15(15+1)}{2}$$

$$= 2850 - 120$$

$$= 2730$$

8. Find the sum of $9^3 + 10^3 + \dots + 21^3$

Solution:

$$\begin{aligned} & 9^3 + 10^3 + \dots + 21^3 \\ &= (1^3 + 2^3 + 3^3 \dots + 21^3) - (1^3 + 2^3 + 3^3 \dots + 8^3) \\ &= \left[\frac{21 \times (21+1)}{2} \right]^2 - \left[\frac{8 \times (8+1)}{2} \right]^2 \\ &= (231)^2 - (36)^2 \\ &= 52065 \end{aligned}$$

9. Find the sum of the following series

(i) $6^2 + 7^2 + 8^2 + \dots + 21^2$

(ii) $10^3 + 11^3 + 12^3 + \dots + 20^3$

Solution:

i. $6^2 + 7^2 + 8^2 + \dots + 21^2$

$$\begin{aligned} &= (1^2 + 2^2 + 3^2 \dots + 21^2) - (1^2 + 2^2 + 3^2 + \dots + 5^2) \\ &= \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)(2n+1)}{6} \\ &= \frac{21 \times (21+1)(42+1)}{6} - \frac{5 \times (5+1)(10+1)}{6} \\ &= \frac{21 \times 22 \times 43}{6} - \frac{5 \times 6 \times 11}{6} \\ &= 3311 - 55 = 3256 \end{aligned}$$

ii. $10^3 + 11^3 + 12^3 + \dots + 20^3$

$$\begin{aligned} &= 1^3 + 2^3 + 3^3 + \dots + 20^3 - 1^3 + 2^3 + 3^3 + \dots + 9^3 \\ &= \left[\frac{n(n+1)}{2} \right]^2 - \left[\frac{n(n+1)}{2} \right]^2 \\ &= \left[\frac{20 \times 21}{2} \right]^2 - \left[\frac{9 \times 10}{2} \right]^2 \\ &= [210]^2 - (45)^2 \\ &= 44100 - 2025 = 42075 \end{aligned}$$

10. The sum of the cubes of the first n natural numbers is 2025, then find the value of n .

Solution:

$$\begin{aligned} & 1^2 + 2^2 + 3^2 + \dots + n^2 = 285 \\ & \frac{n(n+1)(2n+1)}{2 \times 3} = 285 \\ & \frac{n(n+1)(2n+1)}{6} = 285 \\ & n(n+1)(2n+1) = 285 \times 6 \quad \dots (1) \\ & 1^3 + 2^3 + 3^3 + \dots + n^3 = 2025 \\ & \left[\frac{n(n+1)}{2} \right]^2 = 2025 \end{aligned}$$

$$\frac{n(n+1)}{2} = \sqrt{2025} = 45$$

$$n(n+1) = 45 \times 2 \quad \dots (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{n(n+1)(2n+1)}{n(n+1)} = \frac{258 \times 6}{45 \times 2}$$

$$2n+1 = 19$$

$$2n = 19 - 1$$

$$\Rightarrow 2n = 18$$

$$\therefore n = 9$$

11. Rekha has 15 square colour papers of sizes 10 cm, 11 cm, 12 cm, ..., 24 cm. How much area can be decorated with these colour papers?

Solution:

The Required Area

$$= 10^2 + 11^2 + 12^2 + \dots + 24^2$$

$$\begin{aligned} \text{Area} &= (1^2 + 2^2 + 3^2 + \dots + 24^2) \\ &\quad - (1^2 + 2^2 + \dots + 9^2) \end{aligned}$$

$$= \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{24 \times 25 \times 49}{6} - \frac{9 \times 10 \times 19}{6}$$

$$= 4900 - 285 = 4615 \text{ cm}^2$$

Therefore Rekha has 4615 cm² colour paper. She can decorate 4615 cm² area with these colour papers.

12. Find the sum of $15^2 + 16^2 + 17^2 + \dots + 28^2$

$$15^2 + 16^2 + 17^2 + \dots + 28^2$$

$$= (1^2 + 2^2 + 3^2 \dots + 28^2)$$

$$- (1^2 + 2^2 + 3^2 \dots + 14^2)$$

$$= \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{28 \times 29 \times 57}{2 \times 3} - \frac{14 \times 15 \times 29}{2 \times 3}$$

$$= 14 \times 29 \times 19 - 7 \times 5 \times 29$$

$$= 7714 - 1015 = 6699$$

3. Algebra

2 Marks

1. Find the LCM of the given polynomials

(i) $4x^2y, 8x^3y^2$

(ii) $9a^3b^2, 12a^2b^2c$

(iii) $16m, 12m^2n^2, 8n^2$

(iv) $p^2 - 3p + 2, p^2 - 4$

(v) $2x^2 - 5x - 3, 4x^2 - 36$

(vi) $(2x^2 - 3xy)^2, (4x - 6y)^3, 8x^3 - 27y^3$

Solution:

i. $4x^2y, 8x^3y^2$

$$4x^2y = 2^2x^2y$$

$$8x^3y^2 = 2^3x^3y^2$$

$$\therefore \text{LCM}(4x^2y, 8x^3y^2) = 2^3x^3y^2 = 8x^3y^2$$

ii. $9a^3b^2, 12a^2b^2c$

$$9a^3b^2 = (1)(3)^2 a^3b^2$$

$$12a^2b^2c = 2^2 \times 3 \times a^2 \times b^2 \times c$$

$$\therefore \text{LCM}(9a^3b^2, 12a^2b^2c)$$

$$= (1) \times 2^2 \times 3^2 \times a^3 \times b^2 \times c = 36a^3b^2c$$

iii. $16m, 12m^2n^2, 8n^2$

$$16m = 2^4 \times m$$

$$12m^2n^2 = 2^2 \times 3 \times m^2 \times n^2$$

$$8n^2 = 2^3 \times n^2$$

$$\therefore \text{LCM}(16m, 12m^2n^2, 8n^2)$$

$$= 2^4 \times 3 \times m^2 \times n^2 = 48m^2n^2$$

iv. $p^2 - 3p + 2, p^2 - 4$

$$p^2 - 3p + 2 = (p - 1)(p - 2)$$

$$p^2 - 4 = (p + 2)(p - 2)$$

$$\therefore \text{LCM}(p^2 - 3p + 2, p^2 - 4)$$

$$= (p - 1)(p + 2)(p - 2)$$

v. $2x^2 - 5x - 3, 4x^2 - 36$

$$2x^2 - 5x - 3 = (x - 3)(2x + 1)$$

$$4x^2 - 36 = 4(x + 3)(x - 3)$$

$$\therefore \text{LCM}(2x^2 - 5x - 3, 4x^2 - 36)$$

$$= 4(x - 3)(x + 3)(2x + 1)$$

vi. $(2x^2 - 3xy)^2, (4x - 6y)^3, 8x^3 - 27y^3$

$$(2x^2 - 3xy)^2 = x^2(2x - 3y)^2$$

$$(4x - 6y)^3 = 2^3(2x - 3y)^3$$

8 $x^3 - 27y^3 = (2x)^3 - (3y)^3$

$$= (2x - 3y)(4x^2 + 6xy + 9y^2)$$

$$\therefore \text{LCM}((2x^2 - 3xy)^2, (4x - 6y)^3,$$

$$(8x^3 - 27y^3))$$

$$= 2^3 \times x^2 \times (2x - 3y)^3 (4x^2 + 6xy + 9y^2)$$

$$= 8x^2(2x - 3y)^3 (4x^2 + 6xy + 9y^2)$$

2. Simplify:

i) $\frac{4x^2y}{2z^2} \times \frac{6xz^3}{20y^4}$

ii) $\frac{p^2 - 10p + 21}{p - 7} \times \frac{p^2 + p - 12}{(p - 3)^2}$

iii) $\frac{5t^3}{4t - 8} \times \frac{6t - 12}{10t}$

Solution:

i. $\frac{4x^2y}{2z^2} \times \frac{6xz^3}{20y^4} = \frac{3x^3z}{5y^3}$

ii. $\frac{p^2 - 10p + 21}{p - 7} \times \frac{p^2 + p - 12}{(p - 3)^2}$
 $= \frac{(p - 7)(p - 3)}{(p - 7)} = \frac{(p + 4)(p - 3)}{(p - 3)^2} = (p + 4)$

iii. $\frac{5t^3}{4t - 8} \times \frac{6t - 12}{10t}$
 $= \frac{5t^3}{4(t - 2)} \times \frac{6(t - 2)}{10t} = \frac{3t^2}{4}$

3. Simplify: $\frac{x^3}{x - y} + \frac{y^3}{y - x}$

Solution:

$$\frac{x^3}{x - y} + \frac{y^3}{y - x} = \frac{x^3 - y^3}{x - y}$$

$$= \frac{(x^2 + xy + y^2)(x - y)}{(x - y)}$$

$$= x^2 + xy + y^2$$

4. Find the excluded values of the following expressions (if any).

i) $\frac{x + 10}{8x}$ ii) $\frac{7p + 2}{8p^2 + 13p + 5}$

Solution:

i. The expression $\frac{x + 10}{8x}$ is undefined when $8x = 0$ or $x = 0$.

When the excluded value is 0.

ii. The expression $\frac{7p + 2}{8p^2 + 13p + 5}$ is undefined when $8p^2 + 13p + 5 = 0$ that is

$$(8p + 5)(p + 1) = 0 \quad p = \frac{-5}{8}, p = -1.$$

The excluded values are $\frac{-5}{8}$ and -1 .

5. Find the excluded values, if any of the following expressions.

i) $\frac{y}{y^2 - 25}$

ii) $\frac{t}{t^2 - 5t + 6}$

iii) $\frac{x^2 + 6x + 8}{x^2 + x - 2}$

iv) $\frac{x^3 - 27}{x^3 + x^2 - 6x}$

Solution:

i. The expression $\frac{y}{y^2 - 25}$ is undefined

when $y^2 - 5^2 = 0$

$$y^2 - 5^2 = 0$$

$$(y + 5)(y - 5) = 0$$

$$y + 5 = 0, y - 5 = 0$$

$$y = -5, y = 5$$

Hence the excluded values are -5 and 5.

ii. The expression $\frac{t}{t^2 - 5t + 6}$ is undefined

when $t^2 - 5t + 6 = 0$

$$t^2 - 5t + 6 = 0$$

$$(t - 2)(t - 3) = 0$$

$$t - 2 = 0, t - 3 = 0$$

$$t = 2, t = 3$$

Hence the excluded values are 2 and 3.

iii. $\frac{x^2 + 6x + 8}{x^2 + x - 2} = \frac{(x + 4)(x + 2)}{(x + 2)(x - 1)} = \frac{x + 4}{x - 1}$

The expression $\frac{x + 4}{x - 1}$ is undefined when

$$x - 1 = 0. \text{ Hence the excluded value is 1.}$$

iv. $\frac{x^3 - 27}{x^3 + x^2 - 6x} = \frac{(x - 3)(x^2 + 3x + 9)}{x(x^2 + x - 6)}$

$$= \frac{(x - 3)(x^2 + 3x + 9)}{(x)(x + 3)(x - 2)}$$

The expression $\frac{x^3 - 27}{x^3 + x^2 - 6x}$ is undefined

when $x^3 + x^2 - 6x = 0$

$$\Rightarrow (x)(x + 3)(x - 2) = 0$$

$$\Rightarrow x = 0 \text{ or } x = -3 \text{ or } x = 2$$

Hence the excluded values are 0, -3, 2

6. Find the square root of the following rational expression.

$$\frac{400x^4y^{12}z^{16}}{100x^8y^4z^4}$$

Solution:

$$\frac{400x^4y^{12}z^{16}}{100x^8y^4z^4} = \sqrt{\frac{4y^8z^{12}}{x^4}} = 2\left|\frac{y^4z^6}{x^2}\right|$$

7. Find the square root of the following expressions

i) $256(x - a)^8(x - b)^4(x - c)^{16}(x - d)^{20}$

ii) $\frac{144a^8b^{12}c^{16}}{81f^{12}g^4h^{14}}$

Solution:

i. $\sqrt{(256(x - a)^8(x - b)^4(x - c)^{16}(x - d)^{20})}$
 $= 16|(x - a)^4(x - b)^2(x - c)^8(x - d)^{10}|$

ii. $\sqrt{\frac{144a^8b^{12}c^{16}}{81f^{12}g^4h^{14}}} = \frac{4}{3}\left|\frac{a^4b^6c^8}{f^6g^2h^7}\right|$

8. Find the square root of the following rational expression.

$$\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4}$$

Solution:

$$\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4} =$$

$$\sqrt{\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4}}$$

$$= \frac{11}{9}\left|\frac{(a + b)^4(x + y)^4}{(a - b)^6}\right|$$

9. Determine the quadratic equations, whose sum and product of roots are

(i) -9, 20 (ii) $\frac{5}{3}, 4$

Solution:

i. -9, 20

$$x^2 - [\alpha + \beta]x + \alpha\beta = 0$$

$$x^2 - [-9]x + 20 = 0 \Rightarrow x^2 + 9x + 20 = 0$$

ii. $\frac{5}{3}, 4$

Required Quadratic Equations

$$x^2 - (\text{Sum of the roots})x + \text{product of the roots} = 0$$

$$x^2 - \frac{5}{3}x + 4 = 0$$

Multiply 3 on both sides

$$3x^2 - 5x + 12 = 0$$

5. Find the excluded values, if any of the following expressions.

i) $\frac{y}{y^2 - 25}$

ii) $\frac{t}{t^2 - 5t + 6}$

iii) $\frac{x^2 + 6x + 8}{x^2 + x - 2}$

iv) $\frac{x^3 - 27}{x^3 + x^2 - 6x}$

Solution:

i. The expression $\frac{y}{y^2 - 25}$ is undefined

when $y^2 - 5^2 = 0$

$$y^2 - 5^2 = 0$$

$$(y + 5)(y - 5) = 0$$

$$y + 5 = 0, y - 5 = 0$$

$$y = -5, y = 5$$

Hence the excluded values are -5 and 5.

ii. The expression $\frac{t}{t^2 - 5t + 6}$ is undefined

when $t^2 - 5t + 6 = 0$

$$t^2 - 5t + 6 = 0$$

$$(t - 2)(t - 3) = 0$$

$$t - 2 = 0, t - 3 = 0$$

$$t = 2, t = 3$$

Hence the excluded values are 2 and 3.

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The expression $\frac{x + 4}{x - 1}$ is undefined when

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iv. $\frac{x^3 - 27}{x^3 + x^2 - 6x} = \frac{(x - 3)(x^2 + 3x + 9)}{x(x^2 + x - 6)}$

$$= \frac{(x - 3)(x^2 + 3x + 9)}{(x)(x + 3)(x - 2)}$$

The expression $\frac{x^3 - 27}{x^3 + x^2 - 6x}$ is undefined

when $x^3 + x^2 - 6x = 0$

$$\Rightarrow (x)(x + 3)(x - 2) = 0$$

$$\Rightarrow x = 0 \text{ or } x = -3 \text{ or } x = 2$$

Hence the excluded values are 0, -3, 2

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$$\frac{400x^4y^{12}z^{16}}{100x^8y^4z^4}$$

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$$\frac{400x^4y^{12}z^{16}}{100x^8y^4z^4} = \sqrt{\frac{4y^8z^{12}}{x^4}} = 2\left|\frac{y^4z^6}{x^2}\right|$$

7. Find the square root of the following expressions

i) $256(x - a)^8(x - b)^4(x - c)^{16}(x - d)^{20}$

ii) $\frac{144a^8b^{12}c^{16}}{81f^{12}g^4h^{14}}$

Solution:

i. $\sqrt{(256(x - a)^8(x - b)^4(x - c)^{16}(x - d)^{20})}$
 $= 16|(x - a)^4(x - b)^2(x - c)^8(x - d)^{10}|$

ii. $\sqrt{\frac{144a^8b^{12}c^{16}}{81f^{12}g^4h^{14}}} = \frac{4}{3}\left|\frac{a^4b^6c^8}{f^6g^2h^7}\right|$

8. Find the square root of the following rational expression.

$$\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4}$$

Solution:

$$\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4} =$$

$$\sqrt{\frac{121(a + b)^8(x + y)^8(b - c)^8}{81(b - c)^4(a - b)^{12}(b - c)^4}}$$

$$= \frac{11}{9}\left|\frac{(a + b)^4(x + y)^4}{(a - b)^6}\right|$$

9. Determine the quadratic equations, whose sum and product of roots are

(i) -9, 20 (ii) $\frac{5}{3}, 4$

Solution:

i. -9, 20

$$x^2 - [\alpha + \beta]x + \alpha\beta = 0$$

$$x^2 - [-9]x + 20 = 0 \Rightarrow x^2 + 9x + 20 = 0$$

ii. $\frac{5}{3}, 4$

Required Quadratic Equations

$$x^2 - (\text{Sum of the roots})x + \text{product of the roots} = 0$$

$$x^2 - \frac{5}{3}x + 4 = 0$$

Multiply 3 on both sides

$$3x^2 - 5x + 12 = 0$$

10. Find the sum and product of the roots for each of the following quadratic equations

(i) $x^2 + 3x - 28 = 0$ (ii) $x^2 + 3x = 0$

Solution:

i. $x^2 + 3x - 28 = 0$

$a = 1, b = 3, c = -28$

Sum of the roots $= \alpha + \beta = -\frac{b}{a} = -\frac{3}{1} = -3$

Product of the roots $= \alpha\beta = \frac{c}{a}$

$= -\frac{28}{1} = -28$

ii. $x^2 + 3x = 0$

$a = 1, b = 3, c = 0$

Sum of the roots $= \alpha + \beta = -\frac{b}{a} = -\frac{3}{1} = -3$

Product of the roots $= \alpha\beta = \frac{c}{a} = \frac{0}{1} = 0$

11. In the matrix $A = \begin{pmatrix} 8 & 9 & 4 & 3 \\ -1 & \sqrt{7} & \frac{\sqrt{3}}{2} & 5 \\ 1 & 4 & 3 & 0 \\ 6 & 8 & -11 & 1 \end{pmatrix}$,

write

(i) The number of elements

(ii) The order of the matrix

(iii) Write the elements $a_{22}, a_{23}, a_{24}, a_{34}, a_{43}, a_{44}$.

Solution:

i) Number of elements $= 4 \times 4 = 16$

ii) Order of matrix $= 4 \times 4$

iii) $a_{22} = \sqrt{7}; a_{23} = \frac{\sqrt{3}}{2}; a_{24} = 5;$

$a_{34} = 0; a_{43} = -11; a_{44} = 1$

12. If a matrix has 18 elements, what are the possible orders it can have? What if it has 6 elements?

Solution:

Matrix having 18 elements 1×18 (or) 2×9
(or) 3×6 (or) 6×3 (or) 9×2 (or) 18×1

Matrix having 6 elements 1×6 (or) 2×3 (or)
 3×2 (or) 6×1

13. Construct a 3×3 matrix whose elements are given by

(i) $a_{ij} = i - 2j$

(ii) $a_{ij} = \frac{(i+j)^3}{3}$

Solution:

i. $a_{ij} = |i - 2j|$

$$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

$$= \begin{bmatrix} |1-2| & |1-4| & |1-6| \\ |2-2| & |2-4| & |2-6| \\ |3-2| & |3-4| & |3-6| \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 3 & 5 \\ 0 & 2 & 4 \\ 1 & 1 & 3 \end{bmatrix}$$

ii. $a_{ij} = \frac{(i+j)^3}{3}$

$$= \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

$$= \begin{bmatrix} \frac{8}{3} & 9 & \frac{64}{3} \\ 9 & \frac{64}{3} & \frac{125}{3} \\ \frac{64}{3} & \frac{125}{3} & 72 \end{bmatrix}$$

14. Construct a 3×3 matrix whose elements are $a_{ij} = i^2 j^2$

Solution:

The general 3×3 matrix is given by

$$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

$a_{11} = 1^2 \times 1^2 = 1 \times 1 = 1; a_{12} = 1^2 \times 2^2 = 1 \times 4 = 4;$

$a_{13} = 1^2 \times 3^2 = 1 \times 9 = 9; a_{21} = 2^2 \times 1^2 = 4 \times 1 = 4;$

$a_{22} = 2^2 \times 2^2 = 4 \times 4 = 16; a_{23} = 2^2 \times 3^2 = 4 \times 9 = 36$

$a_{31} = 3^2 \times 1^2 = 9 \times 1 = 9; a_{32} = 3^2 \times 2^2 = 9 \times 4 = 36;$

$a_{33} = 3^2 \times 3^2 = 9 \times 9 = 81$

Hence the required matrix is $A = \begin{pmatrix} 1 & 4 & 9 \\ 4 & 16 & 36 \\ 9 & 36 & 81 \end{pmatrix}$

15. If $A = \begin{pmatrix} 5 & 4 & 3 \\ 1 & -7 & 9 \\ 3 & 8 & 2 \end{pmatrix}$ then

find the transpose of A.

Solution:

$$A = \begin{pmatrix} 5 & 4 & 3 \\ 1 & -7 & 9 \\ 3 & 8 & 2 \end{pmatrix} \quad A^T = \begin{pmatrix} 5 & 1 & 3 \\ 4 & -7 & 8 \\ 3 & 9 & 2 \end{pmatrix}$$

16. If $A = \begin{pmatrix} \sqrt{7} & -3 \\ -\sqrt{5} & 2 \\ \sqrt{3} & -5 \end{pmatrix}$ then

find the transpose of $-A$.

Solution:

$$A = \begin{pmatrix} \sqrt{7} & -3 \\ -\sqrt{5} & 2 \\ \sqrt{3} & -5 \end{pmatrix} \quad -A = \begin{pmatrix} -\sqrt{7} & 3 \\ \sqrt{5} & -2 \\ -\sqrt{3} & 5 \end{pmatrix}$$

$$(-A)^T = \begin{pmatrix} -\sqrt{7} & \sqrt{5} & -\sqrt{3} \\ 3 & -2 & 5 \end{pmatrix}$$

17. If $A = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$ then verify $(A^T)^T = A$

Solution:

$$A = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$$

$$A^T = \begin{pmatrix} 5 & -\sqrt{17} & 8 \\ 2 & 0.7 & 3 \\ 2 & \frac{5}{2} & 1 \end{pmatrix}$$

$$(A^T)^T = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$$

$$\therefore (A^T)^T = A$$

18. Find the values of x , y and z from the following equations

(i) $\begin{pmatrix} 12 & 3 \\ x & 5 \end{pmatrix} = \begin{pmatrix} y & z \\ 3 & 5 \end{pmatrix}$

(ii) $\begin{pmatrix} x+y & 2 \\ 5+z & xy \end{pmatrix} = \begin{pmatrix} 6 & 2 \\ 5 & 8 \end{pmatrix}$

(iii) $\begin{pmatrix} x+y+z \\ x+z \\ y+z \end{pmatrix} = \begin{pmatrix} 9 \\ 5 \\ 7 \end{pmatrix}$

Solution:

i. $\begin{pmatrix} 12 & 3 \\ x & 5 \end{pmatrix} = \begin{pmatrix} y & z \\ 3 & 5 \end{pmatrix}$

$$\Rightarrow 12 = y; 3 = z; x = 3$$

ii. $\begin{pmatrix} x+y & 2 \\ 5+z & xy \end{pmatrix} = \begin{pmatrix} 6 & 2 \\ 5 & 8 \end{pmatrix}$

$$\Rightarrow 5+z = 5 \quad x+y = 6;$$

$$z = 5 - 5 \quad y = 6 - x;$$

$$z = 0$$

$$xy = 8$$

$$x(6-x) = 8$$

$$6 \quad x - x^2 - 8 = 0$$

$$\Rightarrow x^2 - 6x + 8 = 0$$

$$x(-2)(x-4) = 0$$

$$x - 2 = 0 \quad (\text{or}) \quad x - 4 = 0$$

$$x = 2 \quad (\text{or}) \quad x = 4$$

$$\text{If } x = 2 \text{ then } y = \frac{8}{x} = \frac{8}{2} = 4;$$

$$\text{If } x = 4 \text{ then } y = \frac{8}{4} = 2$$

iii. $\begin{pmatrix} x+y+z \\ x+z \\ y+z \end{pmatrix} = \begin{pmatrix} 9 \\ 5 \\ 7 \end{pmatrix}$

$$x + y + z = 9 \quad \dots (1)$$

$$x + z = 5 \quad \dots (2)$$

$$y + z = 7 \quad \dots (3)$$

Substitute (3) in (1)

$$x + 7 = 9 \Rightarrow x = 9 - 7 = 2$$

Substitute $x = 2$ in (2)

$$2 + z = 5 \Rightarrow z = 5 - 2 = 3$$

Substitute $z = 3$ in (3)

$$y + 3 = 7 \Rightarrow y = 7 - 3 \Rightarrow y = 4$$

19. If $A = \begin{pmatrix} 7 & 8 & 6 \\ 1 & 3 & 9 \\ -4 & 3 & -1 \end{pmatrix}$, $B = \begin{pmatrix} 4 & 11 & -3 \\ -1 & 2 & 4 \\ 7 & 5 & 0 \end{pmatrix}$

then Find $2A+B$.

Solution:

$$2A + B = 2 \begin{pmatrix} 7 & 8 & 6 \\ 1 & 3 & 9 \\ -4 & 3 & -1 \end{pmatrix} + \begin{pmatrix} 4 & 11 & -3 \\ -1 & 2 & 4 \\ 7 & 5 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 14 & 16 & 12 \\ 2 & 6 & 18 \\ -8 & 6 & -2 \end{pmatrix} + \begin{pmatrix} 4 & 11 & -3 \\ -1 & 2 & 4 \\ 7 & 5 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 14+4 & 16+11 & 12-3 \\ 2-1 & 6+2 & 18+4 \\ -8+7 & 6+5 & -2+0 \end{pmatrix}$$

$$= \begin{pmatrix} 18 & 27 & 9 \\ 1 & 8 & 22 \\ -1 & 11 & -2 \end{pmatrix}$$

20. If $A = \begin{pmatrix} 5 & 4 & -2 \\ 1 & 3 & \sqrt{2} \\ 2 & 4 & 1 \end{pmatrix}$, $B = \begin{pmatrix} -7 & 4 & -3 \\ 1 & 7 & 3 \\ 4 & 2 & 5 \end{pmatrix}$,

find $4A - 3B$.

Solution:

$$\begin{aligned} 4A - 3B &= 4 \begin{pmatrix} 5 & 4 & -2 \\ 1 & 3 & \sqrt{2} \\ 2 & 4 & 1 \end{pmatrix} - 3 \begin{pmatrix} -7 & 4 & -3 \\ 1 & 7 & 3 \\ 4 & 2 & 5 \end{pmatrix} \\ &= \begin{pmatrix} 20 & 16 & -8 \\ 4 & 12 & 4\sqrt{2} \\ 8 & 16 & 4 \end{pmatrix} + \begin{pmatrix} 21 & -12 & 9 \\ -3 & -21 & -9 \\ -12 & 18 & -15 \end{pmatrix} \\ &= \begin{pmatrix} 20+21 & 16-12 & -8+9 \\ 4-3 & 12-21 & 4\sqrt{2}-9 \\ 8-12 & 16+18 & 4-15 \end{pmatrix} \\ &= \begin{pmatrix} 41 & 4 & 1 \\ 1 & -9 & 4\sqrt{2}-9 \\ -4 & 34 & -11 \end{pmatrix} \end{aligned}$$

21. If $A = \begin{pmatrix} 1 & 9 \\ 3 & 4 \\ 8 & -3 \end{pmatrix}$, $B = \begin{pmatrix} 5 & 7 \\ 3 & 3 \\ 1 & 0 \end{pmatrix}$ then verify

that (i) $A+B = B+A$

(ii) $A+(-A) = (-A)+A = O$.

Solution:

i. $A+B = B+A$

$$\begin{aligned} \text{L.H.S.} \\ A+B &= \begin{pmatrix} 1 & 9 \\ 3 & 4 \\ 8 & -3 \end{pmatrix} + \begin{pmatrix} 5 & 7 \\ 3 & 3 \\ 1 & 0 \end{pmatrix} \\ &= \begin{pmatrix} 6 & 16 \\ 6 & 7 \\ 9 & -3 \end{pmatrix} \quad \dots (1) \end{aligned}$$

$$\begin{aligned} \text{R.H.S.} \\ B+A &= \begin{pmatrix} 5 & 7 \\ 3 & 3 \\ 1 & 0 \end{pmatrix} + \begin{pmatrix} 1 & 9 \\ 3 & 4 \\ 8 & -3 \end{pmatrix} \\ &= \begin{pmatrix} 6 & 16 \\ 6 & 7 \\ 9 & -3 \end{pmatrix} \quad \dots (2) \end{aligned}$$

(1), (2) $\Rightarrow A+B = B+A$

ii. $A+(-A) = (-A)+A = O$

$$\begin{aligned} A+(-A) &= \begin{pmatrix} 1 & 9 \\ 3 & 4 \\ 8 & -3 \end{pmatrix} + \begin{pmatrix} -1 & -9 \\ -3 & -4 \\ -8 & 3 \end{pmatrix} \\ &= \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix} \quad \dots (1) \end{aligned}$$

$$\begin{aligned} (-A)+A &= \begin{pmatrix} -1 & -9 \\ -3 & -4 \\ -8 & 3 \end{pmatrix} + \begin{pmatrix} 1 & 9 \\ 3 & 4 \\ 8 & -3 \end{pmatrix} \\ &= \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix} \quad \dots (2) \end{aligned}$$

(1), (2) $\Rightarrow A+(-A) = (-A)+A = O$

22. If $A = \begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix}$, $B = \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix}$
find the value of (i) $B - 5A$ (ii) $3A - 9B$

Solution:

$$A = \begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix}, B = \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix}$$

i. $B - 5A$

$$\begin{aligned} &= \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix} - 5 \begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix} \\ &= \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix} + \begin{pmatrix} 0 & -20 & -45 \\ -40 & -15 & -35 \end{pmatrix} \\ &= \begin{pmatrix} 7 & -17 & -37 \\ -39 & -11 & -26 \end{pmatrix} \end{aligned}$$

ii. $3A - 9B$

$$\begin{aligned} &= 3 \begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix} - 9 \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix} \\ &= \begin{pmatrix} 0 & 12 & 27 \\ 24 & 9 & 21 \end{pmatrix} + \begin{pmatrix} -63 & -27 & -72 \\ -9 & -36 & -81 \end{pmatrix} \\ &= \begin{pmatrix} -63 & -15 & -45 \\ 15 & -27 & -60 \end{pmatrix} \end{aligned}$$

ii. $ax^4 + bx^3 + 361x^2 + 220x + 100$

Solution:

	10	11	12		
10	100	220	361	b	a
	(-)	100			
20	11	220	361		
	(-)	220	(-)	121	
20	22	12	240	b	a
	(-)	240	(-)	264	(-)
				a = 144	b = 264

5. Find the values of m and n if the following polynomials are perfect squares

i. $36x^4 - 60x^3 + 61x^2 - mx + n$

Solution:

	6	-5	3		
6	36	-60	61	-m	n
	(-)	36			
12	-5	-60	61		
	(+)	-60	(-)	25	
12	-10	36	-m	n	
	3	(-)	36	(+)	-30
				(-)	9
				-m = -30, m = 30	
				n = 9	

ii. $x^4 - 8x^3 + mx^2 + nx + 16$

Solution:

	1	-4	4		
1	1	-8	m	n	16
	(-)	1			
2	-4	-8	m		
	(+)	-8	(-)	16	
2	-8	4	m-16	n	16
	(-)	8	(+)	-32	(-)
					16
					0

$$\frac{m-16}{2} = 4$$

$$m - 16 = 8, n = -32$$

$$m = 8 + 16$$

$$m = 24$$

6. If $A = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix}, B = \begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix}$

and $C = \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix}$ then verify that

$$A + (B + C) = (A + B) + C.$$

Solution:

$$A + (B + C) = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix}$$

$$+ \left(\begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix} + \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix} \right)$$

$$= \begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix} + \begin{pmatrix} 10 & 6 & 8 \\ 2 & 7 & 5 \\ -5 & 5 & -2 \end{pmatrix}$$

$$= \begin{pmatrix} 14 & 9 & 9 \\ 4 & 10 & -3 \\ -4 & 5 & -6 \end{pmatrix} \dots (1)$$

$(A + B) + C$

$$= \left(\begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix} + \begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix} \right)$$

$$+ \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix}$$

$$= \begin{pmatrix} 14 & 9 & 9 \\ 4 & 10 & -3 \\ -4 & 5 & -6 \end{pmatrix} \dots (2)$$

From (1) & (2) LHS = RHS

7. If $A = \begin{pmatrix} 1 & 1 \\ -1 & 3 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ -4 & 2 \end{pmatrix}, C = \begin{pmatrix} -7 & 6 \\ 3 & 2 \end{pmatrix}$

verify that $A(B + C) = AB + AC.$

Solution:

$$B + C = \begin{pmatrix} 1 & 2 \\ -4 & 2 \end{pmatrix} + \begin{pmatrix} -7 & 6 \\ 3 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 1-7 & 2+6 \\ -4+3 & 2+2 \end{pmatrix} = \begin{pmatrix} -6 & 8 \\ -1 & 4 \end{pmatrix}$$

LHS = $A(B + C)$

$$= \begin{pmatrix} 1 & 1 \\ -1 & 3 \end{pmatrix} \begin{pmatrix} -6 & 8 \\ -1 & 4 \end{pmatrix}$$

$$= \begin{pmatrix} -6-1 & 8+4 \\ 6-3 & -8+12 \end{pmatrix} = \begin{pmatrix} -7 & 12 \\ 3 & 4 \end{pmatrix}$$

AB = $\begin{pmatrix} 1 & 1 \\ -1 & 3 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ -4 & 2 \end{pmatrix}$

$$= \begin{pmatrix} 1-4 & 2+2 \\ -1-12 & -2+6 \end{pmatrix} = \begin{pmatrix} -3 & 4 \\ -13 & 4 \end{pmatrix}$$

AC = $\begin{pmatrix} 1 & 1 \\ -1 & 3 \end{pmatrix} \begin{pmatrix} -7 & 6 \\ 3 & 2 \end{pmatrix}$

$$= \begin{pmatrix} -7+3 & 6+2 \\ 7+9 & -6+6 \end{pmatrix} = \begin{pmatrix} -4 & 8 \\ 16 & 0 \end{pmatrix}$$

$$\text{RHS} = \text{AB} + \text{AC}$$

$$= \begin{pmatrix} -3 & 4 \\ -13 & 4 \end{pmatrix} + \begin{pmatrix} -4 & 8 \\ 16 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} -3-4 & 4+8 \\ -13+16 & 4+0 \end{pmatrix} = \begin{pmatrix} -7 & 12 \\ 3 & 4 \end{pmatrix}$$

$$\therefore \text{LHS} = \text{RHS}$$

8. If $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$

show that $(\text{AB})^T = \text{B}^T \text{A}^T$

Solution:

$$\text{AB} = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix} \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 2-2+0 & -1+8+2 \\ 4+1+0 & -2-4+2 \end{pmatrix} = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix}$$

$$\text{AB}^T = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix}$$

$$\text{B}^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix} \quad \text{A}^T = \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}$$

$$\text{B}^T \text{A}^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}$$

$$\text{B}^T \text{A}^T = \begin{pmatrix} 2-2+0 & 4+1+0 \\ -1+8+2 & -2-4+2 \end{pmatrix} = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix}$$

$$\therefore \text{LHS} = \text{RHS}$$

9. Given that $A = \begin{pmatrix} 1 & 3 \\ 5 & -1 \end{pmatrix}$,

$$B = \begin{pmatrix} 1 & -1 & 2 \\ 3 & 5 & 2 \end{pmatrix}, C = \begin{pmatrix} 1 & 3 & 2 \\ -4 & 1 & 3 \end{pmatrix}$$

verify that $A(\text{B} + \text{C}) = \text{AB} + \text{AC}$.

Solution:

$$A = \begin{pmatrix} 1 & 3 \\ 5 & -1 \end{pmatrix}, B = \begin{pmatrix} 1 & -1 & 2 \\ 3 & 5 & 2 \end{pmatrix}, C = \begin{pmatrix} 1 & 3 & 2 \\ -4 & 1 & 3 \end{pmatrix}$$

To verify that $A(\text{B} + \text{C}) = \text{AB} + \text{AC}$

$$\text{LHS}$$

$$\text{B} + \text{C} = \begin{pmatrix} 1 & -1 & 2 \\ 3 & 5 & 2 \end{pmatrix} + \begin{pmatrix} 1 & 3 & 2 \\ -4 & 1 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} 2 & 2 & 4 \\ -1 & 6 & 5 \end{pmatrix}$$

$$\text{A}(\text{B} + \text{C}) = \begin{pmatrix} 1 & 3 \\ 5 & -1 \end{pmatrix} \times \begin{pmatrix} 2 & 2 & 4 \\ -1 & 6 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} 2-3 & 2+18 & 4+15 \\ 10+1 & 10-6 & 20-5 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 20 & 19 \\ 11 & 4 & 15 \end{pmatrix} \quad \dots(1)$$

$$\text{AB} = \begin{pmatrix} 1 & 3 \\ 5 & -1 \end{pmatrix} \times \begin{pmatrix} 1 & -1 & 2 \\ 3 & 5 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 1+9 & -1+15 & 2+6 \\ 5-3 & -5-5 & 10-2 \end{pmatrix} = \begin{pmatrix} 10 & 14 & 8 \\ 2 & -10 & 8 \end{pmatrix}$$

$$\text{AB} + \text{AC} = \begin{pmatrix} -1 & 20 & 19 \\ 11 & 4 & 15 \end{pmatrix} \quad \dots(2)$$

$$(1), (2) \Rightarrow \text{A}(\text{B} + \text{C}) = \text{AB} + \text{AC}.$$

10. If $A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$

verify that $(\text{AB})^T = \text{B}^T \text{A}^T$

Solution:

$$A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}, B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$$

$$\text{AB} = \begin{pmatrix} 5+2+45 & 35+4-9 \\ 1+2+40 & 7+4-8 \end{pmatrix} = \begin{pmatrix} 52 & 30 \\ 43 & 3 \end{pmatrix}$$

$$(\text{AB})^T = \begin{pmatrix} 52 & 43 \\ 30 & 3 \end{pmatrix}$$

$$\text{B}^T = \begin{pmatrix} 1 & 1 & 5 \\ 7 & 2 & -1 \end{pmatrix} \quad \text{A}^T = \begin{pmatrix} 5 & 1 \\ 2 & 2 \\ 9 & 8 \end{pmatrix}$$

$$\text{B}^T \text{A}^T = \begin{pmatrix} 1 & 1 & 5 \\ 7 & 2 & -1 \end{pmatrix} \times \begin{pmatrix} 5 & 1 \\ 2 & 2 \\ 9 & 8 \end{pmatrix}$$

$$= \begin{pmatrix} 5+2+45 & 1+2+40 \\ 35+4-9 & 7+4-8 \end{pmatrix} = \begin{pmatrix} 52 & 43 \\ 30 & 3 \end{pmatrix}$$

$$(1), (2) \Rightarrow (\text{AB})^T = \text{B}^T \text{A}^T$$

11. If $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ show that $\text{A}^2 - 5\text{A} + 7\text{I}_2 = 0$

Solution:

$$\text{A}^2 = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 9-1 & 3+2 \\ -3-2 & -1+4 \end{pmatrix} = \begin{pmatrix} 8 & 5 \\ -5 & 3 \end{pmatrix}$$

$$\text{A}^2 - 5\text{A} + 7\text{I}_2$$

$$= \begin{pmatrix} 8 & 5 \\ -5 & 3 \end{pmatrix} - \begin{pmatrix} -15 & -5 \\ 5 & -10 \end{pmatrix} + \begin{pmatrix} 7 & 0 \\ 0 & 7 \end{pmatrix}$$

$$= \begin{pmatrix} 8-15+7 & 5-5+0 \\ -5+5+0 & 3-10+7 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\text{Hence, } \text{A}^2 - 5\text{A} + 7\text{I}_2 = 0$$

8 Marks

1. Varshika drew 6 circles with different sizes. Draw a graph for the relationship between the diameter and circumference of each circle as shown in the table and use it to find the circumference of a circle when its diameter is 6 cm.

Diameter (x) cm	1	2	3	4	5
Circumference (y) cm	3.1	6.2	9.3	12.4	15.5

Solution:

I. Table (Given)

Diameter(x) cm	1	2	3	4	5
Circumference (y) cm	3.1	6.2	9.3	12.4	15.5

II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

Let $y = kx$, where k is a constant of proportionality.

From the given values, we have,

$$k = \frac{y}{x} = \frac{3.1}{1} = \frac{6.2}{2} = \frac{9.3}{3} = \frac{12.4}{4} = \dots = 3.1$$

$$\therefore y = 3.1x$$

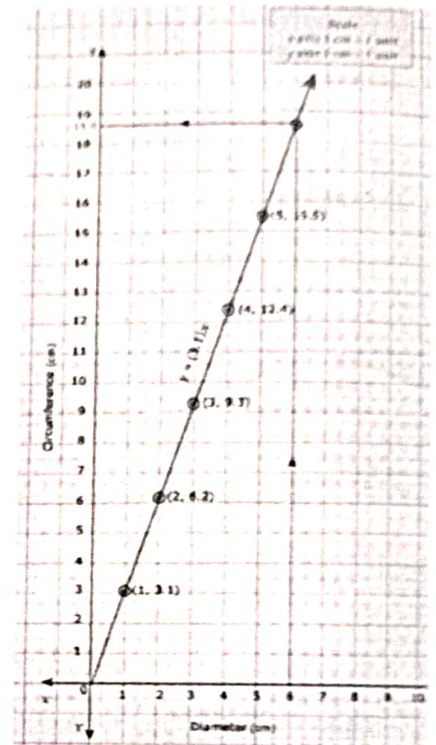
III. Points

(1, 3.1) (2, 6.2) (3, 9.3), (4, 12.4), (5, 15.5)

IV. Solution:

From the graph, when diameter is 6 cm, its circumference is 18.6 cm.

Verify: When $x = 6$, $y = (3.1) \times 6 = 18.6$



2. A bus is travelling at a uniform speed of 50 km/hr. Draw the distance-time graph and hence find (i) the constant of variation (ii) how far will it travel in 1½ hr (iii) the time required to cover a distance of 300 km from the graph.

Solution: I. Table

Time taken x (in minutes)	60	120	180	240	300	360
Distance y (in km)	50	100	150	200	250	300

II. Variation:

When 'x' increases, 'y' also increases.

Thus, the variation is a direct variation.

$$\frac{y}{x} = \frac{50}{60} = \frac{100}{120} = \frac{5}{6} \therefore \text{Equation } y = \frac{5}{6}x$$

III. Points: (60, 50), (120, 100), (180, 150), (240, 200), (300, 250)

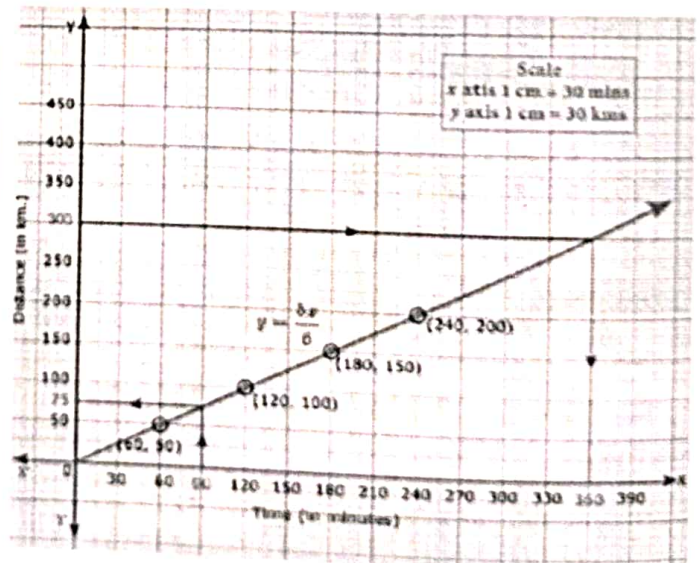
IV. Solution:

(i) the constant of variation $k = \frac{y}{x} = \frac{5}{6}$

(ii) the bus will travel 75 km in 90 mins

$$\text{(verify : } y = \frac{5}{6} \times 90 = \frac{450}{6} = 75)$$

(iii) from the graph, the time required to cover a distance of 300 km is 360 minutes.



3. A company initially started with 40 workers to complete the work by 150 days. Later, it decided to fasten up the work increasing the number of workers as shown below.

Number of workers (x)	40	50	60	75
Number of days (y)	150	120	100	80

(i) Graph the above data and identify the type of variation. (ii) From the graph, find the number of days required to complete the work if the company decides to opt for 120 workers? (iii) If the work has to be completed by 30 days, how many workers are required?

Solution: I. Table (Given)

Number of workers (x)	40	50	60	75
Number of days (y)	150	120	100	80

II. Variation:

When 'x' increases, 'y' also decreases. Hence, inverse variation. i.e. $xy = k$

$$xy = 40 \times 150 = 50 \times 120 = \dots = 6000 (k)$$

\therefore Required Equation $xy = 6000$

III. Points: (40, 150) (50, 120) (60, 100), (75, 80)

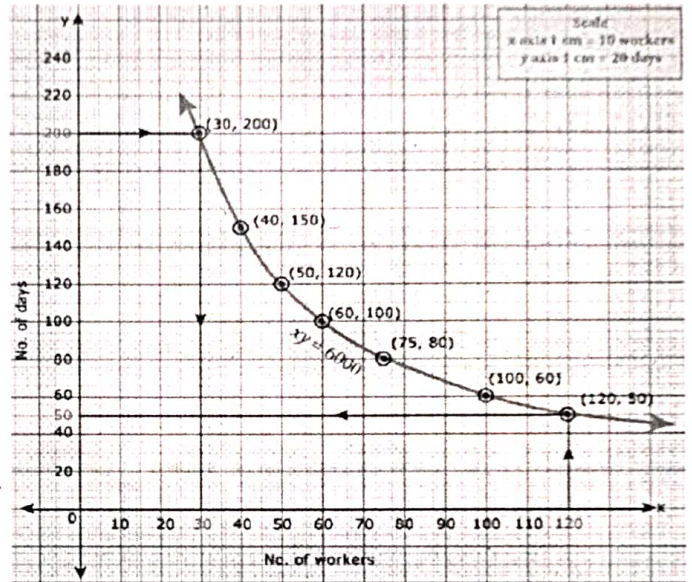
IV. Solution:

(i) Inverse Variation

(ii) When $x = 120 \Rightarrow 120 \times y = 6000$

$\Rightarrow y = \frac{6000}{120} = 50$. Also from the graph, the No. of days required to complete the work if the company decides to opt for 120 workers is 50 days.

(iii) When $y = 200 \Rightarrow x \times 200 = 6000 \Rightarrow x = \frac{6000}{200} = 30$. Also from the graph, the No. of workers required to complete in 200 days is 30.



4. Nishanth is the winner in a Marathon race of 12 km distance. He ran at the uniform speed of 12 km/hr and reached the destination in 1 hour. He was followed by Aradhana, Ponmozhi, Jeyanth, Sathya and Swetha with their respective speed of 6 km/hr, 4 km/hr, 3 km/hr and 2 km/hr. And, they covered the distance in 2 hrs, 3 hrs, 4 hrs and 6 hours respectively. Draw the speed-time graph and use it to find the time taken to Kaushik with his speed of 2.4 km/hr.

Solution: I. Table:

Speed x(km / hr)	12	6	4	3	2
Time y (hours)	1	2	3	4	6

II. Variation:

From the table, we observe that as x decreases, y increases. Hence, the type is inverse variation.

Let $y = \frac{k}{x} \Rightarrow xy = k, k > 0$ is called the constant of variation.

$$k = 12 \times 1 = 6 \times 2 = \dots = 2 \times 6 = 12 (k)$$

Therefore, $xy = 12$.

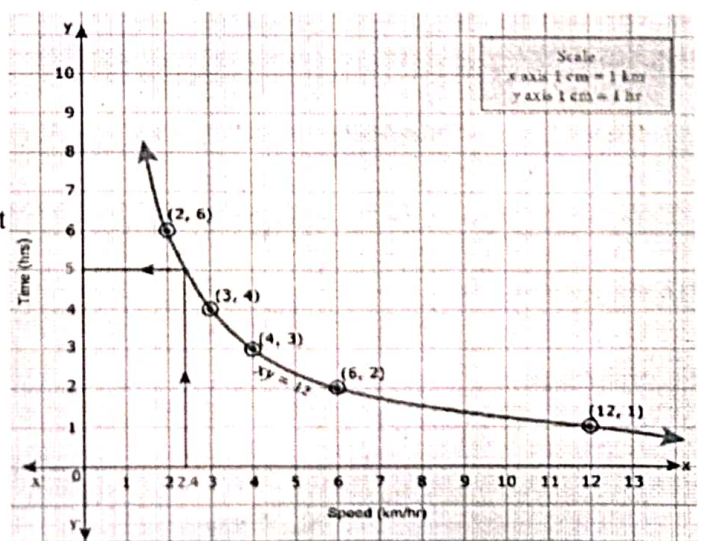
III. Points: (12, 1), (6, 2), (4, 3), (3, 4), (2, 6)

IV. Solution:

When $x = 2.4 \Rightarrow 2.4 \times y = 12$.

$$y = \frac{12}{2.4} = 5$$

Also, from the graph, the time taken to Kaushik with his speed of 2.4 km / hr is 5 hours.



5. A garment shop announces a flat 50% discount on every purchase of items for their customers. Draw the graph for the relation between the Marked Price and the Discount. Hence find
 (i) the marked price when a customer gets a discount of ₹ 3250 (from graph)
 (ii) the discount when the marked price is ₹ 2500

Solution: I. Table (Given)

Marked Price ₹ (x)	1000	2000	3000	4000	5000	6000
Discounted Price ₹ (y)	500	1000	1500	2000	2500	3000

II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

Let $y = kx$, where k is a constant of proportionality. From the given values, we have,

$$k = \frac{y}{x} = \frac{500}{1000} = \frac{1000}{2000} = \dots = \frac{1}{2}$$

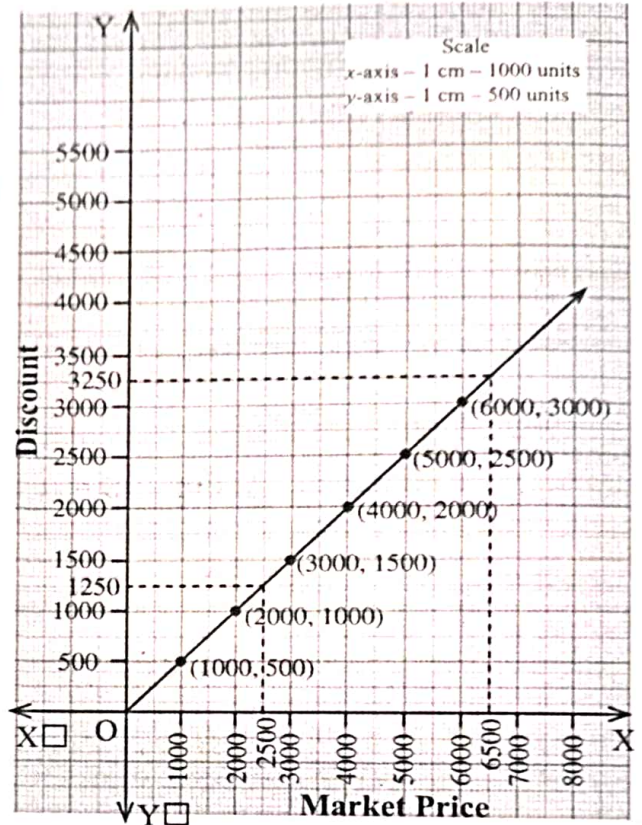
$$\therefore \text{Required Equation is } y = \frac{1}{2}x$$

III. Points: (1000, 500), (2000, 1000), (3000, 1500), (4000, 2000), (5000, 2500), (6000, 3000)

IV. Solution:

- (i) From the graph, when a discount price is ₹ 3250, the marked price is ₹ 6500
 (ii) From the graph, when the marked price is ₹ 2500, the discounted price is ₹ 1250

Verify: When $x = 6$, $y = (3.1) \times 6 = 18.6$



6. Draw the graph of $xy = 24$, $x, y > 0$. Using the graph find,
 (i) y when $x = 3$ and (ii) x when $y = 6$.

Solution:

I. Table: (Given)

x	1	2	3	4	6	12	24
y	24	12	8	6	4	2	1

II. Variation:

When 'x' increases, 'y' also decreases.

Hence, inverse variation.

$$\text{i.e. } xy = k$$

$$xy = 1 \times 24 = 2 \times 12 = \dots = 12 \times 2 = 24$$

$$\therefore \text{Required Equation } xy = 24$$

III. Points:

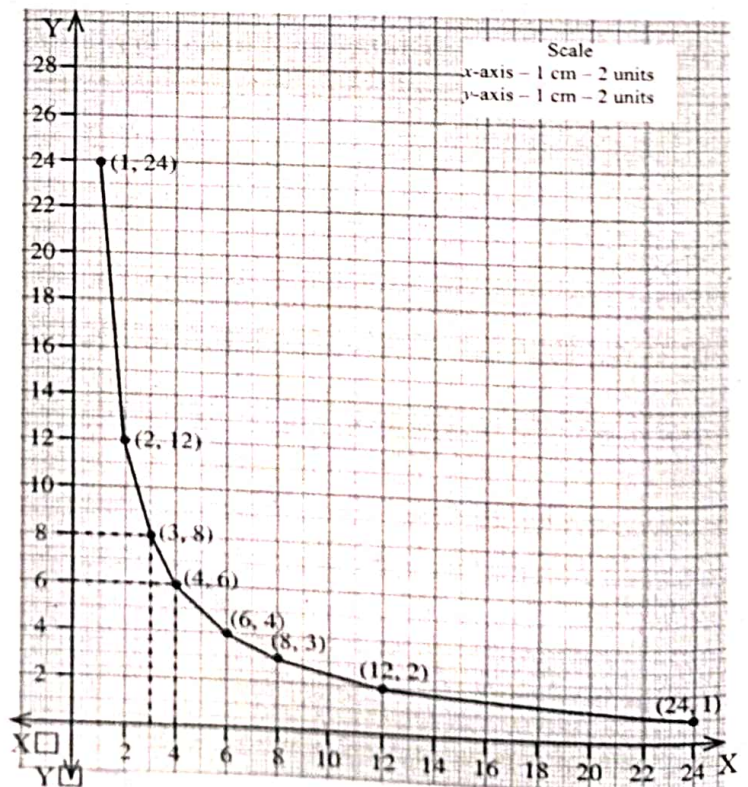
(1, 24), (2, 12), (3, 8), (4, 6), (6, 4), (12, 2)

IV. Solution:

(i) $x = 3 \Rightarrow 3 \times y = 24 \Rightarrow y = \frac{24}{3} = 8 \Rightarrow y = 8$

(ii) $y = 6 \Rightarrow x \times 6 = 24 \Rightarrow x = \frac{24}{6} = 4 \Rightarrow x = 4$

Also, Verified in the Graph.



7. Graph the following linear function $y = 1/2 x$. Identify the constant of variation and verify it with the graph. Also (i) find y when $x = 9$ (ii) find x when $y = 7.5$.

Solution: I. Table: (Given)

x	2	4	6	8	10
y	1	2	3	4	5

II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

Let $y = kx$, where k is a constant of proportionality. From the given values, we have,

$$k = \frac{y}{x} = \frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \dots = \frac{1}{2}$$

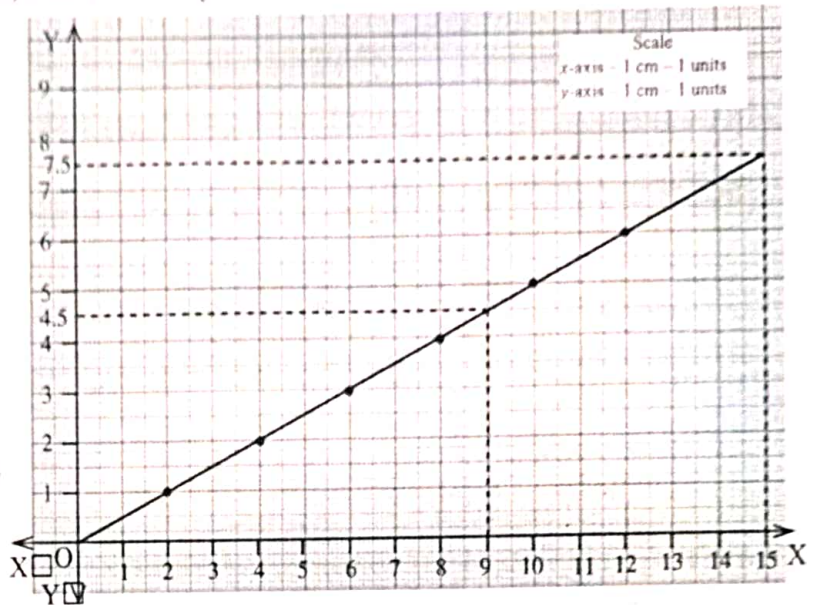
\therefore Required Equation is $y = \frac{1}{2} x$

III. Points: (2,1), (4, 2), (6, 3), (8, 4), (10, 5)

IV. Solution:

From the graph, when $x = 9$, $y = 4.5$

From the graph, when $y = 7.5$, $x = 15$



8. The following table shows the data about the number of pipes and the time taken to till the same tank.

No. of pipes (x)	2	3	6	9
Time Taken (in min) (y)	45	30	15	10

Draw the graph for the above data and hence

(i) find the time taken to fill the tank when five pipes are used

(ii) find the number of pipes when the time is 9 minutes.

Solution:

I. Table (Given):

No. of pipes (x)	2	3	6	9
Time Taken (in min) (y)	45	30	15	10

II. Variation:

When 'x' increases, 'y' also decreases. Hence, inverse variation. i.e. $xy = k$

$$xy = 2 \times 45 = 3 \times 30 = \dots 6 \times 15 = 9 \times 10 = 90$$

\therefore Required Equation $xy = 90$

III. Points: (2, 45), (3, 30), (6, 15), (9, 10)

IV. Solution:

$$x = 5 \Rightarrow 5 \times y = 90$$

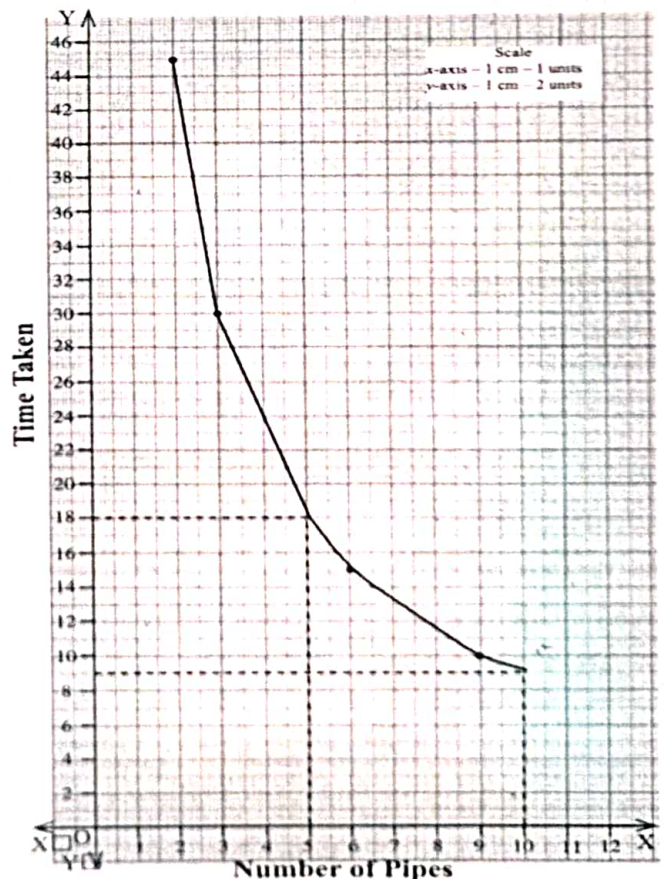
$$y = \frac{90}{5} = 18 \quad (\text{Verified with Graph})$$

Hence, the time taken to fill the tank when five pipes are used is 18.

$$y = 9 \Rightarrow x \times 9 = 90$$

$$x = \frac{90}{9} = 10 \quad (\text{Verified with Graph})$$

Hence, the No. of pipes when the time 9 minutes is 10



9. A school announces that for a certain competitions, the cash price will be distributed for all the participants equally as show below

No. of participants (x)	2	4	6	8	10
Amount for each participant in ₹ (y)	180	90	60	45	36

(i) Find the constant of variation.

(ii) Graph the above data and hence, find how much will each participant get if the number of participants are 12.

Solution: I. Table(Given)

No. of participants (x)	2	4	6	8	10
Amount for each participant in ₹ (y)	180	90	60	45	36

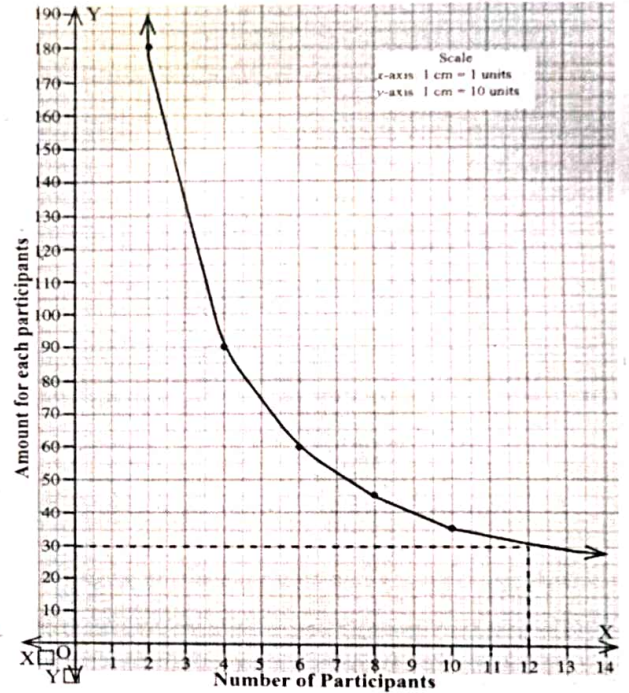
II. Variation:

When 'x' increases, 'y' also decreases.
Hence, inverse variation. i.e. $xy = k$
 $xy = 2 \times 180 = 4 \times 90 = \dots 10 \times 36 = 360 = k$
 \therefore Required Equation $xy = 360$

III. Points: (2,180), (4,90), (6,60), (8,45), (10,36)

IV. Solution:

Constant of Variation: $k = 360$
When $x = 12 \Rightarrow xy = 360 \Rightarrow 12y = 360$
 $y = \frac{360}{12} = 30$ (Verified with Graph)
Hence, When the number of participants are 12, then each participant will get ₹30



10. A two wheeler parking zone near bus stand charges as below.

Time (in hours) (x)	4	8	12	24
Amount (y)	60	120	180	360

Check if the amount charged are in direct variation or in inverse variation to the parking time. Graph the data. Also (i) find the amount to be paid when parking time is 6 hr; (ii) find the parking duration when the amount paid is 150.

Solution: I. Table (Given):

Time (in hours) (x)	4	8	12	24
Amount ₹ (y)	60	120	180	360

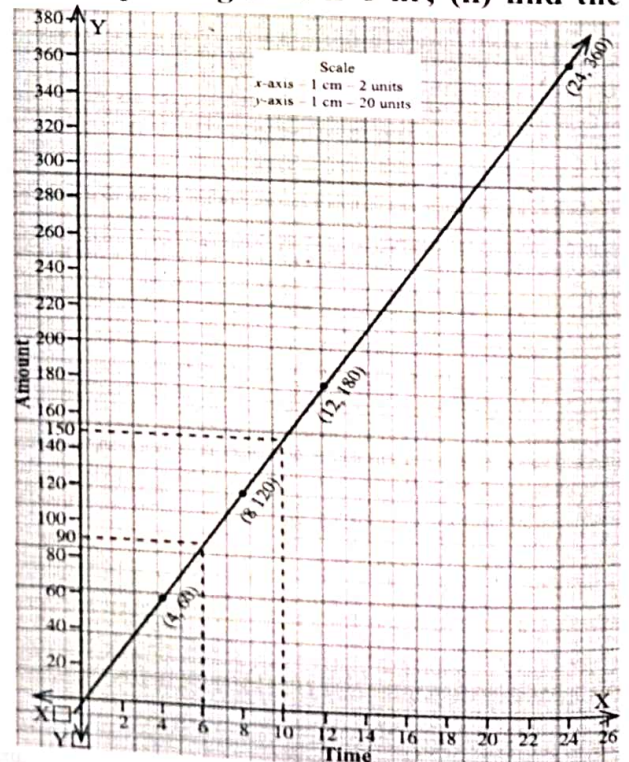
II. Variation:

When 'x' increases, 'y' also increases.
Thus, the variation is a direct variation.
Let $y = kx$, where k is a constant of proportionality. From the given values, we have,
 $k = \frac{y}{x} = \frac{60}{4} = \frac{120}{8} = \dots \frac{180}{12} = \frac{360}{24} = 15 = k$
 \therefore Required Equation is $y = 15x$

III. Points: (4, 60), (8, 120), (12, 180), (24, 360)

IV. Solution:

From the graph, when parking time is 6 hours, then the amount to be paid is ₹ 90.
From the graph, when them amount paid is 1510, then the parking duration is 10 hours.



4. Geometry

2 Marks

1. If ΔABC is similar to ΔDEF such that $BC = 3$ cm, $EF = 4$ cm and area of $\Delta ABC = 54$ cm². Find the area of ΔDEF .

Solution:

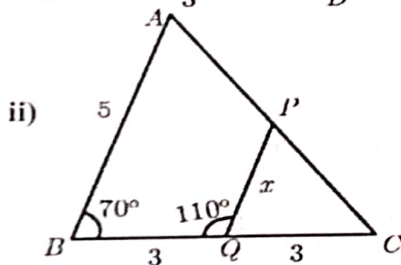
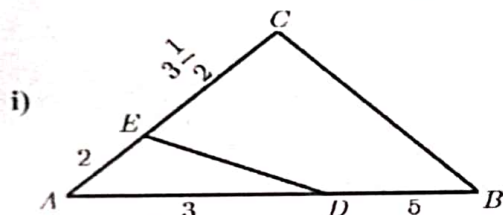
Since the ratio of area of two similar triangles is equal to the ratio of the squares of any two corresponding sides, we have

$$\frac{\text{Area}(\Delta ABC)}{\text{Area}(\Delta DEF)} = \frac{BC^2}{EF^2}$$

gives
$$\frac{54}{\text{Area}(\Delta DEF)} = \frac{3^2}{4^2}$$

$$\text{Area}(\Delta DEF) = \frac{16 \times 54}{9} = 96 \text{ cm}^2$$

2. Check whether the which triangles are similar and find the value of x .



Solution:

- i. From the figure, in ΔABC and ΔADE

$$\frac{AC}{AE} = \frac{3 \frac{1}{2} + 2}{2} = \frac{7 + 2}{2} = \frac{7 + 4}{2} = \frac{11}{2} \times \frac{1}{2} = \frac{11}{4} \quad \dots (1)$$

$$\frac{AB}{AD} = \frac{3 + 5}{3} = \frac{8}{3} \quad \dots (2)$$

$$\text{From (1), (2)} \Rightarrow \frac{AC}{AE} \neq \frac{AB}{AD}$$

$\therefore \Delta ABC$ and ΔADE are not similar

- ii. From the figure, in ΔABC and ΔPQC

$$\angle ABC = \angle PQC = 70^\circ \quad \dots (1)$$

(Corresponding angles are equal)

$$\angle C = \angle C \text{ (Common Angles)} \quad \dots (2)$$

$\therefore \angle A = \angle QPC$ (\because AAA criterion)

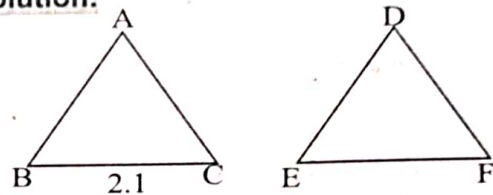
Hence, ΔABC and ΔPQC are similar triangles

$$\text{Then, } \frac{AB}{PQ} = \frac{BC}{QC} \Rightarrow \frac{5}{x} = \frac{6}{3} = 2$$

$$\therefore x = \frac{5}{2} = 2.5$$

3. If $\Delta ABC \sim \Delta DEF$ such that area of ΔABC is 9 cm² and the area of ΔDEF is 16 cm² and $BC = 2.1$ cm. Find the length of EF .

Solution:



Given $\Delta ABC \sim \Delta DEF$

$$\frac{\text{Area of } (\Delta ABC)}{\text{Area of } (\Delta DEF)} = \frac{BC^2}{EF^2} = \frac{AB^2}{DE^2} = \frac{AC^2}{DF^2}$$

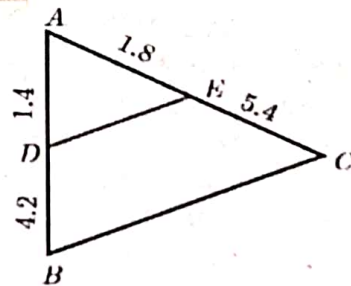
$$\Rightarrow \frac{9}{16} = \frac{(2.1)^2}{EF^2}$$

$$\Rightarrow EF^2 = (2.1)^2 \times \frac{16}{9}$$

$$\Rightarrow EF = 2.1 \times \frac{4}{3} = 2.8 \text{ cm}$$

4. D and E are respectively the points on the sides AB and AC of a ΔABC such that $AB = 5.6$ cm, $AD = 1.4$ cm, $AC = 7.2$ cm and $AE = 1.8$ cm, show that $DE \parallel BC$.

Solution:



$AB = 5.6$ cm, $AD = 1.4$ cm, $AC = 7.2$ cm and $AE = 1.8$ cm

$BD = AB - AD = 5.6 - 1.4 = 4.2$ cm and

$EC = AC - AE = 7.2 - 1.8 = 5.4$ cm

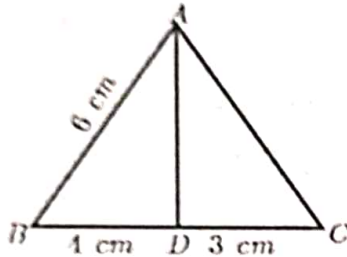
$$\frac{AD}{DB} = \frac{1.4}{4.2} = \frac{1}{3} \text{ and } \frac{AE}{EC} = \frac{1.8}{5.4} = \frac{1}{3}$$

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Therefore, by converse of Basic Proportionality Theorem, we have DE is parallel to BC.

Hence Proved.

5. In the Figure, AD is the bisector of $\angle A$. If $BD = 4$ cm, $DC = 3$ cm and $AB = 6$ cm, find AC.



Solution:

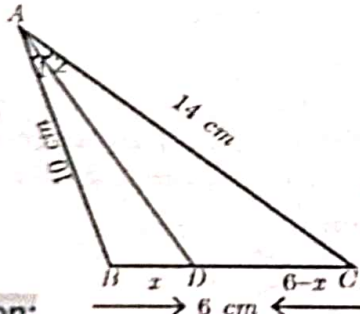
In $\triangle ABC$, AD is the bisector of $\angle A$.
Therefore by Angle Bisector Theorem

$$\frac{BD}{DC} = \frac{AB}{AC}$$

$$\frac{4}{3} = \frac{6}{AC} \text{ gives } 4AC = 18$$

Hence $AC = \frac{9}{2} = 4.5$ cm

6. In the Figure, AD is the bisector of $\angle BAC$, if $AB = 10$ cm, $AC = 14$ cm and $BC = 6$ cm. Find BD and DC.



Solution:

AD is the bisector of $\angle BAC$
 $AB = 10$ cm, $AC = 14$ cm, $BC = 6$ cm
By Angle Bisector Theorem

$$\frac{BD}{DC} = \frac{AB}{AC}$$

$$\frac{x}{6-x} = \frac{10}{14}$$

$$\frac{x}{6-x} = \frac{5}{7}$$

$$7x = 30 - 5x$$

$$12x = 30$$

$$x = \frac{30}{12} = 2.5 \text{ cm}$$

$\therefore BD = 2.5$ cm $DC = 3.5$ cm

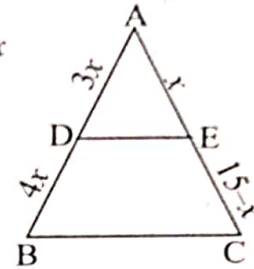
7. In $\triangle ABC$, D and E are points on the sides AB and AC respectively such that $DE \parallel BC$

(i) If $\frac{AD}{DB} = \frac{3}{4}$ and $AC = 15$ cm find AE.

(ii) If $AD = 8x - 7$, $DB = 5x - 3$, $AE = 4x - 3$ and $EC = 3x - 1$, find the value of x .

Solution:

- i. If $\frac{AD}{DB} = \frac{3}{4}$, $AC = 15$ cm, $AE = x$,
 $EC = 15 - x$



$DE \parallel BC$ then by basic proportionality theorem.

$$\frac{AD}{DB} = \frac{AE}{EC}$$

$$\Rightarrow \frac{3}{4} = \frac{x}{15-x}$$

$$3(15-x) = 4x$$

$$45 - 3x = 4x$$

$$45 = 7x$$

$$x = \frac{45}{7} = 6.43 \text{ cm}$$

- ii. Given $AD = 8x - 7$, $DB = 5x - 3$,
 $AE = 4x - 3$ and $EC = 3x - 1$

By basic proportionality theorem

$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{8x-7}{5x-3} = \frac{4x-3}{3x-1}$$

$$\Rightarrow (8x-7)(3x-1) = (5x-3)(4x-3)$$

$$\Rightarrow 24x^2 - 29x + 7 = 20x^2 - 27x + 9$$

$$24x^2 - 20x^2 - 29x + 27x + 7 - 9 = 0$$

$$\Rightarrow 4x^2 - 2x - 2 = 0$$

$$\Rightarrow 2x^2 - x - 1 = 0$$

$$(2x+1)(x-1) = 0$$

$$x = 1, x = -\frac{1}{2} \text{ (Not Admissible)}$$

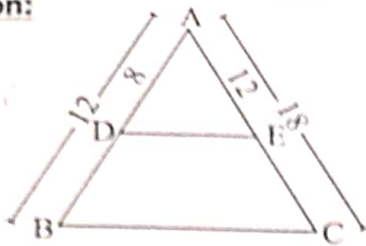
$$\therefore x = 1$$

8. In $\triangle ABC$, D and E are points on the sides AB and AC respectively. For each of the following cases show that $DE \parallel BC$.

(i) $AB = 12$ cm, $AD = 8$ cm, $AE = 12$ cm and $AC = 18$ cm.

(ii) $AB = 5.6$ cm, $AD = 1.4$ cm, $AC = 7.2$ cm and $AE = 1.8$ cm.

Solution:



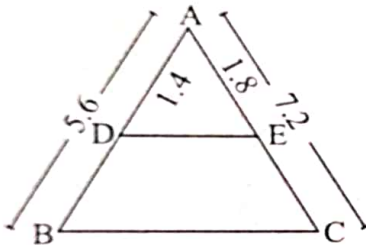
- i. $AB = 12$ cm, $AD = 8$ cm, $AE = 12$ cm and $AC = 18$ cm

$$\frac{AD}{AB} = \frac{8}{12} = \frac{2}{3} \quad \dots (1)$$

$$\frac{AE}{AC} = \frac{12}{18} = \frac{2}{3} \quad \dots (2)$$

$$\text{From (1) \& (2)} \Rightarrow \frac{AD}{AB} = \frac{AE}{AC}$$

$\therefore DE \parallel BC$



- ii. $AB = 5.6$ cm, $AD = 1.4$ cm, $AC = 7.2$ cm and $AE = 1.8$ cm

$$\frac{AD}{AB} = \frac{1.4}{5.6} = \frac{1}{4} \quad \dots (1)$$

$$\frac{AE}{AC} = \frac{1.8}{7.2} = \frac{1}{4} \quad \dots (2)$$

$$(1), (2) \Rightarrow \frac{AD}{AB} = \frac{AE}{AC}$$

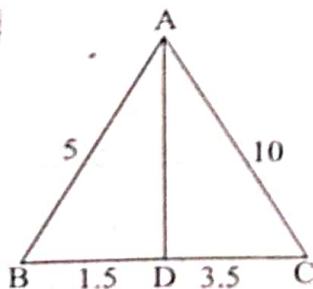
$\therefore DE \parallel BC$

9. Check whether AD is bisector of $\angle A$ of $\triangle ABC$ in each of the following

- (i) $AB = 5$ cm, $AC = 10$ cm, $BD = 1.5$ cm and $CD = 3.5$ cm.

- (ii) $AB = 4$ cm, $AC = 6$ cm, $BD = 1.6$ cm and $CD = 2.4$ cm.

Solution:



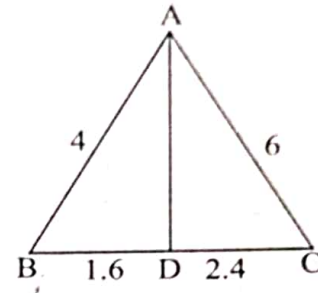
- i. $AB = 5$ cm, $AC = 10$ cm, $BD = 1.5$ cm and $CD = 3.5$ cm

$$\frac{AB}{AC} = \frac{5}{10} = \frac{1}{2} \quad \dots (1)$$

$$\frac{BD}{CD} = \frac{1.5}{3.5} = \frac{3}{7} \quad \dots (2)$$

$$(1), (2) \Rightarrow \frac{AB}{AC} \neq \frac{BD}{CD} \quad (\because \text{By ABT})$$

AD is not a bisector of $\angle A$ in $\triangle ABC$



- ii. $AB = 4$ cm, $AC = 6$ cm, $BD = 1.6$ cm and $CD = 2.4$ cm

$$\frac{AB}{AC} = \frac{4}{6} = \frac{2}{3} \quad \dots (1)$$

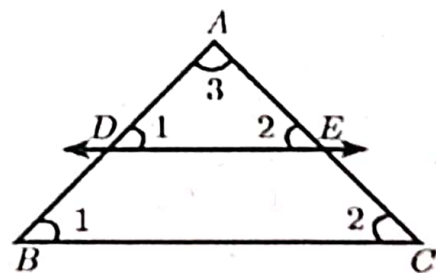
$$\frac{BD}{CD} = \frac{1.6}{2.4} = \frac{2}{3} \quad \dots (2)$$

$$(1), (2) \Rightarrow \frac{AB}{AC} = \frac{BD}{CD} \quad (\because \text{By ABT})$$

AD is a bisector of $\angle A$ in $\triangle ABC$

5 Marks

1. State and Prove Basic Proportionality Theorem (BPT) or Thales Theorem.



Statement:

A straight line drawn parallel to a side of triangle intersecting the other two sides, divides the sides in the same ratio.

Proof

Given:

In $\triangle ABC$, D is a point on AB and E is a point on AC

To Prove:

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Construction: Draw a line $DE \parallel BC$

No.	Statement	Reason
1.	$\angle ABC = \angle ADE$ → 1	Corresponding angles are equal because $DE \parallel BC$
2.	$\angle ACB = \angle AED$ → 2	Corresponding angles are equal because $DE \parallel BC$
3.	$\angle DAE = \angle BAC$ → 3	Both triangles have a common angle.
	$\Delta ABC \sim \Delta ADE$	By AAA similarity
	$\frac{AB}{AD} = \frac{AC}{AE}$	Corresponding sides are proportional
	$\frac{AD}{AD} = \frac{DB}{AE}$ $= \frac{AE + EC}{AE}$	Split AB and AC using the points D and E
	$1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$	On Simplification
	$\frac{DB}{AD} = \frac{EC}{AE}$	Cancelling 1 on both sides
	$\frac{AD}{DB} = \frac{AE}{EC}$	Taking reciprocals
Hence Proved		

2. State and Prove Angle Bisector Theorem.

Statement:

The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the corresponding sides containing the angle

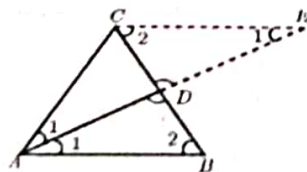
Proof

Given:

In ΔABC , AD is the internal bisector

To Prove:

$$\frac{AB}{AC} = \frac{BD}{CD}$$



Construction:

Draw a line through C parallel to AB.
Extend AD to meet line through C at E.

No.	Statement	Reason
1.	$\angle AEC = \angle BAE$ $= \angle 1$	Two parallel lines cut by a transversal make alternate angles equal.

2.	ΔACE is isosceles $AC = CE \dots (1)$	In ΔACE $\angle CAE = \angle CEA.$
3.	$\Delta ABD \sim \Delta ECD$ $\frac{AB}{CE} = \frac{BD}{CD}$	By AA Similarity
4.	$\frac{AB}{AC} = \frac{BD}{CD}$	From (1), $AC = CE.$ Hence Proved.

3. State and Prove Pythagoras Theorem.

Statement:

In a right angle triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

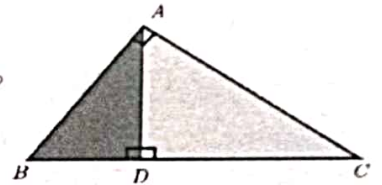
Proof

Given:

In ΔABC , $\angle A = 90^\circ$

To Prove:

$$AB^2 + AC^2 = BC^2$$



Construction: Draw $AD \perp BC$

No.	Statement	Reason
1.	Compare ΔABC and ΔABD $\angle B$ is common $\angle BAC = \angle BDA = 90^\circ$ Therefore, $\Delta ABC \sim \Delta ABD$ $\frac{AB}{BD} = \frac{BC}{AB}$ $AB^2 = BC \times BD$ (1)	Given $\angle BAC = 90^\circ$ and by construction $\angle BDA = 90^\circ$ By AA similarity
2.	Compare ΔABC and ΔADC $\angle C$ is common $\angle BAC = \angle ADC = 90^\circ$ Therefore, $\Delta ABC \sim \Delta ADC$ $\frac{BC}{AC} = \frac{AC}{DC}$ $AC^2 = BC \times DC$... (2)	Given $\angle BAC = 90^\circ$ and by construction $\angle CDA = 90^\circ$ By AA similarity

Adding (1) and (2) we get

$$AB^2 + AC^2 = BC \times BD + BC \times DC$$

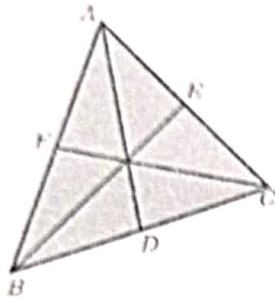
$$= BC (BD + DC)$$

$$AB^2 + AC^2 = BC \times BC = BC^2$$

Hence the theorem is proved.

4. Show that in a triangle, the medians are concurrent.

Solution:



Medians are line segments joining each vertex to the midpoint of the corresponding opposite sides.

Thus medians are the cevians where D, E, F are midpoints of BC, CA and AB respectively. Since D is midpoint of BC,

$$BD = DC. \text{ So } \frac{BD}{DC} = 1 \quad \dots (1)$$

Since E is midpoint of CA,

$$CE = EA. \text{ So } \frac{CE}{EA} = 1 \quad \dots (2)$$

Since F is midpoint of AB,

$$AF = FB. \text{ So } \frac{AF}{FB} = 1 \quad \dots (3)$$

Thus, multiplying (1), (2), (3) we get

$$\frac{BD}{DC} \times \frac{CE}{EA} \times \frac{AF}{FB} = 1 \times 1 \times 1 = 1$$

And so, Ceva's theorem is satisfied.

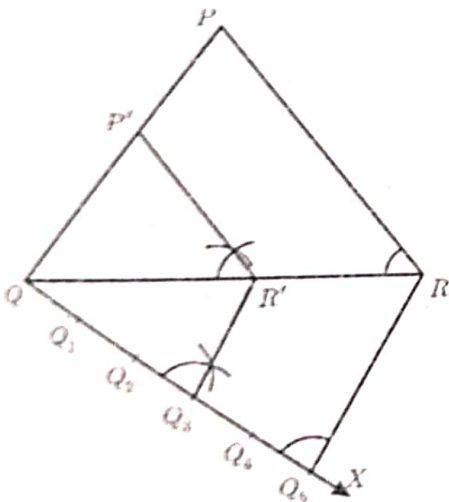
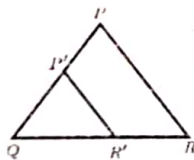
Hence the Medians are concurrent.

8 Marks

1. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{3}{5}$ of the corresponding sides of the triangle PQR (scale factor $\frac{3}{5} < 1$)

Solution:

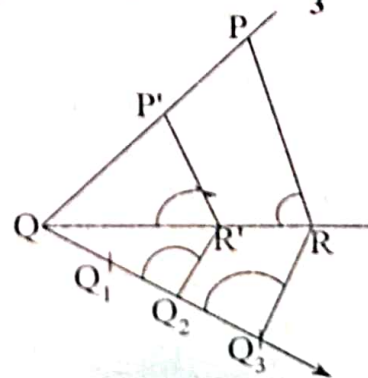
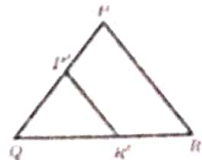
Rough diagram



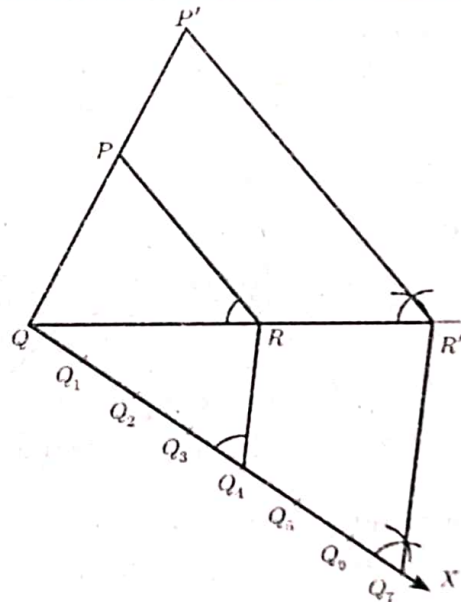
2. Cons Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{4}$ of the corresponding sides of the triangle PQR (scale factor $\frac{7}{4} > 1$)

Solution:

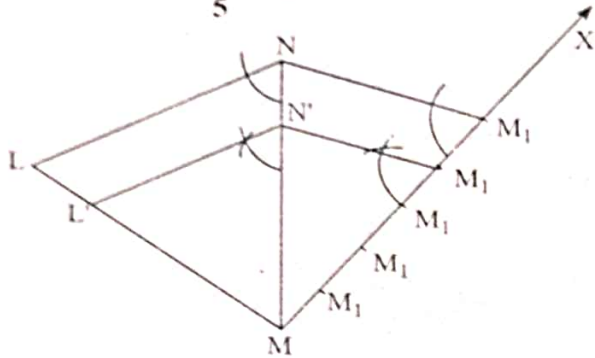
Rough diagram



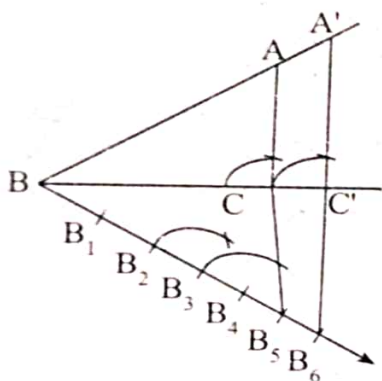
3. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{2}{3}$ of the corresponding sides of the triangle PQR (scale factor $\frac{2}{3} < 1$).



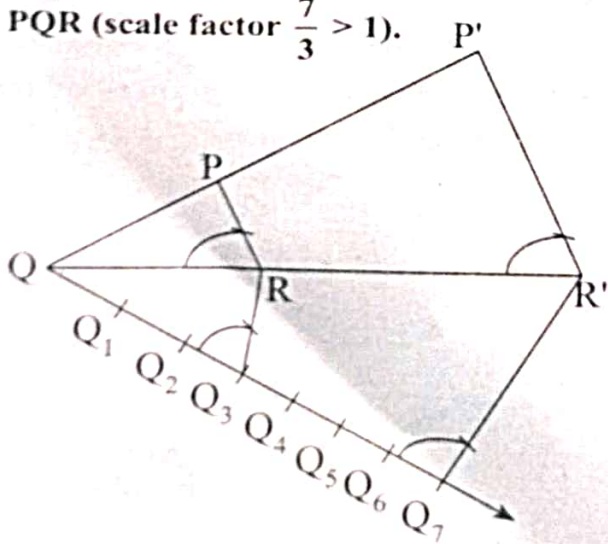
4. Construct a triangle similar to a given triangle LMN with its sides equal to $\frac{4}{5}$ of the corresponding sides of the triangle LMN (scale factor $\frac{4}{5} < 1$).



5. Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{6}{5}$ of the corresponding sides of the triangle ABC (scale factor $\frac{6}{5} > 1$).



6. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{3}$ of the corresponding sides of the triangle PQR (scale factor $\frac{7}{3} > 1$).

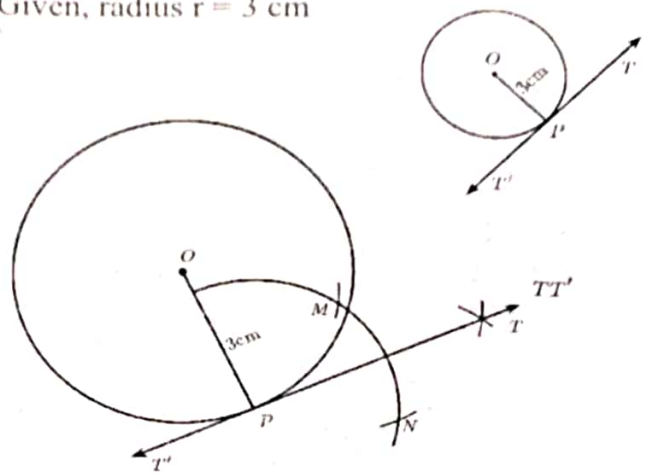


7. Draw a circle of radius 3 cm. Take a point P on this circle and draw a tangent at P.

Solution:

Given, radius $r = 3$ cm

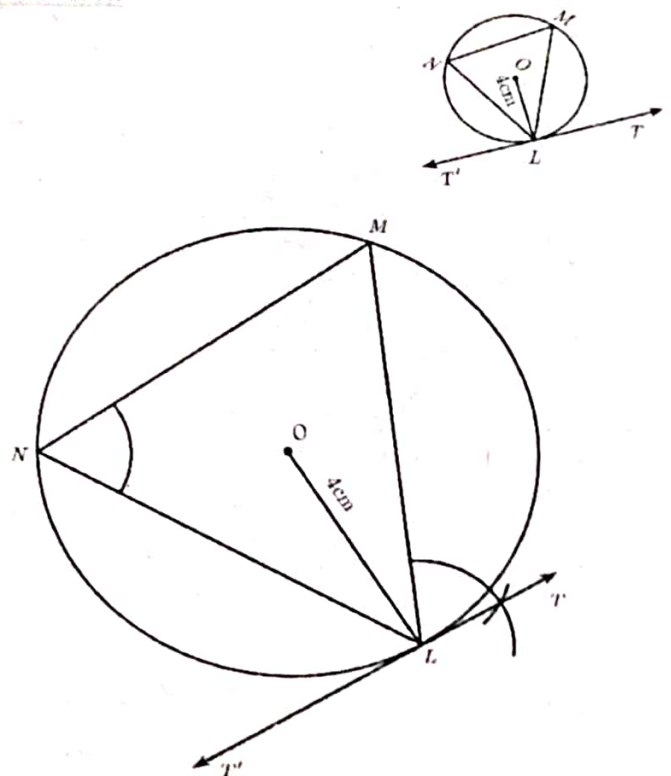
Rough diagram



8. Draw a circle of radius 4 cm. At a point L on it draw a tangent to the circle using the alternate segment.

Solution:

Rough diagram



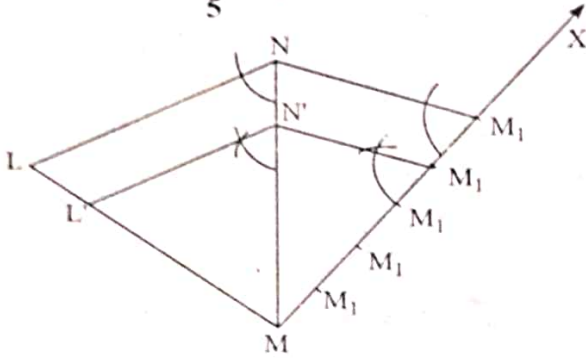
9. Draw a circle of diameter 6 cm from a point P, which is 8 cm away from its centre. Draw the two tangents PA and PB to the circle and measure their lengths.

Verification: In the right angle triangle OAP.

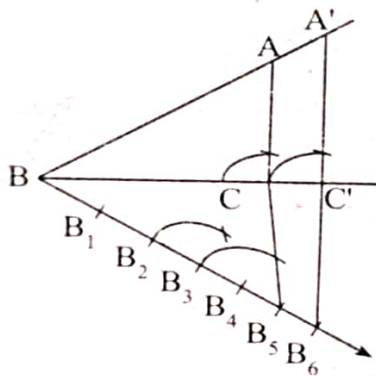
$$PA^2 - OA^2 = 64 - 9 = 55$$

$$PA = \sqrt{55} = 7.4 \text{ cm}$$

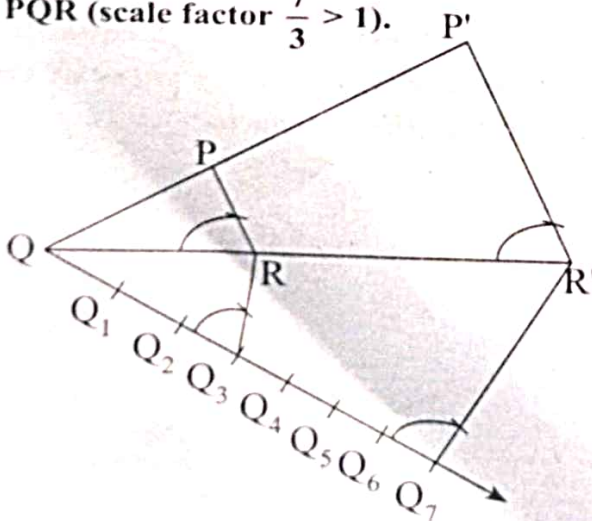
4. Construct a triangle similar to a given triangle LMN with its sides equal to $\frac{4}{5}$ of the corresponding sides of the triangle LMN (scale factor $\frac{4}{5} < 1$).



5. Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{6}{5}$ of the corresponding sides of the triangle ABC (scale factor $\frac{6}{5} > 1$).



6. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{3}$ of the corresponding sides of the triangle PQR (scale factor $\frac{7}{3} > 1$).

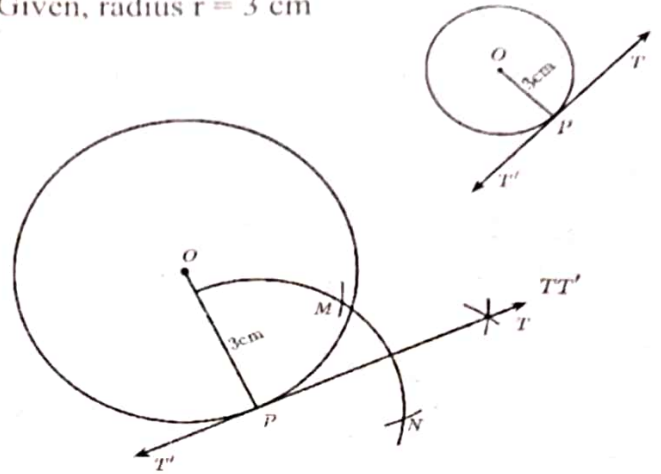


7. Draw a circle of radius 3 cm. Take a point P on this circle and draw a tangent at P.

Solution:

Given, radius $r = 3$ cm

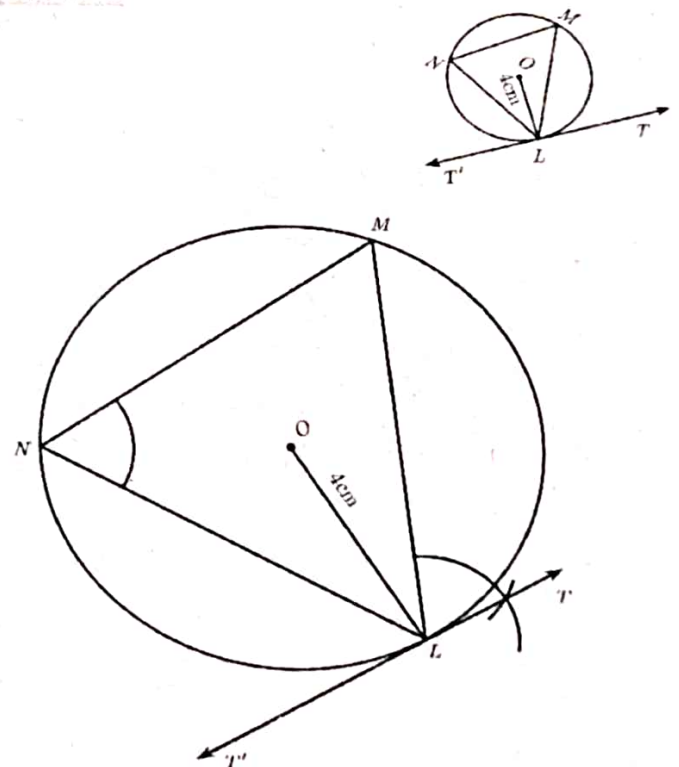
Rough diagram



8. Draw a circle of radius 4 cm. At a point L on it draw a tangent to the circle using the alternate segment.

Solution:

Rough diagram



9. Draw a circle of diameter 6 cm from a point P, which is 8 cm away from its centre. Draw the two tangents PA and PB to the circle and measure their lengths.

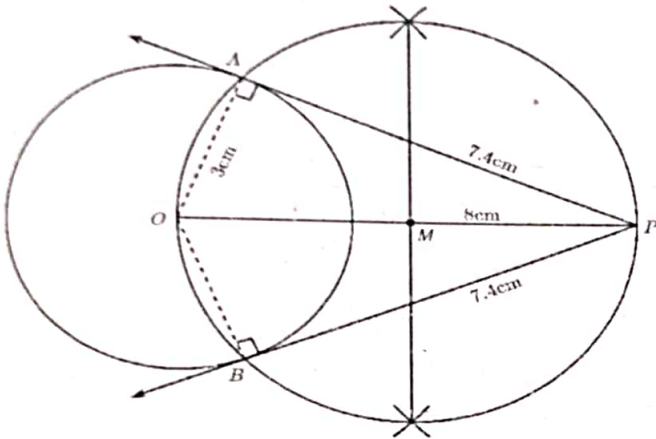
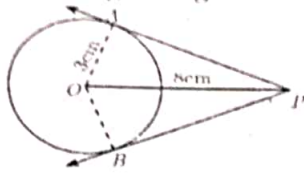
Verification: In the right angle triangle OAP.

$$PA^2 - OA^2 = 64 - 9 = 55$$

$$PA = \sqrt{55} = 7.4 \text{ cm}$$

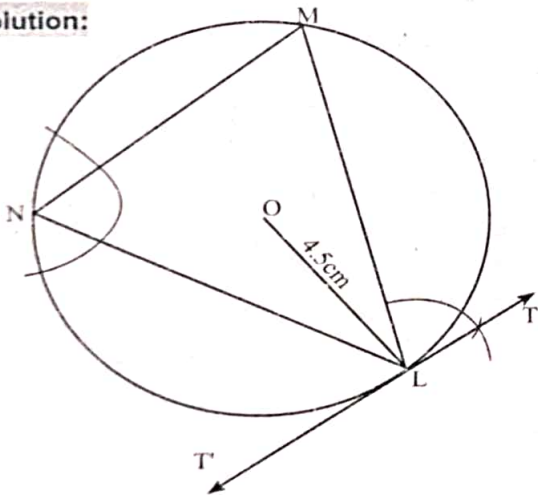
Solution:

Rough diagram



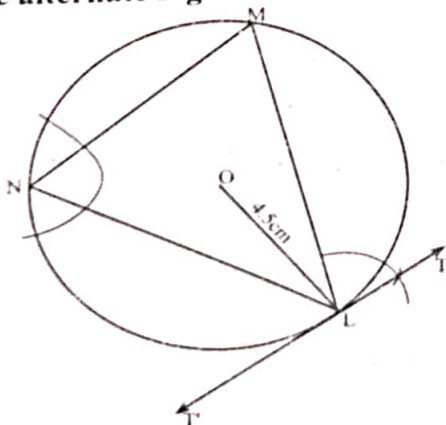
10. Draw a circle of radius 4.5 cm. Take a point on the circle. Draw the tangent at that point using the alternate segment theorem.

Solution:



11. Draw a circle of radius 4.5 cm. Take a point on the circle. Draw the tangent at that point using the alternate segment theorem.

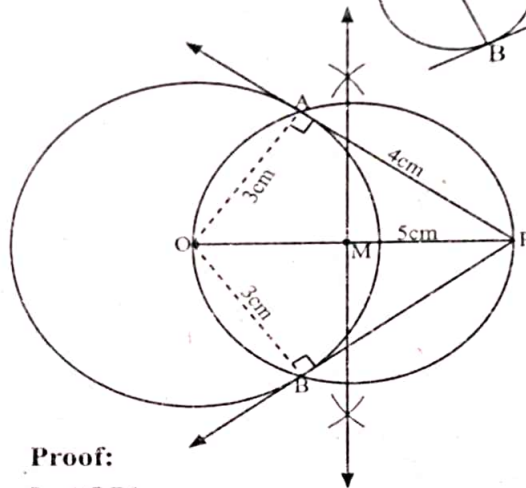
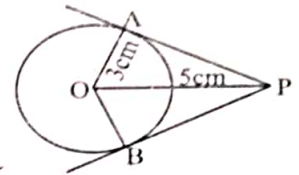
Solution:



12. Draw the two tangents from a point which is 10 cm away from the centre of a circle of radius 5 cm. Also, measure the lengths of the tangents.

Solution:

Rough Diagram



Proof:

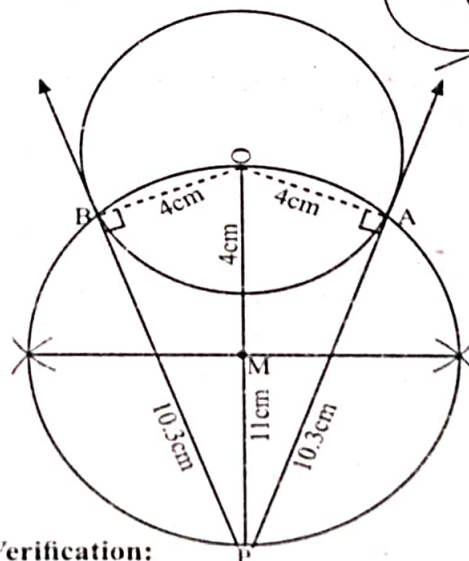
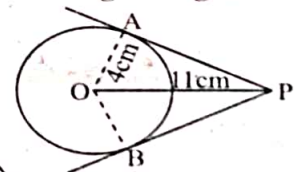
In $\triangle OPA$

$$PA^2 = OP^2 - OA^2 = 10^2 - 5^2 = 100 - 25 = 75$$

$$PA = \sqrt{75} = 8.6 \text{ cm (approx)}$$

13. Take a point which is 11 cm away from the centre of a circle of radius 4 cm and draw the two tangents to the circle from that point.

Rough Diagram



Verification:

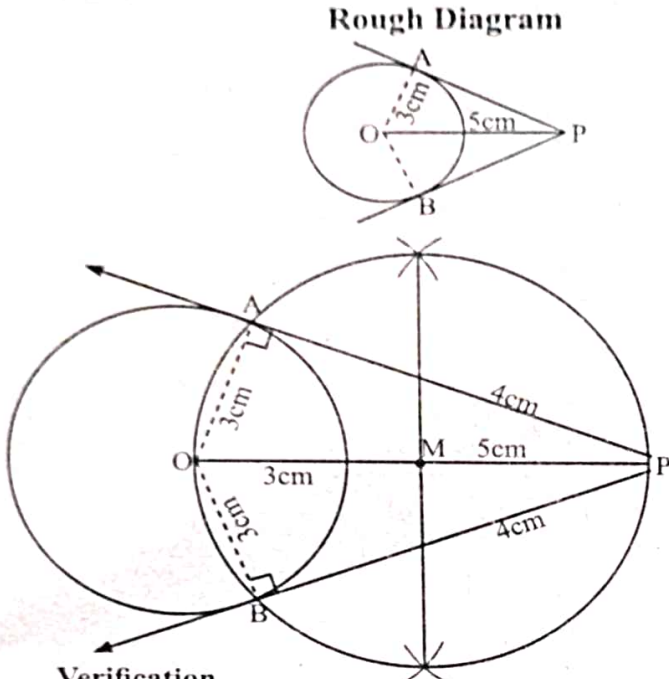
$$\text{In } \triangle OPA \text{ } AP^2 = OP^2 - OA^2$$

$$= 11^2 - 4^2 = 121 - 16 = 105$$

$$AP = \sqrt{105} = 10.2 \text{ cm}$$

14. Draw the two tangents from a point which is 5 cm away from the centre of a circle of diameter 6 cm. Also, measure the lengths of the tangents.

Solution:



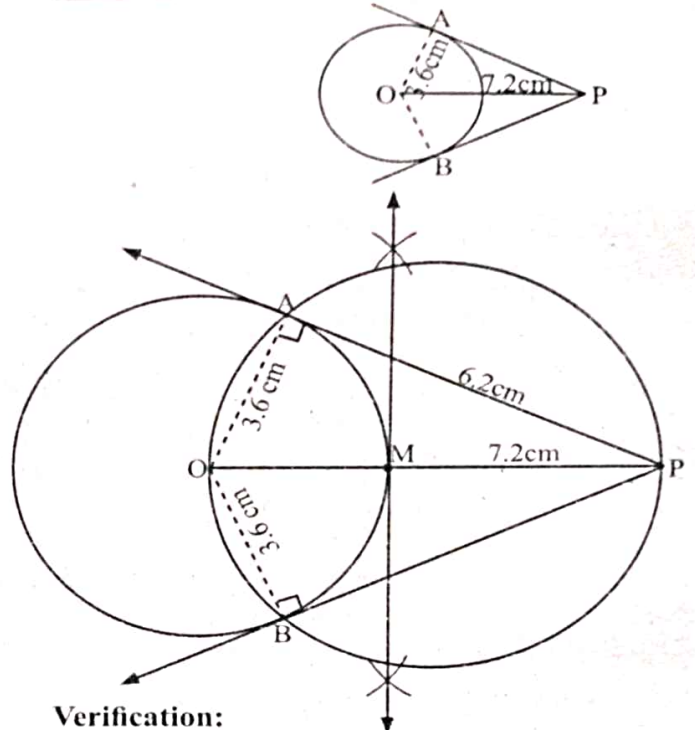
Verification

$$\begin{aligned} \text{In } \triangle OPA \quad AP^2 &= OP^2 - OA^2 \\ &= 5^2 - 3^2 = 25 - 9 = 16 \\ AP &= \sqrt{16} = 4 \text{ cm} \end{aligned}$$

15. Draw a tangent to the circle from the point P having radius 3.6cm, and centre at O. Point P is at a distance 7.2 cm from the centre.

Solution:

Rough Diagram



Verification:

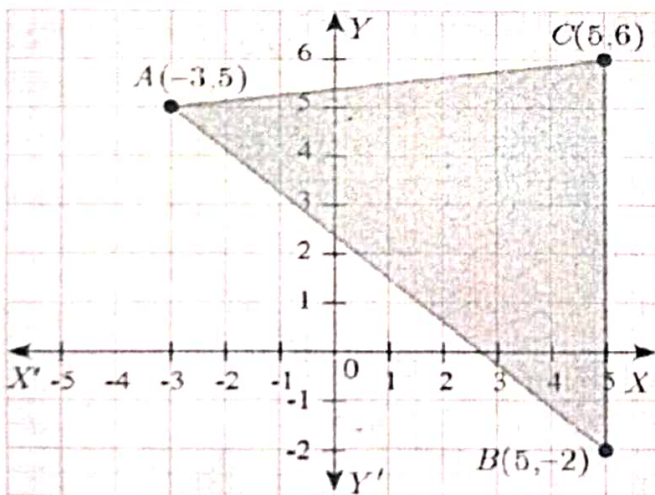
$$\begin{aligned} \text{In } \triangle OPA, \quad PA^2 &= OP^2 - OA^2 \\ &= 7.2^2 - 3.6^2 \\ &= 51.84 - 12.96 \\ &= 38.88 \\ PA &= \sqrt{38.88} = 6.2 \text{ cm (approx)} \end{aligned}$$

5. Coordinate Geometry

2 Marks

1. Find the area of the triangle whose vertices are (-3, 5), (5, 6) and (5, -2)

Solution:



$$A(-3, 5), \quad B(5, -2), \quad C(5, 6)$$

$$\begin{matrix} \downarrow & \downarrow & \downarrow \\ x_1y_1 & x_2y_2 & x_3y_3 \end{matrix}$$

$$\begin{aligned} \text{Area of } \Delta &= - \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} -3 & 5 \\ 5 & -2 \\ 5 & 6 \end{vmatrix} \\ &= \frac{1}{2} [(6+30+25) - (25-10-18)] \\ &= \frac{1}{2} [61 + 3] \\ &= \left| \frac{64}{2} \right| = 32 \text{ sq. units.} \end{aligned}$$

2. Show that the points P (-1.5, 3), Q (6, -2), R (-3, 4) are collinear.

Solution:

Area of $\triangle PQR = 0$

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = 0 \Rightarrow \frac{1}{2} \begin{vmatrix} -1.5 & 3 \\ 6 & -2 \\ -3 & 4 \end{vmatrix} = 0$$

$$\frac{1}{2} [(3+24-9) - (18+6-6)] = 0$$

$$\frac{1}{2} [18 - 18] = 0$$

\(\therefore\) Therefore, the given points are collinear.

3. If the area of the triangle formed by the vertices A (-1, 2), B (k, -2) and C (7, 4) (taken in order) is 22 sq. units, find the value of k.

Solution:

The vertices are A (-1, 2), B (k, -2) and C (7, 4)

Area of \(\Delta ABC\) is 22 sq.units

$$\frac{1}{2} \begin{vmatrix} -1 & 2 \\ k & -2 \\ 7 & 4 \end{vmatrix} = 22$$

$$\begin{vmatrix} -1 & 2 \\ k & -2 \\ 7 & 4 \end{vmatrix} = 44$$

$$\{(2 + 4k + 14) - (2k - 14 - 4)\} = 44$$

$$4k + 16 - 2k + 18 = 44$$

$$2k + 34 = 44$$

$$2k = 10$$

$$\text{Therefore } k = 5$$

4. Find the area of the triangle formed by the points (i) (1, -1), (-4, 6) and (-3, -5)
(ii) (-10, -4), (-8, -1) and (-3, -5)

Solution:

$$\text{i. Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} 1 & -1 \\ -4 & 6 \\ -3 & -5 \end{vmatrix}$$

$$= \frac{1}{2} [(6+20+3) - (4-18-5)]$$

$$= \frac{1}{2} [6+20+3-4+18+5]$$

$$= \frac{1}{2} [(6+20+3+18+5)-4]$$

$$= \frac{1}{2} [52-4]$$

$$= \frac{1}{2} [48] = 24 \text{ sq.units.}$$

$$\text{ii. Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} 10 & 4 \\ -8 & -1 \\ -3 & -5 \end{vmatrix}$$

$$= \frac{1}{2} [(10+40+12) - (32+3+50)]$$

$$= \frac{1}{2} [62 - 85]$$

$$= \frac{1}{2} [-23] = -11.5 \text{ sq.units.}$$

\(\therefore\) Area of the Triangle = 11.5 sq.units

5. Determine whether the sets of points are collinear?

(i) \(\left(-\frac{1}{2}, 3\right)\) (-5, 6) and (-8, 8)

Solution:

\(\left(-\frac{1}{2}, 3\right)\) (-5, 6) and (-8, 8)

$$\text{Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} -\frac{1}{2} & 3 \\ -5 & 6 \\ -8 & 8 \end{vmatrix}$$

$$= \frac{1}{2} [(-3-40-24) - (-15-48-4)]$$

$$= \frac{1}{2} [(-67) - (-67)] = 0$$

\(\therefore\) The given points are collinear.

(ii) (a, b+c), (b, c+a) and (c, a+b)

Solution:

$$\text{Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} a & b+c \\ b & c+a \\ c & a+b \end{vmatrix}$$

$$= \frac{1}{2} [(ac + a^2 + ab + b^2 + bc + c^2) - (b^2 + bc + c^2 + ca + a^2 + ab)]$$

$$= \frac{1}{2} [ac + a^2 + ab + b^2 + bc + c^2 - b^2 - bc - c^2 - ca - a^2 - ab]$$

$$= \frac{1}{2} [0] = 0 \text{ sq.units.}$$

Aliter:

(a, b+c), (b, c+a), (c, a+b)

x_1, y_1 x_2, y_2 x_3, y_3

$$\text{Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 - x_2 & x_1 - x_3 \\ y_1 - y_2 & y_1 - y_3 \end{vmatrix}$$

$$\begin{aligned}
 &= \frac{1}{2} \begin{vmatrix} a-b & a-c \\ b+c-c-a & b+c-a-b \end{vmatrix} \\
 &= \frac{1}{2} \begin{vmatrix} a-b & a-c \\ -(a-b) & -(a-c) \end{vmatrix} \\
 &= \frac{1}{2} [(a-b)(a-c) + (a-b)(a-c)] \\
 &= \frac{1}{2} [0] = 0
 \end{aligned}$$

∴ The given points are collinear.

6. Vertices of given triangles are taken in order and their areas are provided aside. In each case, find the value of 'p'.

S.No.	Vertices	Area (sq.units)
(i)	(0, 0), (p, 8), (6, 2)	20
(ii)	(p, p), (5, 6), (5, -2)	32

Solution:

- i. A (0, 0), B (p, 8), C (6, 2)

$$\text{Area of } \triangle ABC = 20 \text{ sq.units.}$$

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \text{Area of } \triangle ABC$$

$$\frac{1}{2} \begin{vmatrix} 0 & 0 \\ p & 8 \\ 6 & 2 \end{vmatrix} = 20$$

$$(0+2p+0) - (0+48+0) = 40$$

$$2p - 48 = 40$$

$$2p = 88$$

$$p = 44$$

- ii. A (p, p), B (5, 6), C (5, -2)

$$\text{Area of } \triangle = 32 \text{ sq.units}$$

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = 32$$

$$\frac{1}{2} \begin{vmatrix} p & p \\ 5 & 6 \\ 5 & -2 \end{vmatrix} = 32$$

$$\begin{vmatrix} p & p \\ 5 & 6 \\ 5 & -2 \end{vmatrix} = 64$$

$$(6p-10+5p) - (5p+30-2p) = 64$$

$$6p - 10 + 5p - 5p - 30 + 2p = 64$$

$$8p - 40 = 64$$

$$\Rightarrow 8p = 64 + 40$$

$$8p = 104$$

$$\Rightarrow p = \frac{104}{8}$$

$$\Rightarrow p = 13$$

7. In each of the following, find the value of 'a' for which the given points are collinear.

(i) (2, 3), (4, a) and (6, -3)

(ii) (a, 2-2a), (-a+1, 2a) and (-4-a, 6-2a)

Solution:

- i. (2, 3), (4, a) and (6, -3)

$$\Delta = 0$$

$$\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = 0 \Rightarrow \begin{vmatrix} 2 & 3 \\ 4 & a \\ 6 & -3 \end{vmatrix} = 0$$

$$[(2a-12+18) - (12+6a-6)] = 0$$

$$2a - 12 + 18 - 12 - 6a + 6 = 0$$

$$-4a = 0$$

$$\therefore a = 0$$

- ii. (a, 2-2a), (-a+1, 2a) and (-4-a, 6-2a)

$$\Delta = 0 \text{ sq.units.}$$

$$(2a^2 - 6a + 2a^2 + 6 - 2a - 8 + 8a - 2a + 2a^2) -$$

$$(-2a + 2a^2 + 2 - 2a - 8a - 2a^2 + 6a - 2a^2) = 0$$

$$\Rightarrow (6a^2 - 2a - 2) - (-2a^2 - 6a + 2) = 0$$

$$\Rightarrow 8a^2 + 4a - 4 = 0 \div 4$$

$$2a^2 + a - 1 = 0$$

$$(a+1)(2a-1) = 0$$

$$\Rightarrow \therefore a = +\frac{1}{2} \text{ and } a = -1$$

Aliter:

$$(a, a-2a), (-a+1, 2a), (-4-a, 6-2a)$$

$$x_1, y_1 \quad x_2, y_2 \quad x_3, y_3$$

$$\text{Area of } \Delta = \frac{1}{2} \begin{vmatrix} x_1 - x_2 & x_1 - x_3 \\ y_1 - y_2 & y_1 - y_3 \end{vmatrix} = 0$$

$$\begin{vmatrix} a+a-1 & a+4+a \\ 2-2a-2a & 2-2a-6+2a \end{vmatrix} = 0$$

$$\begin{vmatrix} 2a-1 & 2a+4 \\ 2-4a & -4 \end{vmatrix} = 0$$

$$-4(2a-1) - (2-4a)(2a+4) = 0$$

$$-8a+4 - [4a+8-8a^2-16a] = 0$$

$$-8a+4-4a-8+8a^2+16a = 0$$

$$8a^2 + 4a - 4 = 0$$

$$2a^2 + a - 1 = 0$$

$$(a+1)(2a-1) = 0$$

$$a = -1 \text{ (or) } a = \frac{1}{2}$$

5 Marks

1. The floor of a hall is covered with identical tiles which are in the shapes of triangles. One such triangle has the vertices at (-3, 2), (-1, -1) and (1, 2). If the floor of the hall is completely covered by 110 tiles, find the area of the floor.

Solution:

Vertices of one triangular tile are at (-3, 2), (-1, -1) (1, 2)

$$\text{Area of this tile} = \frac{1}{2} \begin{vmatrix} -3 & 2 \\ -1 & -1 \\ 1 & 2 \end{vmatrix}$$

$$= \frac{1}{2} \{(3-2+2)-(-2-1-6)\}$$

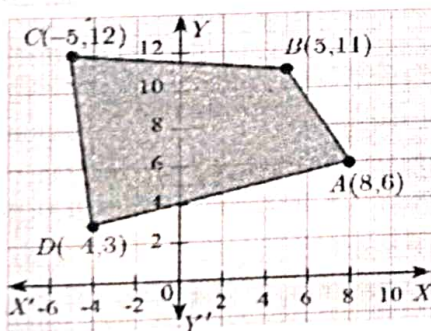
$$= \frac{1}{2} (12) = 6 \text{ sq.units}$$

Since the floor is covered by 110 triangle shaped identical tiles,

Area of the floor = $110 \times 6 = 660 \text{ sq. units}$

2. Find the area of the quadrilateral formed by the points (8, 6), (5, 11), (-5, 12) and (-4, 3).

Solution:



Before determining the area of the quadrilateral, plot the vertices in a graph A (8, 6), B (5, 11), C (-5, 12) and D (-4, 3). Therefore, area of the quadrilateral ABCD

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \\ x_4 & y_4 \\ x_1 & y_1 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} 8 & 6 \\ 5 & 11 \\ -5 & 12 \\ -4 & 3 \\ 8 & 6 \end{vmatrix}$$

$$= \frac{1}{2} [(88 + 60 - 15 - 24) - (30 - 55 - 48 + 24)]$$

$$= \frac{1}{2} [88 + 60 - 15 - 24 - 30 + 55 + 48 - 24]$$

$$= \frac{1}{2} [88 + 60 + 55 + 48 - 15 - 24 - 30 - 24]$$

$$= \frac{1}{2} [251 - 93]$$

$$= \frac{1}{2} [158] = 79 \text{ sq.units.}$$

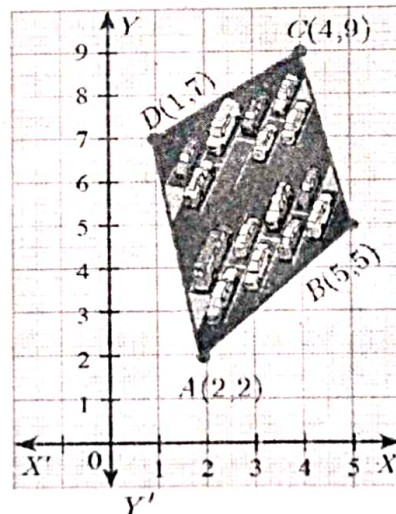
3. The given diagram shows a plan for constructing a new parking lot at a campus. It is estimated that such construction would cost ₹ 1300 per square feet. What will be the total cost for making the parking lot?

Solution:

The parking lot is a quadrilateral whose vertices A (2, 2), B (5, 5), C (4, 9) and D (1, 7).

Therefore, Area of parking lot is

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \\ x_4 & y_4 \\ x_1 & y_1 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} 2 & 2 \\ 5 & 5 \\ 4 & 9 \\ 1 & 7 \\ 2 & 2 \end{vmatrix}$$



$$= \frac{1}{2} [(10 + 45 + 28 + 2) - (10 + 20 + 9 + 14)]$$

$$= \frac{1}{2} [85 - 53]$$

$$= \frac{1}{2} [32] = 16 \text{ sq.units}$$

So, Area of parking lot = 16 sq.feet.

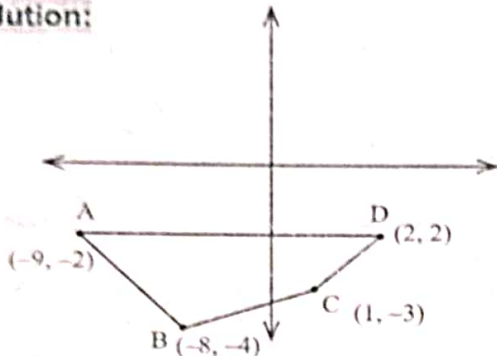
Construction rate per square fee = ₹ 1300

Therefore, total cost for constructing the parking lot = $16 \times 1300 = ₹ 20,800$

4. Find the area of the quadrilateral whose vertices are at

(i) $(-9, -2)$, $(-8, -4)$, $(2, 2)$ and $(1, -3)$

Solution:



Let A $(-9, -2)$, B $(-8, -4)$, C $(1, -3)$, D $(2, 2)$

$$\text{Area of the quadrilateral} = \frac{1}{2} \begin{vmatrix} -9 & -2 \\ -8 & -4 \\ 1 & -3 \\ 2 & 2 \\ -9 & -2 \end{vmatrix}$$

$$= \frac{1}{2} [(36+24+2-4) - (16-4-6-18)]$$

$$= \frac{1}{2} [(36+24+2-4-16+4+6+18)]$$

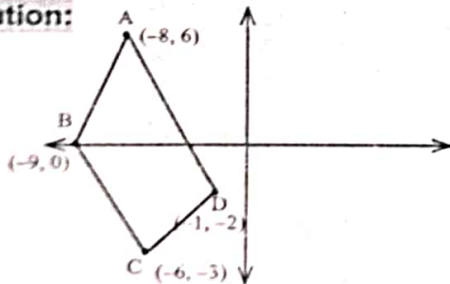
$$= \frac{1}{2} [(36+24+2+4+6+18) - (4+16)]$$

$$= \frac{1}{2} [90 - (20)]$$

$$= \frac{1}{2} [70] = 35 \text{ sq. units}$$

(ii) $(-9, 0)$, $(-8, 6)$, $(-1, -2)$ and $(-6, -3)$

Solution:



A $(-8, 6)$, B $(-9, 0)$, C $(-6, -3)$, D $(-1, -2)$

$$\text{Area of the quadrilateral} = \frac{1}{2} \begin{vmatrix} -8 & 6 \\ -9 & 0 \\ -6 & -3 \\ -1 & -2 \\ -8 & 6 \end{vmatrix}$$

$$= \frac{1}{2} [(0+27+12-6) - (-54+0+3+16)]$$

$$= \frac{1}{2} [27+12-6+54-3-16]$$

$$= \frac{1}{2} [(27+12+54) - (6+3+16)]$$

$$= \frac{1}{2} [93-25] = \frac{1}{2} [68] = 34 \text{ sq. units}$$

Aliter:

A $(-8, 6)$, B $(-9, 0)$, C $(-6, -3)$, D $(-1, -2)$

x_1, y_1 x_2, y_2 x_3, y_3 x_4, y_4

Area of the quadrilateral

$$= \frac{1}{2} \begin{vmatrix} x_1 - x_3 & x_2 - x_4 \\ y_1 - y_3 & y_2 - y_4 \end{vmatrix}$$

$$= \frac{1}{2} \begin{vmatrix} -8 - (-6) & -9 - (-1) \\ 6 - (-3) & 0 - (-2) \end{vmatrix}$$

$$= \frac{1}{2} \begin{vmatrix} -8+6 & -9+1 \\ 6+3 & 0+2 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} -2 & -8 \\ 9 & 2 \end{vmatrix}$$

$$= \frac{1}{2} [-4 + 72] = \frac{1}{2} [68] = 34 \text{ sq. units}$$

5. Find the value of k , if the area of a quadrilateral is 28 sq. units, whose vertices are $(-4, -2)$, $(-3, k)$, $(3, -2)$ and $(2, 3)$

Solution:

$$\frac{1}{2} \begin{vmatrix} -4 & -2 \\ -3 & k \\ 3 & -2 \\ 2 & 3 \\ -4 & -2 \end{vmatrix} = 28$$

$$\Rightarrow (-4k + 6 + 9 - 4) - (6 + 3k - 4 - 12) = 56$$

$$\Rightarrow (11 - 4k) - (3k - 10) = 56$$

$$\Rightarrow 11 - 4k - 3k + 10 = 56 \Rightarrow 21 - 7k = 56$$

$$\Rightarrow 7k = -35 \Rightarrow k = -5$$

6. If the points A $(-3, 9)$, B (a, b) and C $(4, -5)$ are collinear and if $a + b = 1$, then find a and b .

Solution:

Given A $(-3, 9)$, B (a, b) , C $(4, -5)$ are collinear and $a + b = 1$ (1)

Area of the triangle formed by 3 points = 0

$$\frac{1}{2} \begin{vmatrix} -3 & 9 \\ a & b \\ 4 & -5 \\ -3 & 9 \end{vmatrix} = 0$$

$$\Rightarrow (-3b - 5a + 36) - (9a + 4b + 15) = 0$$

$$\Rightarrow -5a - 3b + 36 - 9a - 4b - 15 = 0$$

$$\Rightarrow -14a - 7b + 21 = 0 \Rightarrow -14a - 7b = -21$$

$$\Rightarrow 14a + 7b = 21 \quad (+7) \Rightarrow 2a + b = 3 \quad \text{..... (2)}$$

Given $a + b = 1$ (1)

$$(1) - (2) \Rightarrow a = 2 \quad b = -1$$

7. A triangular shaped glass with vertices at A (-5, -4), B (1, 6) and C (7, -4) has to be painted. If one bucket of paint covers 6 square feet, how many buckets of paint will be required to paint the whole glass, if only one coat of paint is applied.

Solution:

The required number of buckets =
$$\frac{\text{Area of the } \Delta ABC}{\text{Area of the paint covered by one bucket}}$$

8. Statistics and Probability

2 Marks

1. Find the range and coefficient of range of the following data: 25, 67, 48, 53, 18, 39, 44.

Solution:

Largest value $L = 67$; Smallest value $S = 18$

Range $R = L - S = 67 - 18 = 49$

Coefficient of range =
$$\frac{L - S}{L + S}$$

Coefficient of range =
$$\frac{67 - 18}{67 + 18} = \frac{49}{85} = 0.576$$

2. Find the range of the following distribution.

Age (in years)	16-18	18-20	20-22	22-24	24-26	26-28
Number of students	0	4	6	8	2	2

Solution:

Here

Largest value, $L = 28$

Smallest Value, $S = 18$

Range $R = L - S$

$R = 28 - 18 = 10$ Years.

3. The range of a set of data is 13.67 and the largest value is 70.08. Find the smallest value.

Solution:

Range $R = 13.67$

Largest value $L = 70.08$

Range $R = L - S$

$13.67 = 70.08 - S$

$S = 70.08 - 13.67 = 56.41$

Therefore, the smallest value is 56.41

4. Find the range and coefficient of range of following data

(i) 63, 89, 98, 125, 79, 108, 117, 68

(ii) 43.5, 13.6, 18.9, 38.4, 61.4, 29.8

$$\text{Area of the } \Delta ABC = \frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} -5 & -4 \\ 1 & 6 \\ 7 & -4 \end{vmatrix}$$

$$= \frac{1}{2} [(-30 - 4 - 28) - (-4 + 42 + 20)]$$

$$= \frac{1}{2} [-62 - 58] = \frac{1}{2} [-120] = 60 \text{ sq. units.}$$

$$\therefore \text{The required number of buckets} = \frac{60}{6} = 10$$

Solution:

- i. 63, 89, 98, 125, 79, 108, 117, 68

$L = 125, S = 63$

Range, $R = L - S = 125 - 63 = 62$

Coefficient of Range =
$$\frac{L - S}{L + S}$$

$$= \frac{125 - 63}{125 + 63} = \frac{62}{188} = 0.33$$

- ii. 43.5, 13.6, 18.9, 38.4, 61.4, 29.8

$L = 61.4, S = 13.6$

Range, $R = L - S = 61.4 - 13.6 = 47.8$

Coefficient of Range =
$$\frac{L - S}{L + S}$$

$$= \frac{47.8}{61.4 + 13.6} = \frac{47.8}{75.0} = 0.64$$

5. If the range and the smallest value of a set of data are 36.8 and 13.4 respectively, then find the largest value.

Solution:

Range, $R = 36.8$

Smallest Value, $S = 13.4$

Largest Value, $L = R + S$

$$= 36.8 + 13.4 = 50.2$$

6. Calculate the range of the following data.

Income	400-450	450-500	500-550
Number of workers	8	12	30
Income	550-600	600-650	
Number of workers	21	6	

Solution:

Given: Largest Value, $L = 650$

Smallest Value, $S = 400$

\therefore Range = $L - S = 650 - 400 = 250$

7. Find the standard deviation of first 21 natural numbers.

Solution:

Standard Deviation of first 21 natural numbers,

$$\begin{aligned}\sigma &= \sqrt{\frac{n^2-1}{12}} \\ &= \sqrt{\frac{(21)^2-1}{12}} = \sqrt{\frac{441-1}{12}} = \sqrt{\frac{440}{12}} \\ &= \sqrt{36.66} = 6.05\end{aligned}$$

8. If the standard deviation of a data is 4.5 and if each value of the data is decreased by 5, then find the new standard deviation.

Solution:

standard deviation of a data, $\sigma = 4.5$
each value of the data decreased by 5,
the new standard deviation does not change and it is also 4.5.

9. If the standard deviation of a data is 3.6 and each value of the data is divided by 3, then find the new variance and new standard deviation.

Solution:

The new standard deviation of a data is 3.6, and each of the data is divided by 3 then the new standard deviation is also divided by 3.

$$\text{The new standard deviation} = \frac{3.6}{3} = 1.2$$

$$\begin{aligned}\text{The new variance} &= (\text{Standard Deviation})^2 \\ &= \sigma^2 = (1.2)^2 = 1.44\end{aligned}$$

10. The mean of a data is 25.6 and its coefficient of variation is 18.75. Find the standard deviation.

Solution:

$$\text{Mean } \bar{x} = 25.6$$

$$\text{Coefficient of variation, C.V.} = 18.75$$

$$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100$$

$$18.75 = \frac{\sigma}{25.6} \times 100$$

$$\sigma = \frac{18.75 \times 25.6}{100} = 4.8$$

11. The standard deviation and mean of a data are 6.5 and 12.5 respectively. Find the coefficient of variation.

Solution:

$$\text{Co-efficient of variation C.V.} = \frac{\sigma}{\bar{x}} \times 100.$$

$$\sigma = 6.5, \bar{x} = 12.5$$

$$\begin{aligned}\text{C.V.} &= \frac{\sigma}{\bar{x}} \times 100 = \frac{6.5}{12.5} \times 100 \\ &= \frac{6500}{125} = 52\%\end{aligned}$$

12. If the mean and coefficient of variation of a data are 15 and 48 respectively, then find the value of standard deviation.

Solution:

$$\bar{x} = 15, \text{C.V.} = 48,$$

$$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100$$

$$\sigma = \frac{\text{C.V.} \times \bar{x}}{100} = \frac{48 \times 15}{100} = \frac{720}{100} = 7.2$$

13. If $n = 5$, $\sum x = 6$, $\sum x^2 = 765$, then calculate the coefficient of variation.

Solution:

$$n = 5, \bar{x} = 6, \sum x^2 = 765$$

$$\begin{aligned}\sigma &= \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2} = \sqrt{\frac{765}{5} - (6)^2} \\ &= \sqrt{153 - 36} = \sqrt{117} = 10.8\end{aligned}$$

$$\text{C.V.} = \frac{\sigma}{\bar{x}} \times 100\%$$

$$= \frac{10.8}{6} \times 100 = \frac{1080}{6} = 180\%$$

14. A bag contains 5 blue balls and 4 green balls. A ball is drawn at random from the bag. Find the probability that the ball drawn is (i) blue (ii) not blue.

Solution:

Total number of possible outcomes

$$n(S) = 5 + 4 = 9$$

- i) Let A be the event of getting a blue ball.

Number of favourable outcomes for the event A. Therefore, $n(A) = 5$

Probability that the ball drawn is blue.

$$\text{Therefore, } P(A) = \frac{n(A)}{n(S)} = \frac{5}{9}$$

- ii) A will be the event of not getting a blue ball.

$$\text{So } P(\bar{A}) = 1 - P(A) = 1 - \frac{5}{9} = \frac{4}{9}$$

15. Two coins are tossed together. What is the probability of getting different faces on the coins?

Solution:

When two coins are tossed together, the sample space is

$S = \{HH, HT, TH, TT\}; n(S) = 4$

Let A be the event of getting different faces on the coins.

$A = \{HT, TH\}; n(A) = 2$

Probability of getting different faces on the coins is

$$P(A) = \frac{n(A)}{n(S)} = \frac{2}{4} = \frac{1}{2}$$

16. A coin is tossed thrice. What is the probability of getting two consecutive tails?

Solution:

$S = \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$

$n(S) = 8$

Event A :

Two Consecutive tails = $\{HTT, TTH, TTT\}$

$n(A) = 3$

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{8}$$

17. What is the probability that a leap year selected at random will contain 53 Saturdays.

Solution:

A leap year has 366 days.

So it has 52 full weeks and 2 days.

52 Saturdays must be in 52 full weeks.

$S = \{(\text{Sun} - \text{Mon}, \text{Mon} - \text{Tue}, \text{Tue} - \text{Wed}, \text{Wed} - \text{Thu}, \text{Thu} - \text{Fri}, \text{Fri} - \text{Sat}, \text{Sat} - \text{Sun})\}$

$n(S) = 7$

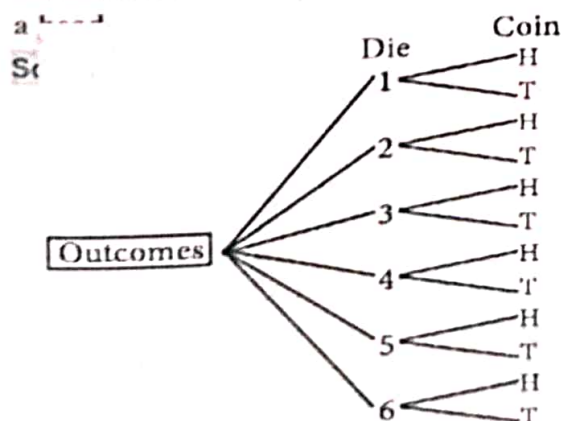
Let A be the event of getting 53rd Saturday.

Then $A = \{\text{Fri} - \text{Sat}, \text{Sat} - \text{Sun}\}$ $n(A) = 2$

Probability of getting 53 Saturdays in a leap

year is $P(A) = \frac{n(A)}{n(S)} = \frac{2}{7}$

18. A die is rolled and a coin is tossed simultaneously. Find the probability that the die shows an odd number and the coin shows a head.



Sample space

$S = \{1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T\};$

$n(S) = 12$

Let A be the event of getting an odd number and a head.

$A = \{1H, 3H, 5H\}; n(A) = 3$

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{12} = \frac{1}{4}$$

19. If $P(A) = 0.37, P(B) = 0.42, P(A \cap B) = 0.09$ then find $P(A \cup B)$.

Solution:

$P(A) = 0.37, P(B) = 0.42, P(A \cap B) = 0.09$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$P(A \cup B) = 0.37 + 0.42 - 0.09 = 0.7$$

20. If $P(A) = \frac{2}{3}, P(B) = \frac{2}{5}, P(A \cup B) = \frac{1}{3}$ then find $P(A \cap B)$.

Solution:

$$P(A) = \frac{2}{3}, P(B) = \frac{2}{5}, P(A \cup B) = \frac{1}{3}$$

$$P(A \cap B) = P(A) + P(B) - P(A \cup B)$$

$$= \frac{2}{3} + \frac{2}{5} - \frac{1}{3}$$

$$= \frac{10 + 6 - 5}{15}$$

$$P(A \cap B) = \frac{11}{15}$$

21. The probability that atleast one of A and B occur is 0.6. If A and B occur simultaneously with probability 0.2, then find $P(\bar{A}) + P(\bar{B})$.

Solution:

Given $P(A \cup B) = 0.6, P(A \cap B) = 0.2$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A) + P(B) = P(A \cup B) + P(A \cap B)$$

$$= 0.6 + 0.2$$

$$= 0.8$$

$$\therefore P(\bar{A}) + P(\bar{B}) = 1 - P(A) + 1 - P(B)$$

$$= 2 - [P(A) + P(B)]$$

$$= 2 - 0.8$$

$$= 1.2$$

5 Marks

1. Find the mean and variance of the first n natural numbers.

Solution:

$$\text{Mean } \bar{x} = \frac{\text{Sum of all the observations}}{\text{Number of observations}}$$

$$= \frac{\sum x_i}{n} = \frac{1+2+3+\dots+n}{n} = \frac{n(n+1)}{2 \times n}$$

$$\bar{x} = \frac{n+1}{2}$$

Variance σ^2

$$= \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n} \right)^2 \left| \begin{array}{l} \sum x_i^2 = 1^2 + 2^2 + 3^2 + \dots + n^2 \\ (\sum x_i)^2 = (1+2+3+\dots+n)^2 \end{array} \right|$$

$$= \frac{n(n+1)(2n+1)}{6 \times n} - \left| \frac{n(n+1)}{2 \times n} \right|^2$$

$$= \frac{n+1}{2} \left[\frac{2n+1}{3} - \frac{n+1}{2} \right] = \frac{n+1}{2} \left[\frac{4n+2-3n-3}{6} \right]$$

$$\text{Variance } \sigma^2 = \frac{n+1}{2} \left[\frac{n-1}{6} \right] = \frac{n^2-1}{12}$$

2. Two dice are rolled. Find the probability that the sum of outcomes is (i) equal to 4 (ii) greater than 10 (iii) less than 13

Solution:

When we roll two dice, the sample space is given by

$$S = \{ (1,1), (1,2), (1,3), (1,4), (1,5), (1,6) \\ (2,1), (2,2), (2,3), (2,4), (2,5), (2,6) \\ (3,1), (3,2), (3,3), (3,4), (3,5), (3,6) \\ (4,1), (4,2), (4,3), (4,4), (4,5), (4,6) \\ (5,1), (5,2), (5,3), (5,4), (5,5), (5,6) \\ (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \};$$

$$n(S) = 36$$

- i) Let A be the event of getting the sum of outcome values equal to 4.

$$\text{Then } A = \{ (1,3), (2,2), (3,1) \}; \quad n(A) = 3$$

Probability of getting the sum of outcomes equal to 4 is

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

- ii) Let B be the event of getting the sum of outcome values greater than 10.

$$\text{Then } B = \{ (5,6), (6,5), (6,6) \}; \quad n(B) = 3$$

Probability of getting the sum of outcomes greater than 10 is

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

- iii) Let C be the event of getting the sum of outcomes less than 13. Here all the outcomes have the sum value less than 13. Hence $C = S$. Therefore, $n(C) = n(S) = 36$

Probability of getting the total value less than 13 is

$$P(C) = \frac{n(C)}{n(S)} = \frac{36}{36} = 1$$

3. Two dice are rolled together. Find the probability of getting a doublet or sum of faces as 4.

Solution:

$$n(S) = 36$$

When two dice are rolled together, there will be $6 \times 6 = 36$ outcomes.

Let S be the sample space. Then $n(S) = 36$

Let A be the event of getting a doublet and B be the event of getting face sum 4.

$$\text{Then } A = \{ (1,1), (2,2), (3,3), (4,4), (5,5), (6,6) \}$$

$$B = \{ (1,3), (2,2), (3,1) \}$$

$$\therefore A \cap B = \{ (2,2) \}$$

$$\text{Then, } n(A) = 6, \quad n(B) = 3, \quad n(A \cap B) = 1$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{36}$$

$$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{1}{36}$$

$$\therefore P(\text{getting a doublet or a total of 4}) = P(A \cup B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{6}{36} + \frac{3}{36} - \frac{1}{36} = \frac{8}{36} = \frac{2}{9}$$

Hence, the required probability is $\frac{2}{9}$.

4. If A is an event of a random experiment such that $P(A) : P(\bar{A}) = 17:15$ and $n(S) = 640$ then find (i) $P(\bar{A})$ (ii) $n(A)$.

Solution:

$$\text{Given } n(S) = 640$$

$$\frac{P(A)}{P(\bar{A})} = \frac{17}{15}$$

$$\frac{1 - P(\bar{A})}{P(\bar{A})} = \frac{17}{15}$$

$$15[1 - P(\bar{A})] = 17P(\bar{A})$$

$$15 - 15P(\bar{A}) = 17P(\bar{A})$$

$$15 = 15P(\bar{A}) + 17P(\bar{A})$$

$$32P(\bar{A}) = 15$$

$$P(\bar{A}) = \frac{15}{32}$$

$$P(A) = 1 - P(\bar{A}) = 1 - \frac{15}{32}$$

$$= \frac{32 - 15}{32} = \frac{17}{32}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$\frac{17}{32} = \frac{n(A)}{640}$$

$$n(A) = \frac{17 \times 640}{32}$$

$$n(A) = 340$$

5. Two unbiased dice are rolled once. Find the probability of getting

- a doublet (equal numbers on both dice)
- the product as a prime number
- the sum as a prime number
- the sum as 1

Solution:

$$n(S) = 36$$

i) A = Probability of getting Doublets
(Equal numbers on both dice)

$$A = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$$

$$n(A) = 6; P(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

B = Probability of getting the product of the prime number

ii) B = $\{(1,2), (1,3), (1,5), (2,1), (3,1), (5,1)\}$

$$n(B) = 6; P(B) = \frac{n(B)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

C = Probability of getting sum of the prime number.

iii) C = $\{(1,1), (2,1), (1,2), (1,4), (4,1), (1,6), (6,1), (2,3), (2,5), (3,2), (3,4), (4,3), (5,2), (5,6), (6,5)\}$

$$n(C) = 14; P(C) = \frac{n(C)}{n(S)} = \frac{14}{36} = \frac{7}{18}$$

iv) D = Probability of getting the sum as 1

$$n(D) = 0; P(D) = \frac{n(D)}{n(S)} = 0$$

6. Three fair coins are tossed together. Find the probability of getting

- all heads
- atleast one tail
- atmost one head
- atmost two tails

Solution:

Possible Outcomes = {HHH, HHT, HTH, THH, TTT, TTH, THT, HTT}

No. of possible outcomes,

$$n(S) = 2 \times 2 \times 2 = 8$$

i) A = Probability of getting all heads

$$A = \{HHH\} \quad n(A) = 1$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{1}{8}$$

ii) B = Probability of getting atleast one tail
B = {HHT, HTH, THH, TTT, TTH, THT, HTT}

$$n(B) = 7 \quad P(B) = \frac{n(B)}{n(S)} = \frac{7}{8}$$

iii) C = Probability of getting atmost one head.

C = {TTT, TTH, THT, HTT}

$$n(C) = 4 \quad P(C) = \frac{n(C)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

iv) D = Probability of getting atmost two tails.

D = {TTH, THT, HTT, HHT, HTH, THH, HHH}

$$n(D) = 7 \quad P(D) = \frac{n(D)}{n(S)} = \frac{7}{8}$$

7. A bag contains 5 red balls, 6 white balls, 7 green balls, 8 black balls. One ball is drawn at random from the bag. Find the probability that the ball drawn is

- white
- black or red
- not white
- neither white nor black

Solution:

S = {5 Red, 6 White, 7 Green, 8 Black}

$$n(S) = 26$$

i) A – probability of getting white balls

$$n(A) = 6; P(A) = \frac{6}{26} = \frac{3}{13}$$

ii) B – Probability of getting black (or) red balls

$$n(B) = 8 + 5 = 13; P(B) = \frac{13}{26} = \frac{1}{2}$$

iii) C – Probability of not getting white balls

$$n(C) = 20; P(C) = \frac{20}{26} = \frac{10}{13}$$

iv) D – Probability of getting of neither white nor black

$$n(D) = 12; P(D) = \frac{12}{26} = \frac{6}{13}$$

8. In a box there are 20 non-defective and some defective bulbs. If the probability that a bulb selected at random from the box found to be defective is $\frac{3}{8}$ then, find the number of defective bulbs.

Solution:

In a box there are 20 non – defective and x defective bulbs

$$n(S) = x + 20$$

Let A – probability of getting Defective Bulbs

$$n(A) = x$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{x}{x+20}$$

From Given data

$$\frac{x}{x+20} = \frac{3}{8}$$

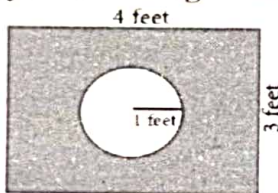
$$8x = 3x + 60$$

$$5x = 60$$

$$x = 12$$

∴ Number of defective bulbs = 12

9. Some boys are playing a game, in which the stone thrown by them landing in a circular region (given in the figure) is considered as win and landing other than the circular region is considered as loss. What is the probability to win the game? ($\pi = 3.14$)

**Solution:**

$$\text{Total Region} = 4 \times 3 = 12 \text{ sq.ft}$$

$$\therefore n(S) = 12$$

Winning Region = Area of circle

$$= \pi r^2 = \pi(1)^2$$

$$= \pi = 3.14 \text{ sq. unit}$$

$$n(A) = 3.14$$

$$\begin{aligned} P(\text{Winning the Game}) &= \frac{n(A)}{n(S)} \\ &= \frac{3.14}{12} = \frac{314}{1200} \\ &= \frac{157}{600} \end{aligned}$$

10. The standard deviation and coefficient of variation of a data are 1.2 and 25.6 respectively. Find the value of mean.

Solution:

$$\sigma = 1.2, \text{ CV} = 25.6, c = ?$$

$$\text{CV} = \frac{\sigma}{\bar{x}} \times 100$$

$$\bar{x} = \frac{\sigma}{\text{CV}} \times 100 = \frac{1.2}{25.6} \times 100 = \frac{1200}{256}$$

$$\bar{x} = 4.7$$

11. Two customers Priya and Amuthan are visiting a particular shop in the same week (Monday to Saturday). Each is equally likely to visit the shop on any one day as on another day. What is the probability that both will visit the shop on

- (i) the same day (ii) different days
(iii) consecutive days?

Solution:

$$n(S) = 36$$

- i) A be the Probability of Priya and Amuthan to visit shop on same day

$$A = \{(\text{Mon, Mon}), (\text{Tue, Tue}), (\text{Wed, Wed}), (\text{Thurs, Thurs}), (\text{Fri, Fri}), (\text{Sat, Sat})\}$$

$$n(A) = 6$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

- ii) P (Priya and Amuthan Visit on Different Days)

$$= P(\bar{A}) = 1 - P(A) = 1 - \frac{1}{6} = \frac{5}{6}$$

C be the Probability of Priya and Amuthan to visit on Consequent days

- iii) C = {(Mon, Tue), (Tue, Wed), (Wed, Thurs), (Thurs, Fri), (Fri, Sat) (Tue, Mon), (Wed, Tue), (Thurs, Wed), (Fri, Thurs), (Sat, Fri),}

$$n(C) = 10$$

$$P(C) = \frac{n(C)}{n(S)} = \frac{10}{36} = \frac{5}{18}$$

12. In a game, the entry fee is ₹ 150. The game consists of tossing a coin 3 times. Dhana bought a ticket for entry . If one or two heads show, she gets her entry fee back. If she throws 3 heads, she receives double the entry fees. Otherwise she will lose. Find the probability that she (i) gets double entry fee (ii) just gets her entry fee (iii) loses the entry fee.

Solution:

$$S = \{HHH, HHT, HTH, THH, TTT, TTH, THT, HTT\}$$

$$n(S) = 8$$

- i) For Receiving double entry Fees have to get Three Heads

A = Probability of Getting three Heads

$$A = \{HHH\}$$

$$n(A) = 1$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{1}{8}$$

- ii) For getting Entry Fess getting atleast one Head

$B =$ Probability of Getting One or Two Heads

$B = \{TTH, THT, HTT, HHT, HTH, THH\}$

$n(B) = 6$

$$P(B) = \frac{n(B)}{n(S)} = \frac{6}{8} = \frac{3}{4}$$

- iii) To loss the entry fees, she have to get no Heads

$C =$ Probability of Getting No Heads

$C = \{TTT\}$

$n(C) = 1$

$$P(C) = \frac{n(C)}{n(S)} = \frac{1}{8}$$

13. Two dice are rolled together. Find the probability of getting a doublet or sum of faces as 4.

Solution:

$n(S) = 36$

When two dice are rolled together, there will be $6 \times 6 = 36$ outcomes.

Let S be the sample space.

Then $n(S) = 36$

Let A be the event of getting a doublet and B be the event of getting face sum 4.

Then $A = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

$B = \{(1,3), (2,2), (3,1)\}$

$\therefore A \cap B = \{(2,2)\}$

Then, $n(A) = 6$, $n(B) = 3$, $n(A \cap B) = 1$.

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{36}$$

$$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{1}{36}$$

$\therefore P(\text{getting a doublet or a total of 4}) = P(A \cup B)$

$$\begin{aligned} P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\ &= \frac{6}{36} + \frac{3}{36} - \frac{1}{36} = \frac{8}{36} = \frac{2}{9} \end{aligned}$$

Hence, the required probability is $\frac{2}{9}$.

14. If A and B are two events such that $P(A) = \frac{1}{4}$

$P(B) = \frac{1}{2}$ and $P(A \text{ and } B) = \frac{1}{8}$, find

- (i) $P(A \text{ or } B)$ (ii) $P(\text{not } A \text{ and not } B)$.

Solution:

$$\begin{aligned} \text{i. } P(A \text{ or } B) &= P(A \cup B) \\ &= P(A) + P(B) - P(A \cap B) \end{aligned}$$

$$P(A \text{ or } B) = \frac{1}{4} + \frac{1}{2} - \frac{1}{8} = \frac{5}{8}$$

$$\text{ii. } P(\text{not } A \text{ and not } B) = P(\bar{A} \cap \bar{B})$$

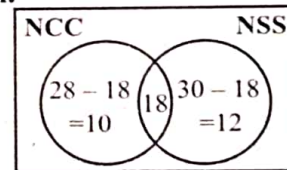
$$= P(\overline{A \cup B})$$

$$= 1 - P(A \cup B)$$

$$P(\text{not } A \text{ and not } B) = 1 - \frac{5}{8} = \frac{3}{8}$$

15. In a class of 50 students, 28 opted for NCC, 30 opted for NSS and 18 opted both NCC and NSS. One of the students is selected at random. Find the probability that

- (i) The student opted for NCC but not NSS.
 (ii) The student opted for NSS but not NCC.
 (iii) The student opted for exactly one of them.



Solution:

Total number of students $n(S) = 50$

- i. A : A : opted only NCC but not NSS

$$P(A) = \frac{n(A)}{n(S)} = \frac{10}{50} = \frac{1}{5}$$

- ii. B : opted only NSS but not NCC

$$P(B) = \frac{n(B)}{n(S)} = \frac{12}{50} = \frac{6}{25}$$

- iii. C : opted only one

$$P(C) = \frac{n(C)}{n(S)} = \frac{(10+12)}{50} = \frac{22}{50} = \frac{11}{25}$$

16. Two dice are rolled once. Find the probability of getting an even number on the first die or a total of face sum 8.

Solution:

$S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

$n(S) = 36$

$A =$ Probability of getting an even number in the first die.

$$A = \{ (2,1), (2,2), (2,3), (2,4), (2,5), (2,6) \\ (4,1), (4,2), (4,3), (4,4), (4,5), (4,6) \\ (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \}$$

$$n(A) = 18; \quad P(A) = \frac{n(A)}{n(S)} = \frac{18}{36}$$

B = Probability of getting a total face sum is 8

$$B = \{ (2,6), (3,5), (4,4), (5,3), (6,2) \}$$

$$n(B) = 5; \quad P(B) = \frac{n(B)}{n(S)} = \frac{5}{36}$$

$$A \cap B = \{ (2,6), (4,4), (6,2) \}$$

$$n(A \cap B) = 3$$

$$P(A \cap B) = \frac{3}{36}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{18}{36} + \frac{5}{36} - \frac{3}{36}$$

$$= \frac{20}{36} = \frac{5}{9}$$

17. A box contains cards numbered 3, 5, 7, 9, ... 35, 37. A card is drawn at random from the box. Find the probability that the drawn card have either multiples of 7 or a prime number.

Solution:

$$S = \{ 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, \\ 27, 29, 31, 33, 35, 37 \}$$

$$n(S) = 18$$

Let A = Multiple of 7

$$A = \{ 7, 21, 35 \}, \quad n(A) = 3$$

$$P(A) = \frac{3}{18}$$

Let B = a Prime number

$$B = \{ 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37 \}$$

$$n(B) = 11; \quad P(B) = \frac{11}{18}$$

$$A \cap B = \{ 7 \} \Rightarrow n(A \cap B) = 1$$

$$P(A \cap B) = \frac{1}{18}$$

$$P(\text{Either A or B}) = P(A \cup B)$$

$$= P(A) + P(B) - P(A \cap B)$$

$$= \frac{3}{18} + \frac{11}{18} - \frac{1}{18} = \frac{13}{18}$$

18. Three unbiased coins are tossed once. Find the probability of getting atmost 2 tails or atleast 2 heads.

Solution:

$$S = \{ HHH, HHT, HTH, THH, TTT, TTH, THT, \\ HTT \}$$

$$n(S) = 8$$

A = Probability of getting atmost 2 tails

$$A = \{ HHH, HHT, HTH, THH, TTH, THT, \\ HTT \}$$

$$n(A) = 7 \quad P(A) = \frac{7}{8}$$

B = Probability of getting atleast 2 heads

$$B = \{ HHT, HTH, THH, HHH \}$$

$$n(B) = 4 \quad P(B) = \frac{4}{8}$$

$$P(A \cap B) = \frac{4}{8}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{7}{8} + \frac{4}{8} - \frac{4}{8} = \frac{7}{8}$$

SCIENCE

1. LAWS OF MOTION

- Define inertia. Give its classification**
To resist any change in its rest or uniform motion.
Types: i. Inertia of rest, ii. Inertia of motion
iii. Inertia of direction
- Classify the types of force based on their application**
i. Like parallel forces, ii. Unlike parallel forces.
- Differentiate mass and weight**

	Mass	Weight
1.	Quantity of matter	Gravitational force
2.	SI unit- kilogram	SI unit- Newton
- Define moment of couple**
 $M = F \times S$
- State the principle of moments**
 $F_1 \times d_1 = F_2 \times d_2$
- State Newton's second law**
 $F = ma$
- Why a spanner with a long handle is preferred to tighten screws in heavy vehicles?**
i. To minimize the force
ii. To increase the turning effect
- While catching a cricket ball the fielder lowers his hands backwards. Why?**
i. To increase the time to catch ball
ii. To decrease the change in momentum
- How does an astronaut float in a space shuttle?**
i. Space station and astronauts have equal acceleration.
ii. They have huge orbital velocity.
- What are the types of inertia? Give an example for each type To resist any change in its rest or uniform motion.**
Types: i. Inertia of rest, ii. Inertia of motion
iii. Inertia of direction

2. OPTICS

- What is refractive index?**

$$\mu = \frac{c}{v}$$

- State Snell's law**

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$$

- Define dispersion of light**

White light splits into its component colours.

- State Rayleigh's law of scattering**

$$S \propto \frac{1}{\lambda^4}$$

- Differentiate convex lens and concave lens**

	Convex lens	Concave lens
1.	Converging lens	Diverging lens
2.	Real images	Virtual images
3.	Thicker in middle	Thinner in middle

- What are the causes of "Myopia"?**

Lengthening of eye ball.

- Why does the sky appear in blue colour?**

Blue colour is scattered to a greater extent.

- Why are traffic signals red in colour?**

i. Red light has highest wavelength

ii. It travels a longer distance.

- List any five properties of light.**

i. Light is an energy. ii. It travels straight line.

iii. It can travel through vacuum

iv. No medium for its propagation.

- Differentiate the eye defects: Myopia and Hypermetropia**

	Myopia	Hypermetropia
1.	Short sightedness	Long sightedness
2.	Lengthening of eye ball	Shortening of eye ball
3.	Distant objects cannot visible	Nearby objects cannot visible
4.	Concave lens	Convex lens

3. THERMAL PHYSICS

- Define one calorie**

To rise the temperature of 1 gram of water through 1°C.

- State Boyle's law**

$$P \propto \frac{1}{v}$$

- State – The law of volume**

$$V \propto T$$

- Derive the ideal gas equation**

Boyle's law : $PV = \text{constant}$ ----- 1

Charles law: $\frac{V}{T} = \text{constant}$ ----- 2

Avogadro's law: $\frac{V}{N} = \text{constant}$ -----3

from equation 1, 2, 3

$$PV = RT$$

4. ELECTRICITY

1. Define the unit of current

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

2. What happens to the resistance, as the conductor is made thicker?

Resistance decreases

3. Why is tungsten metal used in bulbs, but not in fuse wires?

i. High melting point, ii. It will not melt easily

4. Name any two devices, which are working on the heating effect of the electric current.

i. Electric heater, ii. Iron box

5. State Ohm's law.

$$V = IR$$

6. Distinguish between the resistivity and conductivity of a conductor

	Resistivity	Conductivity
1.	Resistance of a conductor	Reciprocal of resistivity
2.	ohm meter	ohm ⁻¹ meter ¹

7. What connection is used in domestic appliances and why?

i. Parallel connection, ii. Get full voltage

8. a) What is meant by electric current?

Flow of charges

- b) Name and define its unit

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

- c) Which instrument is used to measure the electric current? How should it be connected in a circuit?

Ammeter – series connection.

9. a) What are the advantages of LED TV over the normal TV?

i. Brighter, ii. Thinner, iii. More lifespan

- b) List the merits of LED bulb

i. No loss of energy ii. Need low power
iii. Low cost.

5. ACOUSTICS

- What is a longitudinal wave?
Particles of a medium vibrate along the wave.
- What is the audible range of frequency?
20 Hz to 20000 Hz
- What is the minimum distance needed for an echo?
17.2m
- Name three animals which can hear ultrasonic vibrations
Mosquito, dogs, bats
- Why does sound travel faster on a rainy day than on a dry day?
i. Humidity increases, ii. Speed of sound increases
- Explain why the ceilings of halls are curved?
i. Reflection reaches every corner
ii. The audience can hear clearly
- Mention two causes in which there is no Doppler effect in sound
i. S and L - rest, ii. S and L – constant distance
- What are the factors that affect the speed of sound in gases?
i. Density $\propto \frac{1}{\text{Velocity}}$ ii. Temperature $\propto \text{Velocity}$
iii. Humidity $\propto \text{Velocity}$
- What do you understand by the term "Ultrasonic vibration"?
Greater than 20 Hz
 - State three uses of ultrasonic vibrations
i. Used in SONAR, ii. Used in medicinal field
 - Name three animals which can hear ultrasonic vibrations
Mosquito, dogs, bats
- What is an echo?
Reflection of the sound
 - State two conditions necessary for hearing an echo
i. Time gap – 0.1 Second, ii. Distance – 17.2 meter
 - What are the medical applications of echo?
i. Ultrasonography, ii. No harmful radiations
 - How can you calculate the speed of sound using echo?
$$\frac{\text{Distance}}{\text{Time}}$$

6. NUCLEAR PHYSICS

- Write any three features of natural and artificial radioactivity?

	Natural Radioactivity	Artificial Radioactivity
1.	Uncontrolled	Controlled
2.	Spontaneous process	Induced process
3.	Atomic number more than 83	Atomic number less than 83

- Define one Roentgen
Produces a charge of 2.58×10^{-4} coulomb in 1kg air.
- In Japan, some of the new born children are having congenital diseases. Why?
i. Nuclear bomb blast, ii. Radiation poisoning.
- What is stellar energy?
Fusion reaction in Sun and Stars.
- Give any two uses of radio isotopes in the field of agriculture.
i. Productivity of crops, ii. To kill insects
- Explain the process of controlled and uncontrolled chain reactions

	Controlled chain reactions	Uncontrolled chain reactions
1.	Controlled manner	Uncontrolled manner
2.	Sustainable process	Unsustainable process

- Compare the properties of alpha, beta and gamma radiations

	Alpha rays	Beta rays	Gamma rays
1.	Helium nucleus	Electrons	Photons
2.	Positive charge	Negative charge	Neutral charge
3.	Low penetrating power	High penetrating power	Very high penetrating power

- What is nuclear reactor? Explain its essential parts with their functions.
i. Fuel, ii. Moderator, iii. Control rod
iv. Coolant, v. Protection wall.

7. ATOMS AND MOLECULES

- Define- Relative atomic mass
$$\frac{\text{Average mass of the isotopes of the element}}{12^{\text{th}} \text{ of the mass of one Carbon}}$$

- Define- Atomicity
Number of atoms present in the molecule.
- Give any two examples for hetero diatomic molecules
HCl, CO
- Give the salient features of "Modern atomic theory"
i. Atom is the smallest particle
ii. It is divisible, iii. $E = mc^2$
iv. Atom is Neither created not destroyed
- Derive the relationship between Relative molecular mass and Vapour density
Relative molecular mass $2 \times$ Vapour density

8. PERIODIC CLASSIFICATION OF ELEMENTS

- A is a reddish brown metal, which combines with O_2 at <1370 K gives B, a black coloured compound. At a temperature >1370 K, A gives C which is red in colour. Find A, B and C with reaction.
A- Cu, B - CuO, C - Cu_2O
- A is a silvery white metal. A combines with O_2 to form B at $800^\circ C$, the alloy of A used in making the aircraft. Find A and B.
A - Al, B - Al_2O_3
- What is rust? Give the equation for formation of rust.
Iron is exposed to moist air.
- State two conditions necessary for rusting of iron
i. Moist air, ii. Presence of water

9. SOLUTIONS

- Define the term : Solution
Solute + Solvent = Solution
- What is meant by binary solution?
One solute + One solvent
- What is aqueous and non- aqueous solution?
Give an example

	Aqueous solution	Non- aqueous solution
1.	Water as a solvent	Other than water as a solvent
2.	Common salt in water	Sulphur in carbon disulphide

- Define - Volume percentage
$$\frac{\text{Volume of the solute}}{\text{Volume of the solute} + \text{Volume of the solvent}} \times 100$$

5. The aquatic animals live more in cold region. Why?

More dissolved oxygen

6. Write notes on saturated solution and unsaturated solution

	Saturated solution	Unsaturated solution
1.	No more solute can be dissolved	Solute can be dissolved
2.	36g of salt in 100g water	20g of salt in 100g water

7. Write notes on various factors affecting solubility

- Non-polar compounds dissolve in non-polar solvents
- Polar compounds dissolve in polar solvents
- Temperature α solubility
- Pressure α solubility

8. In what way hygroscopic substances differ from deliquescent substance

	Hygroscopic substances	Deliquescent substance
1.	Absorb moisture and do not dissolve	Absorb moisture and dissolve
2.	No physical change	Physical change
3.	Crystal	Non-crystal

10. TYPES OF CHEMICAL REACTIONS

1. Why does the reaction rate of a reaction increase on raising the temperature?

Break more bonds

2. Define combination reaction. Give one example for an exothermic combination reaction



3. Differentiate reversible and irreversible reactions

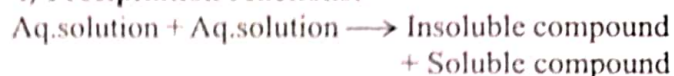
	Reversible reaction	Irreversible reaction
1.	Reversed	Not reversed
2.	Slow reaction	Fast reaction
3.	Attains equilibrium	No equilibrium

4. What are called thermolysis reactions?

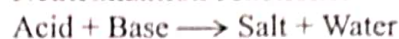
- Decomposed by heat.
- Break the bonds
- Also called "Endothermic reactions"

5. Explain the types of double displacement reactions with examples

i) Precipitation reactions:



ii) Neutralization reactions:



6. Explain the factors influencing the rate of a reaction

- Nature of reactants α Rate of reaction
- Concentration of reactants α Rate of reaction
- Temperature α Rate of reaction
- Pressure α Rate of reaction
- Catalyst α Rate of reaction

7. How does pH play an important role in everyday life?

- To know about blood values.
- To know about digestive system
- To know about tooth decay
- To know about soil
- To know about rain water.

8. What is chemical equilibrium? What are its characteristics?

Rate of forward reaction = Rate of backward reaction

11. CARBON AND ITS COMPOUNDS

1. How do detergents cause water pollution? Suggest remedial measures to prevent this pollution?

- Detergents are non-biodegradable
- We can use linear hydrocarbon chains

2. Differentiate soaps and detergents

	Soaps	Detergents
1.	Used in hard water	Do not used in hard water
2.	Biodegradable	Non-biodegradable
3.	Poor foaming	Rich foaming

3. What is called homologous series? Give any three of its characteristics.

- Similar chemical properties and general formula
- Prepared by common method
- General molecular formula.

4. How is ethanol manufactured from sugarcane?

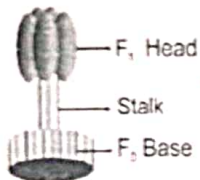
- Dilution of molasses
- Addition of nitrogen source
- Addition of yeast
- Distillation of wash

5. Explain the mechanism of cleansing action of soap
 i. Hydrophilic – Water loving part
 ii. Hydrophobic – Water hating part
 iii. We can remove dirt from these two parts.

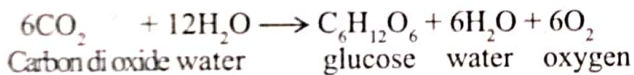
12. PLANT ANATOMY AND PLANT PHYSIOLOGY

1. What is collateral vascular bundle?
 If xylem and phloem lies towards the periphery is called collateral vascular bundle.
2. What is the common step in aerobic and anaerobic pathway?
 Glycolysis
3. Write a short note on mesophyll
 Between the upper and lower epidermis is called mesophyll.

4. Draw and label the structure of Oxyisomes



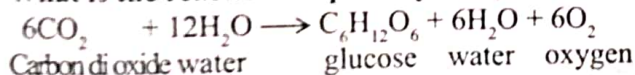
5. What is photosynthesis and where in a cell does it occur?



6. What is respiratory quotient?

$$\text{RQ} = \frac{\text{Volume of CO}_2 \text{ liberated}}{\text{Volume of O}_2 \text{ consumed}}$$

7. What is the reaction for photosynthesis?



8. Differentiate between monocot root and dicot root

	Monocot root	Dicot root
1.	Polyarch	Tetrarch
2.	Pith present	Pith absent
3.	Secondary growth present	Secondary growth absent

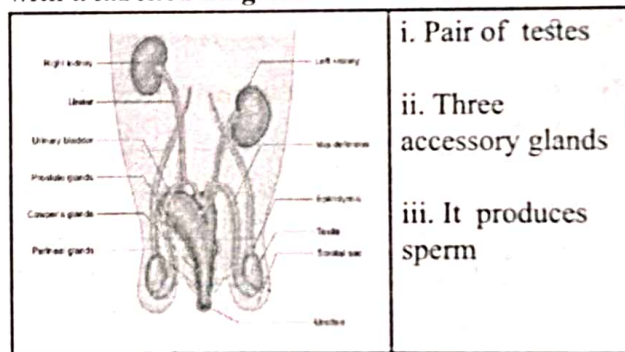
9. Differentiate between aerobic and anaerobic respiration

	Aerobic respiration	Anaerobic respiration
1.	With oxygen	Without oxygen
2.	Most plants and animals	Some organisms only

13. STRUCTURAL ORGANISATION OF ANIMALS

1. Write the dental formula of rabbit

$$\frac{2033}{1023}$$
2. How is diastema formed in rabbit?
 i. Absence of canines
 ii. So the gap is called diastema.
3. Why is the teeth of rabbit called heterodont?
 Rabbit has different type of teeth II
4. How does leech suck blood from the host?
 i. To make Y shape incision, ii. Presence of hirudin.
5. Why are the rings of cartilages found in trachea of rabbit?
 Free passage of air.
6. List out the parasitic adaptations in leech
 i. To make Y shape incision, ii. Presence of hirudin.
7. How does locomotion take place in leech?
 i. Looping movement, ii. Swimming movement
8. Explain the male reproductive system of rabbit with a labelled diagram



- i. Pair of testes
 ii. Three accessory glands
 iii. It produces sperm

14. TRANSPORTATION IN PLANTS AND CIRCULATION IN ANIMALS

1. Name two layered protective covering of human heart
 Pericardium
2. What causes the opening and closing of guard cells of stomata during transpiration?
 Change in turgidity
3. What is cohesion?
 The force of attraction between molecules of water is called cohesion.
4. Trace the pathway followed by water molecules from the time it enters a plant root to the time it escapes into the atmosphere from a leaf?
 By osmosis method, water moves to leaves

5. **What would happen to the leaves of a plant that transpires more water than its absorption in the roots?**
Drying of leaves lead to death.
6. **Describe the structure and working of the human heart**
 - i. Made up of cardiac muscles,
 - ii. Enclosed by pericardium
 - iii. It has four chamber,
 - iv. It has ventricle and atrium
7. **Why is the circulation in man referred to as double circulation?**
Blood circulates twice through the heart in one complete cycle.
8. **What are heart sounds? How are they produced?**
 - i. Closure and opening of heart valves
 - ii. So the sound LUBB DUPP produced.
9. **What is the importance of valves in the heart?**
 - i. Regulate the blood circulation
 - ii. Prevent the backflow.
10. **Who discovered Rh factor? Why was it named so?**
 - i. Landsteiner and Wiener,
 - ii. Name of the Rhesus monkey
11. **How are arteries and veins structurally different from one another?**

	Arteries	Veins
1.	Distributing vessel	Collecting vessel
2.	Pink colour	Red colour
3.	Deep location	Superficial

12. **Why is the sinoatrial node called the pacemaker of heart?**
Stimulate the heart muscles to contract.
13. **What is transpiration? Give the importance of transpiration**
 - i. Transpirational pull of water.
 - ii. It helps for photosynthesis
 - iii. Transport minerals,
 - iv. Cools the leaves
14. **Enumerate the functions of blood.**
 - i. Transport of respiratory gases.
 - ii. Transport of digested food
 - iii. Transport of hormones,
 - iv. Maintains the water balance

15. NERVOUS SYSTEM

1. **Define- stimulus**
Changes in the environmental condition.

2. **Define reflex arc**
The pathway taken by the nerve impulse
3. **Name the parts of the hind brain**
 - i. Cerebellum
 - ii. Pons
 - iii. Medulla oblongata
4. **What are the structures involved in the protection of brain?**
 - i. Outer membrane
 - ii. Middle membrane
 - iii. Inner membrane

5. **Differentiate between voluntary and involuntary actions**

	Voluntary action	Involuntary action
1.	Under our control	Not under our control
2.	Controlled by brain	Controlled by hypothalamus

6. **With a neat labelled diagram explain the structure of a neuron.**

- i. Neuron is the functional unit of nervous system.
- ii. It has three basic parts
- iii. It does not divide.

7. **Illustrate the structure and functions of brain**

1.	Fore brain	Relay centre
2.	Mid brain	Voluntary muscle activity
3.	Hind brain	Respiration system

8. **Classify neurons based on its structure**

Unipolar neurons	Bipolar neurons	Multipolar neurons

16. PLANT AND ANIMAL HORMONES

- What are synthetic auxins? Give examples
 - Artificially synthesized auxins are called synthetic auxins.
 - Eg- 2, 4D
- What is bolting? How can it be induced artificially?

The sudden shoot elongation is called bolting.
- Write the difference between endocrine and exocrine gland

	Endocrine gland	Exocrine gland
1.	Ductless glands	Specific ducts
2.	Hormones	Enzymes

- Why are thyroid hormones referred as personality hormone?

It is essential for personality development
- Name the gaseous plant hormone. Describe its three different actions in plants
 - Gaseous plant hormone – Ethylene
 - It helps to ripen.
 - Which hormone is known as stress hormone in plants? Why?

Abscisic acid.
- Write the physiological effect of gibberellins.
 - To stimulate the plant's growth.
 - It produces male flowers.
 - It breaks dormancy, iv. It gives seedless fruit.

17. REPRODUCTION IN PLANTS AND ANIMALS

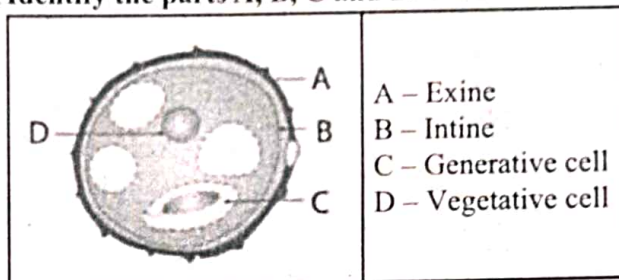
- What will happen if you cut planaria into small fragments?

It gives new generation.
- Why is vegetative propagation practiced for growing some type of plants?

Vegetative propagation happens only in seedless plants.
- Define triple fusion

Male gamete + two polar nuclei = triple fusion
- Write the characteristics of insect pollinated flowers.
 - Flower are coloured ,
 - Flowers have smell
- Name the secondary sex organs in male
 - Vas deferens,
 - Penis
- What is colostrum? How is milk production hormonally regulated?
 - The first fluid after child birth is called colostrum.
 - It is nutrient

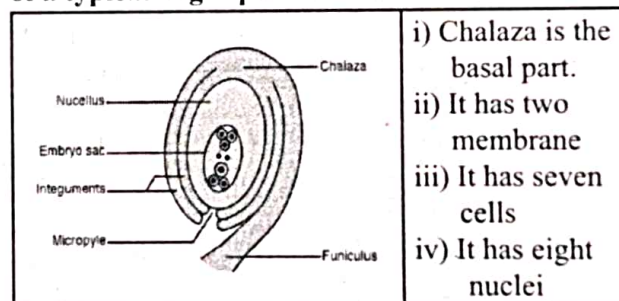
- How can menstrual hygiene be maintained during menstrual days?
 - Napkin should be changed regularly.
 - Wearing loose clothing.
- How does developing embryo gets its nourishment inside the mother's body?
 - Through placenta
 - It allows the exchanging foods.
- Identify the parts A, B, C and D



- Write the events involved in the sexual reproduction of a flowering plant

	Self- pollination	Cross- pollination
1.	No agents involved	Agents involved
3.	No new varieties	New varieties

- With a neat labelled diagram describe the parts of a typical angiospermic ovule.

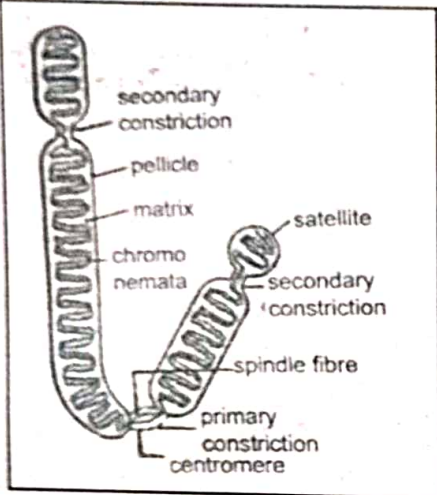
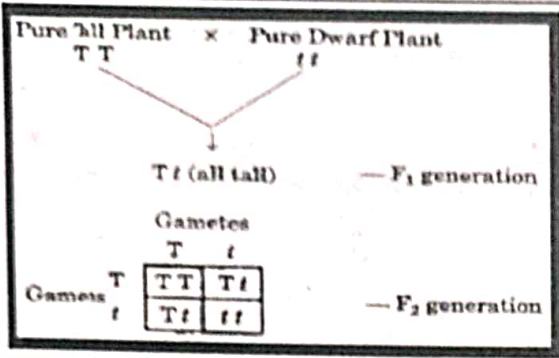


18. GENETICS

- Why did Mendel select pea plant for his experiments?
 - Self- pollinating plant,
 - Easy to cross- pollinate
- What do you understand by the term phenotype and genotype?
 - Phenotype – External expression
 - Genotype – Genetic expression
- What are allosomes?

Determining the sex.
- What are Okazaki fragments?

The short segments during the replication of a DNA.
- A pure tall plant (TT) is crossed with pure dwarf plant (tt), what would be the F1 and F2 generations? Explain.



- i. Primary constriction
- ii. Secondary constriction
- iii. Telomere
- iv. Satellite

7. How is the structure of DNA organized? What is the biological significance of DNA?



- i. It is double helix structure.
- ii. It has hydrogen bond
- iii. $A=T$
- iv. $C \equiv G$

19. ORIGIN AND EVOLUTION OF LIFE

1. Why is Archaeopteryx considered to be a connecting link?
It had wings and tail.
2. Define Ethnobotany and write its importance
To study about regional plants.
3. How can you determine the age of the fossils?
Determined by radioactive elements.

4. Natural selection is a driving force for evolution.
 - i. Survival of the fittest
 - ii. Organisms with unfit may disappear.
 - iii. New species originates.

5. How do you differentiate homologous organs from analogous organs?

	Homologous organs	Analogous organs
1.	Common ancestors	Different ancestors
2.	They look dissimilar	They look similar
3.	Human hand	Wings

20. BREEDING AND BIOTECHNOLOGY

1. Define genetic engineering.
To study about genes.
2. Name the types of stem cells
i. Embryonic stem cells, ii. Adult stem cells
3. Discuss the method of breeding for disease resistance
i. Selection, ii. Hybridization
4. Name three improved characteristics of wheat that helped India to achieve high productivity
i. Atlas 66, ii. Sonalika

5. Distinguish between somatic gene therapy and germ line gene therapy

Somatic gene therapy	Germ line gene therapy
Body cells	Egg and sperm cell

6. Distinguish between undifferentiated cells and differentiated cells

Undifferentiated cells	Differentiated cells
Unspecialized cells	specialized cells

7. State the applications of DNA fingerprinting technique

- i. Used in forensic department,
- ii. Used in paternity testing

8. Differentiate between outbreeding and inbreeding

Outbreeding	Inbreeding
Between two different species	Within same breed

9. Differentiate between outbreeding and inbreeding

- i. Increases milk production
- ii. Increases egg production
- iii. Increased meat production

10. With a neat labelled diagram explain the techniques involved in gene cloning
 - i. Carbon copy of an organism is called cloning.
 - ii. We can multiply our desire organisms.
11. Discuss the importance of biotechnology in the field of medicine
 - i. Treatment of diabetes
 - ii. Prevent heart attack
 - iii. Development of vaccines
 - iv. To treat haemophilia

21. HEALTH AND DISEASES

1. What are psychotropic drugs?
Psychotropic drugs can alter our behaviour
2. Mention the diseases caused by tobacco smoke.
 - i. Cancer,
 - ii. Heart disease
3. What are the various routes by which transmission of human immunodeficiency virus takes place?
 - i. Sexual contact,
 - ii. Contaminated blood.
4. How is a cancer cell different from normal cell?

	Cancer cell	Normal cell
1.	Abnormal cell division	Normal cell division
2.	Destroy surrounding tissue	Do not destroy surrounding tissue

5. Difference between type 1 and type 2 diabetes mellitus

	Type 1	Type 2
1.	Low risk	High risk
2.	Underweight	Obese

6. What precautions can be taken for preventing heart diseases?
 - i. Avoid cholesterol rich food
 - ii. Regular exercise,
 - iii. Avoid alcohol
 - iv. Take more fruits
7. Suggest measures to overcome the problems of an alcoholic
 - i. Education,
 - ii. Create awareness
 - iii. Physical activity,
 - iv. Medical help
 - v. Help from parents and friends

8. Changes in life style is a risk factor for occurrence of cardiovascular diseases. Can it be modified?
If yes, suggest measures for prevention.
 - i. Avoid cholesterol rich food
 - ii. Regular exercise,
 - iii. Avoid alcohol
 - iv. Take more fruits

22. ENVIRONMENTAL MANAGEMENT

1. What will happen if trees are cut down?
 - i. Flood,
 - ii. Drought,
 - iii. Soil erosion
 - iv. Loss of wild life
2. What are the agents of soil erosion?
 - i. Storm,
 - ii. Flood,
 - iii. Landslide
3. Solar energy is a renewable energy? How?
 - i. Unlimited amount in nature,
 - ii. Low cost
4. How are e-wastes generated?
It forms by out dated electronic wastes.
5. What are the importance of rainwater harvesting?
 - i. To increase ground water level
 - ii. To control flood,
 - iii. To control soil erosion
6. How does rain water harvesting structures recharge ground water?
 - i. Roof top rainwater harvesting
 - ii. Recharge pit,
 - iii. Digging tanks,
 - iv. Ooranis
7. How will prevent soil erosion?
 - i. Planting trees,
 - ii. Reforestation
 - iii. To build dams,
 - iv. Soil management
8. Enumerate the importance of forest
 - i. Increase rainfall,
 - ii. Protect wildlife
 - iii. Water conservation,
 - iv. Economic development
 - v. Reduce global warming.

23. VISUAL COMMUNICATION

1. What is scratch?
 - i. It is a software,
 - ii. It is a computer language
2. Write a short notes on editor and its main parts.
 - i. It has three parts,
 - ii. We can alter our programs.
3. What is stage?
 - i. It is a background part
 - ii. We can change background colour.
4. What is sprite?
It is a software.

SOCIAL SCIENCE

HISTORY - TWO MARKS

1. How did Great Depression impact on the Indian Agriculture?
 1. Death blow to Indian agriculture.
 2. The value of farm produce declined.
 3. Prices of agricultural commodities doubled.
 4. Land rent unchanged.
2. How are the peasant uprising in British India Classified?
 1. Restorative Rebellions.
 2. Religious Movements.
 3. Social Banditry.
 4. Mass Insurrection.
3. Name the territories annexed by the British under the Doctrine of Lapse?
 1. Satara,
 2. Jhansi,
 3. Nagpur,
 4. Sambalpur,
 5. Parts of the Punjab.
4. Describe the Pearl Harbour incident?
 1. On Dec 1941, Japan Attacked American's Fleet in Pearl Harbour.
 2. Many battle ships, planes were destroyed.
 3. United states declared war on Japan.
5. What are the duties of Palayakkarars?
 1. To Collect revenue.
 2. To administer the territory.
 3. To Settle disputes.
 4. To Maintain Law and Order.
 5. Police duties were known as padikaval or Arasu kaval.
6. What was the contribution of Annie Besant to India's freedom struggle?
 1. Demand for Home Rule all over India.
 2. Carry forward her agenda through Newspaper and books.
 3. Because of her efforts commoners labourers and students join the national movements.
7. What do you know of Trench warfare?
 1. Introduced in the first world war
 2. Trenches dug by soldiers to protect from enemy fire.
 3. Through trenches food, fresh troops, mail and orders were delivered
8. Name the countries in the Triple Entente
 1. Britain,
 2. France,
 3. Russia
9. What is Poorna Swaraj?
 1. It means complete freedom.
 2. Not Satisfied with Dominion with status.
3. In 1929 congress session Nehru declared Poorna Swaraj as the goal.
10. What do you know of the 'White Terror' in Indo-China?
 1. In 1929 Vietnamese soldiers mutinied and peasant revolt led by communists were crushed.
 2. Thousands of rebels were killed.
11. List the social evils eradicated by Brahmo samaj?
 1. Customs of Sati.
 2. Child Marriage.
 3. Polygamy.
 4. Advocated widows remarriage.
12. Highlights the objectives of Home Rule movement?
 1. To attain self government within the British Empire by using constitutional means.
 2. To use non violent constitutional methods to achieve their goals.
13. Estimate Periyar as a feminist?
 1. He condemned child marriage and the devadasi system.
 2. Emphasising women's right to divorce and property.
 3. Motherhood was a burden to women.
14. What was Marshall Plan?
 1. The US conceived the Marshall Plan.
 2. To bring the countries in western Europe under its influence.
15. What was the impact of Swami Vivekananda's activist ideology?
 1. Cultural nationalism.
 2. Political uprising among Bengali youth.
 3. Regenerate hindu Society.
16. Write short note on the martyrdom of Tirupur Kumaran ?

Kodikatha Kumaran was martyred on Jan, 11, 1932 in Tirupur by the police for carrying the national flag and singing folk songs.
17. What were the results of the Russian Revolution?
 1. Eliminated literacy and poverty in Russia.
 2. Russian industry and Agriculture had developed.
 3. Women got equal rights including right vote.
 4. Industries and banks were Nationalised.
18. Highlight the essence of the Tiruchirappalli proclamation of 1801?
 1. The proclamation was passed on the walls of the nawabs palace in Tiruchirappalli Fort .

2. It was an early call to the Indians to unite against the British.
 3. Many palayakkars of Tamil country rallied together to fight against the English.
- 19. Write a note on reforms of Ramalinga Adigal?**
1. Mercy on all living beings.
 2. Free feeding house for everyone.
 3. Tiruvarutpa (His Songs).
- 20. What were the three militant forms of nationalism in Europe?**
1. England - Jingoism
 2. France - Chauvinism
 3. Germany - Kultur.
- 21. What was the significance of the battle of Kalakadu?**
1. Mahfuzkhan received an additional contingent of Sepoys from Chanda Sahib and the Nawab.
 2. He also had the support of cavalry and infantry from the Carnatic.
 3. But Travancore forces and Puli Thevar forces together defeat Mahfuzkhan's troops in the battle of Kalakadu(1765).
- 22. List out any two causes for the failure of the League of Nations?**
1. Lack of Military Power.
 2. The Principle of 'Collective Security' could not be applied.
- 23. Summarise the essence of Lucknow pact?**
1. Under the Lucknow pact (1916) the Congress and the Muslim League agreed that there should be self government in India as soon as possible.
 2. In return the Congress leadership accepted the concept of separate electorate for Muslims.
- 24. Write a note on the Khilafat movement?**
1. Ali Brothers started Khilafat movement.
 2. Gandhiji supported the moment.
 3. It was an opportunity to unite Hindus and Muslims.
 4. Adopted Gandhi's non violent and non cooperation program.
- 25. Give any two provisions of the Treaty of Versailles?**
1. Germany was found guilty of starting the war and forced to pay the reparations.
 2. All German colonies became mandated territories under the League of Nations.
 3. Poland was recreated.
 4. The Rhineland was to be occupied by the allies.
- 26. What was the bone of contention between the company and Kattabomman?**
1. The company appointed its collectors to collect taxes from all the palayams.
 2. The collectors humiliated the palayakaras and adopted force to collect the taxes.
 3. This was the bone of contention.
- 27. How did Hitler get the support from the people of Germany?**
1. By his impassioned Speeches.
 2. Promising a return to the glorious military past of Germany.
- 28. How do you assess the importance of Sion-Japanese war ?**
1. Japan annexed the Liaotung Peninsula of China.
 2. By this action Japan Proved that the strongest nation in East Asia.
- 29. Discuss Mahadev Ranade's Contribution to Social reforms ?**
1. Inter caste dining and marriage.
 2. Widow remarriage, improvement of women.
 3. Widow marriage Association, Deccan Education Society.
- 30. Who were the three prominent dictators of the post world war I?**
1. Mussoline (Italy).
 2. Hitler (Germany).
 3. Franco (Spain).
- 31. Name the Bretton woods Twins?**
1. World Bank.
 2. International Monetary Fund.
 3. Both Established in 1945.
- 32. What are the objectives of IMF?**
1. To Foster global monetary co-operation.
 2. Secure financial stability.
 3. Promote high employment.
 4. Reduce poverty around the world.
- 33. Write a note in Mao's Long March?**
1. In 1934 Mao's Communist Army of about 1,00,000 Set out on the Long March.
 2. Only 20,000 finally reached Sheni.
- 34. Write a note on Third world Countries?**
- First world - The capitalist countries led by the U.S.
 Second world - The Communist States led by the Soviet Union.
 Third world - States outside these two were called Third world.
- 35. What was the role of Mustafa Kemal Pasha?**
1. He played a remarkable role for Turkey's rebirth as a nation.

2. He modernised Turkey and change it out of all recognition with the support of the Soviet Union.

36. Define 'Dollar Imperialism'?

1. It describes the policy of the USA.
2. Maintaining and dominating over distant lands through economic aid.

37. What do you mean by drain of wealth?

1. India was economically subjugated and transformed into a supply of raw material to the British industries.
2. Transfer of resources from India to Britain without any favourable returns back to India. This is called the drain of wealth.

38. Describe the Jallianwala Bagh Massacre?

1. On 13 April 1919 a public meeting (thousands of villagers) arranged at Jallianwala Bagh.
2. General Dyer surrounded the place with his Troops and firing took place without warning.
3. 379 were killed the more than 1000 injured.

39. What do you know of Beveridge report?

1. It was published in the United Kingdom In 1942.
2. It proposed the government should adopt to provide citizens with adequate income, healthcare education, housing and Employment to overcome poverty and disease.

40. What are the terms of the Poona pact?

1. The principle of separate electorates was abandoned.
2. The principles of joint electorate was accepted with reservation.
3. Reserved seats for the depressed were increased from 71 to 148.

41. Write a note on Bhagat Singh?

1. He reorganised and renamed the Hindustan Republican Army in Punjab.
2. He threw a smoke bomb inside the central Legislative Assembly in 1929.
3. He threw Pamphlets and shouted 'Inquilab Zindgsd' and 'Long Live The proletariat'.
4. So he was arrested and sentenced to death.

42. List out the personalities who contributed to the revival of Tamil literature through their writings?

1. U.Ve.Sa
2. Thiru.Vi.Ka
3. Bharathiyar
4. Bharathidasan
5. Maraimalai Adigal
6. Paruthimar Kalaignar.

43. Write a note on Tamil Renaissance?

1. The introduction of printing press, linguistic research on Dravidian languages, etc..underpinned the process of Tamil renaissance.

2. Publication of the Ancient literary created awareness among the Tamil people
3. The rediscovery of Indian classics and their Publication is considered the foundation of Tamil renaissance.

44. List the major events that took place during the Quit White Movement in Tamil Nadu?

1. Kamaraj organised people during the Quit India Movement.
2. All sections of the society participated in the movement.
3. Students of various colleges took active part in the protests.
4. In Tamilnadu The Quit India Movement was suppressed with brutal force.

45. Name the newspapers published by the Indian liberal Foundation?

1. Dravidian - Tamil,
2. Justice - English
3. Andhra prakasika - Telugu

46. Discuss the importance of Ottawa Economic summit?

1. The give preference to British Goods.
2. British made imports cheaper.
3. Political agitation against British Rule.

GEOGRAPHY - TWO MARKS

1. Name the important multipurpose projects of Tamilnadu?

They are basically designed for the development of irrigation for agriculture and hydro power generation. Example: 1.Mettur dam. 2.Vaigai Dam. 3. Krishnagiri Dam. 4.Sathanur dam. 5.Amaravathi Dam. 6.Mullai Periyar Dam.

2. List the factors affecting climate of India?

1. Latitude.
2. Distance from the sea.
3. Relief features.
4. Monsoon winds.
5. Jet streams.

3. Define Agriculture?

1. Cultivation of certain plants.
2. Producing food for people and cattle.
3. Raising of domesticated animals.

4. Name the tributaries of river Thamirabarani?

1. Karaiyar
2. Servalar
3. Manimuthar
4. Pachaiyar.
5. Chittar.
6. Rama Nathi.

5. What is communication? What are its types?

1. Exchange of information, thoughts and ideas.
2. Two Types
 1. Personal Communication.
 2. Mass Communication.

6. What is 'bust of Monsoon'?
1. The South West monsoon starts with thunder and lightning.
 2. India's temperature will drop.
7. Give the importance of IST?
1. India's central meridian is $82^{\circ} 32' E$ longitude.
 2. It passes through Mirzapur.
 3. The IST is 5.30 Hrs ahead of GMT.
8. Write a brief note on the Island group of Lakshadweep?
1. Located off the west coast of India
 2. Small group of coral islands.
 3. It covers an area of 32 Sq.Km.
 4. Kavaratti - Administrative capital.
9. Name the seasons of agriculture in India?
1. Kharif (June - September)
 2. Rabi (October - November)
 3. Zaid (April - June)
10. Name the areas which receive heavy rainfall?
1. Assam
 2. Thripura
 3. Nagaland
 4. Western Coast
 5. South Megalaya
11. State the boundaries of Tamilnadu?
1. North - Andhra.
 2. East - Bay of Bengal.
 3. South - Indian Ocean.
 4. West - Kerala.
 5. North-West - Karnataka.
12. State the types of agriculture practices in India?
1. Dry
 2. Mixed
 3. Terrace
 4. Intensive
 5. Shifting
 6. Subsistence
13. Define 'International Trade'
1. Trade carried on between two or more countries.
 2. Two components - Import and Export
14. What is mixed farming agriculture?
1. As a system of farm which includes crop production, raising livestock, poultry, fisheries, bee keeping etc.,
 2. It satisfies many needs of the farmers.
15. What is 'Teri'?
- The sand dunes formed along the coast of Ramanathapuram and Thoothukudi districts are called Teri.
16. What are the risk reduction measures taken before cyclone?
1. Keep boots and rafts tied up safely.
 2. Don't venture out in the sea.
 3. Listen to Radio and watch TV for weather updates.
17. Write a brief note on terrace farming?
1. This is practiced specially in hilly areas, where lands are of sloping nature.
 2. The hill and mountain slopes are cut to form terraces.
18. Name the neighbouring countries of India?
1. China,
 2. Srilanka,
 3. Pakistan,
 4. Bangladesh
 5. Afghanistan
 6. Nepal
 7. Bhutan
 8. Myanmar
19. What are the determinants of agriculture?
1. Physical factors
 2. Institutional factors
 3. Infrastructural factors
 4. Technological factors
20. Name of the types of soil found in India?
1. Alluvial,
 2. Black,
 3. Red,
 4. Laterite,
 5. Forest,
 6. Mountain,
 7. Dessert soil.
21. What are the major Physiographic Divisions of India?
1. Northern Mountains, Plains
 2. Peninsular plateau
 3. Coastal plains
 4. Islands
22. Write a short note on Deccan Plateau?
1. Roughly triangular shape.
 2. Area of this plateau is about 7 Lakh Sq.Km
23. What is meant by 'Normal lapse rate'?
1. When the altitude increase, the temperature decreases.
 2. For every 1000 Meters $6.5^{\circ}C$ Temperature decreases.
24. What are 'Jet Streams'?
1. The fast moving winds blowing in a narrow zone in the upper atmosphere
 2. The onset of south west monsoon is driven by westerly jet.
25. Define disaster risk reduction?
1. Concept and Practice of reducing disaster risks.
 2. Analyse and reduce the casual factors of disasters.
26. Name the different types of coal with their carbon content?
1. Anthracite - 80-90%
 2. Bituminous - 60-80%
 3. Lignite - 40-60%
 4. Peat - less than 40%
27. State the uses of Magnesium (Manganese)?
1. For making iron and steel.
 2. Basic raw material for allowing.
 3. Used in manufacturing of Bleaching powder, Insecticides, Paints and Batteries.

28. State any two characteristics of black cotton soil?

1. It is black in colour
2. It is sticky when wet
3. High degree of moisture retentivity state the types of agriculture.

29. What is MRTS?

1. MRTS - Most Rapid Transport System.
2. It is currently developing a metro system.
3. Chennai has a well-established Suburban railway network.

30. Name the important oil producing regions in India?

1. Mumbai High,
2. Gujarat coast
3. Digboi
4. Brahmaputha valley.

31. What are the minerals and state its types?

1. Minerals are the natural substance of organic or inorganic origin with definite chemical and physical properties.
2. Two Types-1. Metallic-Gold, Copper
2. Non-Metallic-Mica, Coal.

32. Define the resource and state its types?

1. Anything derived from the environment.
2. That is used by living thing.

Types

1. Renewable Resources.
2. Non-Renewable Resources.

33. Mention the major areas of jute production in India

1. West Bengal,
2. Andra,
3. Bihar,
4. Assam,
5. Odisha,

34. State the West following rivers of India?

1. Narmada,
2. Tapti,
3. Mahi,
4. Sabarmathi

35. Mention the plantation crops of India?

1. Cultivated for the purpose of exports.
2. Cultivated in large estates on hilly slopes.
Eg-Tea, Coffee, Rubber and Spices.

36. Why is Coimbatore called as 'Manchester of South India' (Tamilnadu)?

1. Major cotton textile industries or concentrated in Coimbatore.
2. Coimbatore is the most important centre in Tamilnadu with 200 mills out of 435 mills.

37. What is migration? State its types?

1. It is the movement of people across regions and territories.
2. Types - 1. Internal, 2. International

38. Write any five Biosphere Reserves in India?

1. India has 18 Biosphere Reserves.
2. The Nilgiris, Gulf of Mannar, Great Nicobar, Sundarbans, Nandadevi, Agasthiyamalai.

39. State the merits of roadways?

1. Roads are the most Universal mode of transport.
2. It is highly suitable for short distance services
3. Carrying goods and passengers for short medium and long distances.

40. What is natural gas?

1. Natural gas usually accompanies the petroleum accumulations.
2. It is naturally occurring hydro carbon gas mixture consisting primary of methane.
3. It is used as a source of energy for heating, cooking and electricity generation.

CIVICS - TWO MARKS

1. What is the qualification of Judges of the Supreme court?

1. Must be a citizen of India
2. The best legal expert
3. Worked as a judge of high court 5 years and as an advocate for 10 Years.

2. List any four guiding principles of panchsheel?

1. Mutual non-aggression.
2. Mutual non-interference.
3. Peaceful co-existence.
4. Equality and co-operation for mutual benefit.
5. Mutual respect for each other's territorial integrity and sovereignty.

3. What is the original jurisdiction of the High Court?

1. Only in matters of admiralty, probate matrimonial and contempt of court.
2. It deals with criminal cases having a value of Rs.2000 and above.

4. What are the classical languages in India?

1. Tamil (2004),
2. Sanskrit (2005),
3. Telugu (2008),
4. Kannada (2008)
5. Malayalam (2013)
6. Odiya (2014)

5. How is President of India Elected?

1. By an electoral college in accordance with the system of proportional representation.
2. By means of single transferable vote.

6. List out the member countries of SAARC?

1. Pakistan
2. Afghanistan
3. India
4. Nepal
5. Maldives
6. Bangladesh.
7. Bhutan
8. Sri Lanka

7. **Mention the main tools of foreign policy?**
 1. Treaties and agreement. 2. Foreign aid.
 3. Armed forces. 4. International trade.
 5. Appointing ambassadors.
8. **Write short note on Money Bill?**
 1. Lok sabha can only introduce money Bill.
 2. Deals with the income and expenditure.
9. **What is meant by citizenship?**
 1. Article 5 to 11 under Part 111 deals citizenship.
 2. It means resident of a city state.
 3. The constitution of India provides for a single and uniform citizenship for the whole of India.
10. **What is a Writ?**
 1. An order or command issued by a court in writing under its seal.
 2. There are five types of writs.
 3. Writs prevent the laws which are against the constitution.
11. **Mention the member countries of BRICS?**
 1. Brazil(B), 2. Russia(R), 3. India(I), 4. China(C)
 5. South Africa.(S)
12. **Name the architects of the Non Aligned movement?**
 1. Jawaharlal Nehru 2. Tito 3. Nasser
 4. Sukarno, 5. Kwame Nkumarah.
13. **What is a constitution?**
 1. Fundamental law of a country
 2. Vehicle of a Nation's progress
 3. Reflects the fundamental principles of a government.
14. **List out the fundamental rights guaranteed by Indian Constitution?**
 1. Right to Equality, 2. Right to Freedom,
 3. Right to Religion, 4. Right against Exploitation
 5. Cultural and Education Right
 6. Right to Constitutional Remedies.
15. **Name the neighbouring countries of India?**
 1. Pakistan 2. Afghanistan 3. China 4. Nepal
 5. Maldives 6. Bangladesh 7. Bhutan 8. Sri Lanka
 9. Myanmar.
16. **List out the three heads of the relations between the centre and the states?**
 1. Legislative relations.
 2. Administrative relations 3. Financial relations.
17. **What are the two themes of India's nuclear doctrine?**
 1. No first use. 2. Credible minimum deterrence.
18. **List out any five global grouping in which India is here member?**
 1. MGC, 2. GCC, 3. RCEP, 4. BCIM, 5. EAS
19. **What are the qualifications for the appointment of Governor?**
 1. He should be a citizen of India.
 2. He must have completed 35 Years of age.
 3. He should not be an MLA and MP.
20. **Differentiate: Domestic policy and Foreign policy?**
Domestic policy :
 1. Nation's plan for dealing issues within its own Nation.
 2. Domestic affairs, Social welfare, Healthcare, Education, Economic issues and Social issues.
Foreign policy :
 1. Nation's plan for dealing with other Nations.
 2. Trade, Diplomacy, Sanctions, Defence intelligence.
21. **What is the importance of the Governor of a State?**
 1. Constitutional head of the State executive.
 2. He can dissolve the house with the advice of Chief Minister.
- Economics - Two Marks**
(Question No : 27 and 28)
1. **Write some name of the nutrition programmes in Tamilnadu?**
 1. Midday meal program and ICDS.
 2. Dr. MGR Nutrition program.
 3. Tamilnadu Integrated Nutrition programs.
 4. Pradhan Manthri Gramodayayojana scheme.
2. **Write a short note on Goods and Service Tax (GST)?**
 1. The act came into effect on 1st July 2017.
 2. The Motto is One Nation-One Market-One Tax.
 3. The GST is one of the indirect taxes.
3. **What is progressive tax?**
 1. The rate of the taxation increases as the tax base increases.
 2. When income increases the tax rate also increases.
 3. Tax calculated by multiplying the tax base with the tax rate.
4. **What is meant by an industrial cluster?**
 Industrial clusters are groups of firms in a defined geographic area that share common markets technology and skill requirements.
5. **What are the problems of industrialisation currently in Tamilnadu?**
 1. Chemicals, Textiles and Leather clusters tend to generate a lot of polluting effluents that affect health and agriculture lands.
 2. Employment generation potential has declined.
 3. Quality of employment also has suffered.
6. **Write the importance of GDP?**
 1. Study of Economic Growth

2. Study of Public Sector
 3. Guide to economic planning
 4. Estimate the purchasing power.
7. Name the sectors contribute to the GDP with examples?
1. Primary sector (Agricultural sector)-Agriculture, Fishing, Mining
 2. Secondary sector (Industrial sector)-Iron, Cement and Paper industries.
 3. Tertiary (Service Sector)-Postal, Teaching, Banking.
8. Define National Income?
- Measure of the total value of goods and services produced over a period of time and a year.
9. What is per Capita Income?
1. It shows the living standard of people in a nation
 2. Per Capita Income = National Income / Population
10. What is Globalization and its types?
1. Integration of a country with the world economy
 2. Types - 1. Archaic, 2. Proto, 3. Modern
11. What are the effects of Green Revolution?
1. Increased food grain Production (Rice and wheat).
 2. Self-Sufficient in food grain production.
12. What are the basic components of food and nutrition security?
1. Availability of food
 2. Access to food
 3. Absorption of food
13. What is meant by Gross Domestic Product (GDP)?
- GDP is the total value of output of goods and services produced the factors of production within the geographical boundaries of the country.
14. Define the Value Added Approach with example?
- Value of intermediate goods = Value of final goods.
Example: Tea powder + Milk + Sugar = Tea.
15. Define tax and the types of taxes?
1. Taxes are compulsory payments to the government without Expectations of direct return or benefit to the tax payer.
 2. Types: Direct Tax - Income Tax, Corporate tax, Wealth tax. Indirect Tax - Stamp duty, Excise duty, Entertainment tax.
16. What is Corporate Tax?
1. This tax is levied on companies that exist as separate entities from their shareholders.
 2. It is charged on royalties, interests gains from sale of capital assets located in India.

17. Define food security according to FAO?

All people at all times have safe and nutritious food for and active and healthy life.

18. What is meant by Black money?

1. Black money is funds earned on the black market on which income and other taxes have not been paid.
2. The unaccounted money that is concealed from the tax administrator.

19. Write the name of economic polices in India?

- | | |
|-----------------|---------------|
| 1. Agriculture | 4. Employment |
| 2. Industrial | 5. Trade |
| 3. New Economic | 6. Population |

20. Write short note on Multinational Corporation?

1. It owns and controls the production of goods and services in more than one country.
2. It is a corporate organization.

21. What is Fair Trade?

1. Aims to keep small farmers an active part of the world market place.
2. Aims to empower consumer to make purchases that support their values.

22. Write any two positive impact of Globalization?

1. It increases the GDP of a country.
2. It increases the standard of living .
3. It increases better trade and employment rapidly.

23. Why we pay tax to the government?

1. Money provided by taxation to carry out many functions and operation of government.
2. Such as Economic infrastructure, Military, Scientific research, Culture and the arts, Public works and Public insurance.

24. What is meant by entrepreneur?

1. He is an innovator of new ideas and business processes.
2. He processes management skills, strong team building ability and essential leadership qualities to manage a business.

25. What are the objectives of World Trade Organization (WTO)

1. To resolve trade disputes.
2. To set and enforce rules for international trade.
3. To increase transparency in decision making.

HISTORY - FIVE MARKS

1. Disuss the main causes of the First World War?

1. European alliances Triple Entente, Triple alliances: Triple Entente, Triple Alliances

2. **Violent Forms of Nationalism :** Growth of Nationalism in England, France, German
 3. **Aggressive attitude of Germany :** Germany and England expanded Navy and involved in the Naval race.
 4. Hostility of France towards Germany
 5. The enmity between Austria and Serbia
 6. Turkey any Bulgaria lost the First and Second Balkan wars.
 7. **Immediate cause :** Assassination of Austria prince Ferdinand.
2. **Analyse the effects of World War-II**
 1. Changed the world in fundamental ways
 2. **New geo - political power alignment:**
The world was divided into two Super powers led by America and Russia
 3. **Nuclear Proliferation :**
The USA and Soviet union entered into a race of nuclear weapons
 4. Defence Spending Sky-rocketed in many countries.
 5. Many international agencies emerged,
 1. The UNO, 2. The world Bank, 3. IMF
 6. Colonies become Independent nations
 7. Women economically independent
 8. Socio economic changes took place.
 3. **Write an essay on the role Played by the 19th century reformers towards the cause of women?**
19th Century Reforms.
 1. **Raja Ram mohan Roy :** Abolished sati, against child marriage and polygamy. He advocated education for women, widows remarriage
 2. **Ishwar Chandra Vidyasagar :** Promoting girls education and schools, widows' Remarriage Reform Act.
 3. **M.G.Ranade :** Promoted inter-caste marriage and widow remarriage.
 4. **Swami Dayanand Saraswathi :** Opposed child marriage, advocated widow remarriage
 5. **Jyotiba Phule :** Opened orphanages and homes for widows, stood for women education.
 4. **What were the causes for the failure of the Great Rebellion (Revolt) of 1857?**
 1. The Revolt was not organised and planned.
 2. Lack of enthusiasm among the Indian princess.
 3. The Indian princess and Zamindars were fearful of British power.
 4. English educated middle class did not support.
 5. The absence of a Central authority.
 6. South Indians were not participated
 7. Lack of weapons, organisation, discipline and betrayal.
5. **Account for the outbreak of Vellore Revolt in 1806?**
New Regulations in Army :
 1. Grievances of Indian soldiers (Low salary and Poor promotion).
 2. Indian soldiers were asked not to wear caste marks.
 3. New experiments in land tenures.
 4. Dire economic straits.
 5. Clean shave and uniform moustache
 6. The new Turban added fuel to fire.**Outbreak and Consequences.**
 1. On 10 July 1806, the Indian Sepoys started the revolt.
 2. Many British officers were killed.
 3. But the revolt was crushed by Col. Gillespie.
 4. Many rebels were convicted, shot dead and hanged.
 5. The military regulations were withdrawn.
 6. **Discuss the response to Swadeshi Movement in Tamilnadu?**
 1. The partition of Bengal (1905) led to the Swadeshi Movement.
 2. Boycott foreign goods and promote national education.
 3. Bharathi's patriotic songs.
 4. Many journals were started to propagate Swadeshi ideas.
 5. Students and youth participated in the Swadeshi movement.
 6. Tirunelveli up rising.
 7. Rajaji and E.V.R were active during the Noncooperation movement.
 8. No tax campaigns and foreign goods were boycotted.
 9. V.O.C started Swadeshi steam navigation company.
 7. **Elaborate about Velunachiyar?**
 1. Born in 1730 and married at the age of 16.
 2. Velunachiyar was trained by martial arts like valerie stick fighting and to wield weapons.
 3. She was also adept in horse riding and archery.
 4. She was proficiency in English, French and Urdu.
 5. With military assistance from Gopal Nayak and Hyder Ali she fought against the British and recaptured Sivagangai.
 6. She was crowned as Queen with the help of Maruthu brothers.
 7. She was the first female ruler or queen to resist the British colonial power in India.
 8. **Write the programme of Non-cooperation movement?**
 1. Boycott of Government schools.

2. Boycott of foreign goods
 3. Boycott the legislature created under the 1919 act.
 4. Non-participation in government functions.
 5. Non-participation in government parties and official functions.
 6. Surrender of all titles of honours and honorary offices
 7. Settlement of court disputes by private arbitration
 8. Refusal to accept civil or military post.
 9. Spreading the doctrine of Swadeshi.
- 9. Discuss the reasons behind the partition of India?**
1. Partition of Bengal and formation of Muslim league are the examples of divide and rule policy. It ended with the partition of India in 1947.
 2. Indian Muslims started the Khilafat Movement against the British and accepted Gandhi's Non Co operation movement.
 3. In 1932 Ramsay MacDonald announced the communal award.
 4. Failure of Nehru's report and Jinnah's amendment.
 5. Jinnah demanded a separate state for the Muslims.
 6. Difference between the Congress and Muslim League developed year by year.
 7. Jinnah declared 16th August 1946 as the Direct Action Day'. So, partition of India became inevitable.
 8. The enactment of the Indian Independence Act on 16 July 1947 by the British parliament.
 9. As per the Mount Batten plan India was divided (India and Pakistan) and got Independence on 15th August 1947.
- 10. Discuss the Circumstances that led to the Reform movements of the 19-th Century.**
1. Influence of western ideas and thoughts.
 2. English education produced a new English educated middle class.
 3. Attempted to harmonize both Indian and Western cultures.
 4. Many Social evils induced the leaders to eradicate them (sati, casteism, Polygamy, Child marriage)
 5. Reformist movements and the revivalist movements
- 11. Describe the role of Tamilnadu in Civil Disobedience Movement?**
1. Gandhiji launched the Civil Disobedience Movement.
 2. Tamilnadu was in the forefront of the civil disobedience movement.
 3. It was a mass movement with the participation of students, shopkeepers, workers, women, etc.,
 4. In the city of Madras, shops were picked and foreign goods boycotted.
 5. Millworkers struck across the province.
 6. Rajaji was arrested because he organised and led a Salt Satyagraha March to Vedaranyam.
 7. Namakkal V. Ramalinganar, Sathya Murthy and Tirupur Kumaran were participated.
 8. Police used brutal force to suppress the moment.
- 12. Estimate Periyar E.V.R's decisive contribution to the social transformation of TamilNadu?**
1. Periyar started Self-Respect movement.
 2. He advocated Self respect and inter caste marriages.
 3. He condemned Child marriage and Devadasi system.
 4. He said that motherhood was a burden to women.
 5. He objected to terms like 'giving in marriage'.
 6. He launched a popular movement the Anti-Hindi agitation.
 7. He criticized Kula Kalvi Thittam.
 8. He welcomed equal rights for males and females in property.
 9. He started newspapers and journals (Kudi Arasu, Viduthalai, Pagutharivu, Puratchi) to spread rational ideas.
 10. He advocated a casteless society' devoid of rituals and differences based on birth.
- 13. Highlight the provisions of the Treaty of Versailles relating to Germany?**
1. Germany was forced to pay the reparation for the losses suffered.
 2. The German army was to be limited and a small Navy was allowed.
 3. The union of Austria and Germany was forbidden.
 4. Alsace-Lorraine were given to France.
 5. Poland was recreated.
 6. The Rhineland was to be occupied by the Allies.
 7. Germany was forced to revoke the Treaty of Brest Litovsk.
 8. Germany was forced to give up all her rights overseas position to the allies.
- 14. Highlight the provisions of the Treaty of Versailles relating to Germany ?**
1. Germany had to pay war indemnity
 2. The German army was limited, a small navy was allowed
 3. The Union of Austria and Germany was forbidden
 4. Alsace-Lorraine was returned to France
 5. Poland was recreated
 6. The Rhineland was demilitarized
 7. All German colonies became mandated territories under the League of Nations.

15. Estimate the role of Mao Tse Tung in making china a communist country :

1. In 1911 Mao joined the revolutionary army.
2. In 1933 full control of the Chinese communist party.
3. In 1934 started long march with communist Army.
4. In 1937 Mao became the leader of 10 million people.
5. Mao tried to get the support of the middle class and wanted democracy.
6. In 1948 - Captured most of the parts of China
7. In 1949- Central Governing Council Chairman.
8. In 1949 -the People's Republic of China emerged.

16. Attempt a narrative account of how the process of decolonization happened in India during the inter war period (1919-1939)

1. Decolonization started with swadeshi movement (1905).
2. In 1919 the Government of India Act introduced Dyarchy.
3. Lack of Measures to Industrialize India
4. The Great Depression has a disastrous impact on British Trade and a death blow to Indian Agriculture.
5. The Government of India Act 1935, Provided greater power to the local government
6. Provincial elections were introduced

HISTORY - EIGHT MARKS

1. Assess the Structure and the activities of the UN ?
Structure of the UN

1. 193 member States each has an equal vote
2. **General Assembly:** Each nation meets once a year and discussed Conflicts
3. **Security Council:** Major issues and conflicts are discussed in Security Council
4. **Administrative Structure :** Executive wing of the UN is the UN Secretariat
5. **International Court of Justice :** Judicial wing of the UN
6. **Economic and Social Council:** Coordinates the economic and Social work of UN
7. **Associated organs:** FAO, WHO, UNESCO, UNICEF, UNDP,
Activities of the UNO
 1. In 1960 - decolonisation
 2. Maintaining Peace in the world through its peacekeeping force.
 3. The issues which the UN deals at present:
 1. Human rights,
 2. Problems of refugees
 3. Climate change,
 4. Gender equality

2. Critically examine the Civil Disobedience Movement as the typical example of Gandhian ?

1. In the congress session (Dec 1929) Poorna Swaraj was declared as the goal.
2. The civil disobedience movement led by Gandhi in the year 1930.
3. It was an important milestone in the history of Indian nationalism.
4. This moment reflected the political ideologies of Ahimsa and Satyagraha of Gandhi.
5. Gandhi started the March from his Sabarmati Ashram to Dandi.
6. Gandhi took a lump of salt, breaking the salt law.
7. Gandhi was arrested at midnight.
8. Dandi salt march had an immense impact on the entire nation.
9. It was the biggest mass movement India had ever witnessed.
10. The movement was given up in 1933, it was an important juncture in the history of Indian independence.

3. Comment on the Life and Teachings of Ramalinga Swamigal?

Life:

1. Ramalinga Swamigal or Ramalinga Adigal was born in marudhur(1823)
2. Popularly known as Vallalar.
3. He established the Samarasa Vedha Sanmarga Sangam in 1865.
4. Ramalinga also established a free feeding house for everyone irrespective of caste at Vadalur.
5. His songs were compiled as Thiruvirutpa.

Teachings :

1. Having no formal education he gained immense scholarship.
2. Ramalinga emphasized the bonds of responsibility and compassion between living beings
3. He showed his compassion and mercy on all living beings.
4. This he called Jeevakarunya.

4. Explain about the activities of the Leagues of Nations and causes for the failure of the League of Nations?

Activities:

1. In 1920-Solved issue on Aaland Islands
2. In 1921-Solved frontier dispute between Germany and Poland
3. In 1925-Ceasefire between Greece and Bulgaria
4. In 1925-Locarno Treaty peace in western Europe
5. It tried to avoid war to establish peace

Causes for the Failure :

1. It didn't have its own military
2. Appeared like the organisation of the victorious power.
3. Collective security principle was not practiced
4. The USA didn't join the League
5. The rise of dictators weakened the League.

5. Evaluate the contributions of Ramakrishna Parmahansa and Swami Vivekananda to regenerate Indian Society?**I. Ramakrishna Paramahansa His Principles:**

1. All religions contain the universal elements for salvation.
2. Jiva is siva
3. Service for man is service for God.

His Achievement :

1. Attracted educated youth
2. His disciples spread his teachings in India and abroad

II. Swami Vivekananda :

1. He emphasized a cultural nationalism
2. His ideas bred a sense of self confidence among Indians.
3. He induced Indian youth to regenerate Hindu Society.
4. His addresses on Hinduism in Chicago was very famous (1893)
5. The youth of Bengal stood for political Change.

6. How did the people of Bengal respond to the partition of Bengal(1905)?

1. The idea of partition was devised to suppress the political activities against the British rule in Bengal.
2. The day Bengal was officially partitioned was declared as a Day of Mourning.
3. Instead of dividing the people, the partition for the United them.
4. The people boycott of British goods was one such.
5. The people protest through prayers, press campaigns petitions and public meetings.
6. The people started Swadeshi movement and Boycott Movement of British goods.
7. The growth of regional newspapers played a role in building a sense of proud Bengali identity.
8. Thousands of people took bath in the Ganga and marched on the streets of Calcutta singing VandeMataram.

7. Describe Gandhiji's early Satyagraha in India and their outcome?**I. Champaran Satyagraha**

1. In champaran the abolition of the tinkathia system,

thereby ending the oppression of the peasants by the Indigo planters.

2. In 1918 fruitful intervention in Ahmedabad mill strike and Kedha Satyagraha.

II. Rowlatt Satyagraha:

1. Gandhi called it a 'Black Act' and in protest called for a nationwide Satyagraha on 6th April 1919.
2. In 1919 the JallianwalaBagh Massacre.
3. Gandhi surrendered his medal.

III. Khilafat movement:

1. Gandhi supported the movement and saw in it an opportunity to unite Hindus and Muslims.
2. In 1920 Khilafat committee meeting adopted Gandhi's nonviolent, non-cooperation program.

8. Highlight the tragic fall of Sivagangai and its outcome?**Fall of Sivagangai :**

1. In May 1801, the English attacked the rebels in Thanjavur and Tiruchirappalli.
2. The rebels went to Piranmalai and Kalayarkoil.
3. They were again defeated by the forces of the English.
4. The rebellion failed and Sivagangai was annexed in 1801.
5. The Marudhu brothers were executed in the Fort of Tirupathur
6. Oomafhurai and Sevathaiah were captured and beheaded at Panchalamkurichi on 16 November 1801.
7. Seventy-three rebels were exiled to Penang in Malaya.
8. Though the palayakkarars fell to the English, their exploits and sacrifices inspired later generations.

9. Discuss the Causes and Effects of the revolt of 1857?**Causes :**

1. Annexation policy of British India.
2. The Doctrine of Lapse.
3. The Doctrine of Paramountcy.
4. Intervention in religion, new dress code and prohibition of wearing religious marks.
5. New cartridges had been greased with cow and pig fat.

Effects :

1. India becomes a crown colony.
2. British followed a cautious approach to the issue of social reform.
3. 1858 — Queen Victoria Proclamation.
4. Company rule Ended.
5. Significant changes were made in the Indian Army.
6. "Divide and Rule" Policy.

10. Describe the background for the formation of the Justice Party and point out its contribution to the cause of social justice?

Southern Indian Liberal Federation (Justice Party)

1. On 20 November 1916 around 30 prominent non — Brahmin leaders including Dr. C. Natesanar, Sir Pitti Theagarayar, J. M. Nair and Alamelu Mangai Thayarammal came together to form the South Indian Liberation Federation (SILF)
2. Publishing three newspapers: Dravidan in Tamil, justice in English and Andhra Prakasika in Telugu, to propagate the ideals of the party.

Programmes and activities:

1. The Justice Party is the head of the non — Brahmin Movement in the country.
2. It widened education and employment opportunities and created space for them in the Political sphere.
3. Support inter-caste marriages and abolition of Devadasi System.
4. To approve Participation of women in the electoral Politics in 1921.
5. Established the Staff Selection Board in 1924.
6. In 1929 established the Public Service Commission
7. The Justice Party introduced the Hindu Religious Endowment (HRE). Act in 1926.

12. Attempt an essay of the heroic fight Veerapandya Kattabomman conducted against the East India Company?

Rebellion of Veerapandya Kattabomman :

1. Veerapandya Kattabomman became the Palayakkarar of Panchalamkurichi at the age of thirty.
2. The Collectors humiliated the palayakkarars and adopted force to collect the taxes.
3. This was the bone of contention between the English and Kattabomman.

Confrontation with Jackson:

1. An Jackson in Ramanathapuram on 19 September 1798.
2. Sensing danger, Kattabomman tried to escape.

Appearance before Madras Court:

1. The Committee found Kattabomman was not guilty. Jackson was dismissed from service.

The Siege of Panchalamkurichi:

1. Bannerman cut off all the communications to the fort.
2. Convey a message asking Kattabomman to surrender. Kattabomman refused.

Execution of Kattabomman:

1. Bannerman made a mockery of a trial for Kattabomman.

2. During the trial Kattabomman bravely admitted all the charges levelled against him.

3. Kattabomman was hanged from a tamarind tree in the old fort of Kayathar, close to Tirunelveli.

12. Attempt a narrative account of how Tilak and Annie Besant by launching Home Rule Movement sustained the Indian freedom struggle after 1916?

1. The Indian national movement was revived and also radicalized during the Home Rule League Movement (1916-1918) led by Tilak and Annie Besant.
2. World War I and Indian's participation it was the back ground for the Home Rule League.
3. When Britain declared war against Germany in 1914, it was hoped that, in return, the British Government would give self government after the war.
4. But the British administration remained non committal to such goals. Tilak set up Home Rule League in April 1916.
5. In September 1916, after repeated demands of her impatient followers, Annie Besant decided to start the Home Rule League without the support of Congress.
6. The Home Rule League were utilized to carry extensive propaganda through, press, speech etc., in favors of self government.
7. They succeeded in enrolling young people in large numbers and extending the movement to the rural areas.

GEOGRAPHY - FIVE MARKS

1. Explain the divisions of Northern Mountains and its importance to India?

Three Divisions are

1. The Trans-Himalayas

- i) Lies in Jammu-Kashmir and Tibetan plateau.
- ii) Prominent ranges: Ladakh, Kailash, Karakoram.

2. The Himalayas

- i) An young fold mountain
- ii) Three divisions
 - 1) The Himadri (Peaks-Everest, Kanchenjunga)
 - 2) The Himachal (Major hill Stations)
 - 3) The Siwaliks (Duns and Duars valleys)

3. The Eastern Himalayas

- i) Purvanchal Hills. ii) East location

Importance of the Himalayas

1. Brings heavy rainfall to North India

2. It is a natural barrier 3. Tourist centre
4. Rich biodiversity 5. Many hill Stations
6. Pilgrim centres
7. Source for perennial rivers.
- 2. What is Urbanisation Explain its problems?**
Urbanisation
Transformation of society from rural to urban.
Problems of Urbanization
It Creates
1. Urban Sprawl 2. Drainage problem
3. Water Scarcity, 4. Over crowding
5. Traffic congestion
6. Shortage of houses
7. Formation of slums,
8. Problem of solid waste management
9. Increases crime rate.
- 3. State any five types of soil in India and explain the characteristics and distribution of soil?**
1. Alluvial Soils
i. Sediments deposited by rivers
ii. Sandy clay (Rice, wheat)
iii. Ganga valley, UP, Punjab.
2. Black Soils
i. Sticky when wet (Cotton, Millets)
ii. Maharashtra, Malwa plateaus.
3. Red Soils
i. Rich in minerals (Rice, Wheat)
ii. Tamilnadu, Kerala
4. Desert Soils
i. Dry-light colour (Millets, Barley)
ii. Rajasthan, Southern punjab
5. Marshy soils
i. High Humidity-Black (Paddy, Jute)
ii. Tamilnadu, Bihar, Odisha
- 4. Write about the plantation farming of Tamil Nadu?**
Plantation Forming:
Cultivated in large estates on hilly slopes.
Plantation crops of Tamil Nadu:
Tea ,Coffee ,Rubber,Pepper,Cashew and Cinchona
1. Tea: Tamil Nadu ranks second in area and production of tea next to Assam. The Nilqiris is the notable regions for tea plantation.
2. Coffee: Tamil Nadu stands second in area and production of coffee next to Karnataka .Coffee plants are grown in the hills of Western Ghats as well as Eastern Ghats
3. Rubber: Rubber plantations are significant in Kanyakumari.
- 4. Pepper:** Pepper is confined to the warm and wet slopes of Eastern and Western Ghats of TamilNadu.
5. Cashew: It is extensively cultivated in Cuddalore district.
- 5. Write about South West Monsoon?**
1. Most significant feature of the Indian Climate.
2. ELNino influences the monsoon.
3. June first weak South India then whole India
4. Sudden approach of monsoon with lightning and thunder (burst of monsoon).
5. Two Branches of South West Monsoon
1. The Arabian sea branch
i. Heavy rainfall to the west cost of India
ii. North India gets heave Rainfall
iii. North west doesn't get rainfall
2.The Bay of Bengal branch
i. Meghalaya gets heavy rainfall
ii. Tamilnadu gets low rainfall
iii. India gets 75% of rainfall
- 6. What is Multipurpose Projects and write about any two Multipurpose projects of India?**
Multipurpose Projects
1. Scientific management of water resources.
2. Construction of dam across rivers for many purposes.
3. Bhakra Nangal Project:
i. River - Sutleg
ii. Benefit states - Punjab, Horyono, Rojosthon
iii. Hydro Power Generation - 1500 MW
4. Hirakud Project:
i. River - Mahanadi
ii. Benefit state - Orissa
iii. Hydro Power Generation - 347.5 MW
5. Major aims of the Projects :
i) Irrigation, ii) Hydro-Power
- 7. What is Multipurpose Projects and write about any two Multipurpose projects of India?**
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8. Give an account on water resources of Tamil Nadu?

1. Water is the precious gift of nature to humankind and millions of other species living on the earth.
2. Tamil Nadu constitutes 4% of India's land area and is inhabited by 6% of India's population, but has only 5% of India's water resources.
3. More than 95% of the surface water and ground water have already been put into use.

4. Water resources:

- River basin – 17, Reservoirs – 81
Tanks – 41,127,
Tube wells and other wells – 4,98,644
Open wells – 15,06,919

5. Multipurpose River Valley Projects :

- Mettur Dam, Bhavani Sagar Dam, Amaravathi Dam, Krishnagiri Dam, Sathanur Dam, Vaigai Dam,

9. What are the major issues faced by farmers in India?

1. Infertile soil.
2. Lack of irrigation.
3. Soil erosion.
4. Scarcity of capital
5. Inadequate transport.
6. Inadequate store facilities.
7. High costs of input.
8. Agricultural marketing.
9. Lack of mechanization.

10. Classify and explain the roadways in India?

1. Most important system of road transportation in India.
2. Connecting capital of states, major ports, rail junctions, industrial and tourist centres.
Longest NH is NH - 44, Shortest NH is NH- 47 A.

State Highways:

1. Links important cities, towns and district headquarters within the state.
2. Administrated and financed by state governments.

District Roads:

1. Links between the district and taluk headquarters.
2. Constructed and maintained by the PWD of the states.

Rural Roads:

1. Links the different villages with their neighbouring towns.
2. Maintained by Village Panchayats.

Border Roads:

1. Roads of strategic importance in border areas.
2. Constructed and maintained by Border Roads Organisation.

Expressways :

1. Multi-lane good quality highways for high speed traffic Ex: Mumbai -Pune Road.

International Highways :

1. Link India with its neighbouring countries for promoting harmonious relationship.

11. Examine the geographical conditions favourable for the cultivation of Rice and Wheat?

Expressways :

Rice:

1. Rice is an indigenous crop. India is the second largest producer of rice in the world after China.
2. It is mainly a tropical crop.
3. Growing mainly with mean temperatures of 24° and annual rainfall of 150cm.
4. Deep fertile clayey or loamy soils are suited well for rice cultivation
5. It needs abundant supply of cheap labour.

Wheat:

1. Wheat is the second most important food crop of the country, after rice.
2. It accounts for 22 % of the total area.
3. 34% of the total production of food grains in the country.
4. It requires 1 -15° at the time of sowing.
5. 20-25°C at the time of ripening of grains.

GEOGRAPHY - FIVE MARKS

12. Write about the distribution of cotton textile industries in India?

1. This sector in India is the second largest in the world.
2. India is the third largest producer of cotton and loom arc and ring spindles in the world.
3. Handloom, Handicrafts and Small Power- Loom units are the biggest source of employment for millions of people.
4. Cotton textile industry is the largest organised modern industry of India.
5. The higher concentration of textile mills in and around Mumbai, makes it as "Manchester of India".
6. In TamilNadu Coimbatore is the most important centre with 200 mills out of its 435 and called as "Manchester of South India".

13. Describe the forests of India?

Tropical Evergreen Forest:

1. 200 cm or more annual rainfall. The annual temperature is about more than 22°C.
2. Found in Western Ghats. Trees are rubber, rosewood, bamboo and palm.

Tropical Deciduous Forest: (A/lonsoon Forest)

1. 100 to 200 cm. annual rainfall.
2. Annual temperature is about 27°C

3. The trees (Teak and Sal) drop their leaves during the spring. (Found in UP, Tamilnadu, Kerala, Andra, Punjab)

Tropical Dry Forest:

1. 50 to 100 cm rainfall.
2. Found in East Rajasthan and Tamilnadu, Haryana, Punjab.(Banyan,Palas,Bamboo, Babool etc.)

Tropical thorn forests:

1. Desert and Semi-desert vegetation.
2. Annual Rainfall of less than 50cm.

Mountain or Montane Forest:

1. The rainfall of this region is moderate .
2. Found in Jammu & Kashmir, Himachal Pradesh.

Alpine Forest:

1. Oak, silver fir, pine are the main trees of forests.

Tidal Forests:(Mangrove forests)

1. These forests occur in and around the deltas, estuaries.

14. Explain the Western and Eastern coastal plains of India?

I. The Western coastal plains:

1. Lies between the Western ghats and the Arabian sea.
2. Vembanadu famous backwater lake.
3. Extends from Rann of Kutch to Kanyakumari.
4. Numerous swallow lagoons and backwaters (Kayals and Teris)
5. Northern part Kongan plain, middle part Canara, Southern part Malabar coast.

II. The Eastern coastal plains:

1. Lies between the Eastern ghats and the Bay of Bengal.
2. Chilika Lake, Kollerulake, Pulicat Lake.
3. These plains are formed by the alluvial fillings.
4. Regular shoreline with well-defined beaches.
5. Northern part Northern Circars, Southern part Coromandel coast.

15. What are the Risk reduction measures taken before , during and after cyclone?

Before:

1. Keep your mobile phones charged.
2. Listen to radio, watch TV, read newspaper for weather updates.
3. Keep your valuable things safely.
4. Untie cattle/animals.
5. Fishermen should keep a radio with extra batteries.
6. Keep boats and rafts tide up safely.

During:

1. Keep all family members inside the house.
2. Don't go out during cyclone

3. Switch off all electrical appliances.
4. Movable items should be kept securely tide.

After:

1. Those who shifted to the cyclone centre must remainder till instructions are received.
2. Strictly avoid lose electrical wires after the cyclone
3. Clear debris and carcasses near the premises.

CIVICS - FIVE MARKS

1. Explain the Salient features of the Constitution of India?

1. It is the lengthiest written Constitution in the world.
2. It is party rigid and party flexible
3. It makes India as a secular state
4. It Provides Single citizenship
5. It Provides federal form of government
6. It Provides an independent Judiciary
7. It has borrowed Provisions from various countries.
8. Right to vote to all above 18 years of age

2. Make any two basic concepts followed by India to maintain friendly relations with its Neighbours?

The basic concepts of India's foreign policy to maintain friendly relations with its neighbours are-

1. Preservation of national interest.
2. Achievement of world peace,
3. Disarmament
4. Fostering cordial relationship with other countries
5. Solving conflicts by peaceful means
6. Independence of thought and action as per the principle of NAM.
7. Equality in conducting international relations
8. Anti-colonialism, anti-imperialism and anti-racism

Policy of Disarmament:

1. No first use
2. Credible minimum deterrence.

Fostering cordial relationship with other countries:

To leverage international partnership for India's domestic development.

3. Discuss the Financial and Judicial powers of the governor?

Financial powers :

1. State legislature should get his approval to introduce budget.
2. Money bills can be introduced only with his prior recommendation.
3. No demand for any grant can be made except on his recommendation.
4. He constitutes a financial commission to review the financial position.

Judicial powers:

1. He appoints the Attorney-General of the state.
2. He appoints judges to the subordinate courts.
3. Appointing the Chief Justice of the High Court with his consultation.
4. He can pardon, commute punishment on receipt of appeals for mercy.

4. Discuss the core determinants of India's foreign policy?

1. Geographical position and size of territory.
2. Nation's history, traditions and philosophical basis.
3. Natural resources.
4. Military strength.
5. International milieu.
6. The compulsion of economic development.
7. Political stability and structure of government.
8. The necessity of peace disarmament and non-proliferation of nuclear weapons.

5. Describe the Executive and Judicial Powers of the President of India?**Executive Powers (Article 77) :**

1. Every executive action of the union Government is undertaken by his name.
2. Appointing - PM, union Ministers, State Governors, Supreme and High Court Judges, Election Commissioners.
3. Inaugurates the Parliament session after the general election
4. First citizen of India
5. Constitutional head of the union

Judicial Powers :

1. Article 72 describes the judicial powers of the president.
2. He Can Pardon, Commute, and relieve Punishment including death Sentence
3. The president is not answerable to any court

6. What are the powers and functions of the Chief-Minister?**Powers and Functions :**

1. Appointing ministers, allocates portfolios
2. Leads, ministerial meetings
3. Shuffles and Reshuffles his ministers
4. He Advises the Governor in the appointment of the high officials
5. He Announces government policies.
6. Introduce bills in the legislative Assembly
7. Recommend for dissolution the Legislative Assembly to the Governor
8. He has to control his party and develop the disciplines.

7. What are the Duties and Functions of Prime Minister of India?**Duties (Article 78) and Functions :**

1. He decides and distributes Various departments to ministers.
2. He organises and presides the Cabinet meeting.
3. He Supervises the works of ministers
4. Acts as the link between the president and the Council of Ministers
5. He is the leader of the nation
6. He is the Chief Spokesperson of the Country.
7. He attends international conferences like SAARC, Commonwealth and etc.
8. He is head of the cabinet and the other ministers.

8. Point out the Fundamental Rights?

1. Part III
2. Article -12 to 35
3. Derived from USA Constitution.
4. Enforceable by a court of Law
5. These have legal Sanctions
6. Strengthen political democracy in the Country.
7. Six Fundamental Rights
 1. Right to Equality (Article 14-18)
 2. Right to Freedom (Article 18 - 22)
 3. Right Against Exploitation (Article 23 - 24)
 4. Right to Religion (Article 25-28)
 5. Cultural & Educational Rights (Article 29 - 30)
 6. Right to Constitutional Remedies (Article-32)

CIVICS - FIVE MARKS**9. Mention the differences between Fundamental Rights and Directive Principles of State Policy?****Fundamental Rights:**

1. It was derived from the Constitution of the USA.
2. Even the Government cannot take away or bridge these rights.
3. These are enforceable by a court of law.
4. These have legal sanctions.
5. These rights strengthen political democracy in the country.

Directive Principles of State Policy:

1. It was drawn on the model of the Constitution of Ireland economic.
2. These are mere institutions to the Government.
3. These are not enforceable in any court.
4. These have moral and political sanctions.
5. The implementation of these principles ensures social and economic democracy.

10. Write a detailed note on Non-Alignment?

1. **Reason:** Nehru, India's first Prime Minister, was opposed to the rivalry of the two super powers

(America and Russia) who were trying to extend their influence over the newly emerged nations of Asia and Africa. So, he chose the path of Non Alignment.

2. **Term :** The term ' Non - Alignment ' was coined by V.Krishna Menon in his speech at the United Nations in 1953.
3. Non-Alignment has been regarded as the most important feature of India's foreign policy.
4. **Aim :** It aimed to maintain national independence in foreign affairs by not joining any military alliance.
5. **Members :** The Non-Aligned Movement (NAM) was formed with a membership of 120 countries and 17 states as observes and 10 international organisations.
6. **Founding fathers :** Jawaharlal Nehru of India, Tito of Yugoslavia, Nasser of Egypt, Sukarno of Indonesia, and Kwame Nkrumah of Ghana.

11. Describe the Legislative powers of the Governor?

1. Head of the State executive and the chancellor of universities.
2. He is part of State Legislature
3. He inaugurates the state legislature after the general election.
4. He can Summon, Prorogue and dissolve the legislative Assembly.
5. Bills become Laws after his approval.
6. He can dissolve the house with the advice of Chief minister.
7. He appoints the District Judges, Attorney General, Finance Commission.
8. The Governor can rule the State, directly during emergency.

ECONOMICS - FIVE MARKS

1. **Write the challenges of Globalization?**
 1. It leads to instability in the developing world
 2. It leads to global imbalance
 3. It has led to environmental degradation
 4. It has led to increase child labour and slavery
 5. Consuming junk food caused ill health and spread of diseases
 6. Increased global competition
 7. Benefits extent to all countries that will not happen automatically
2. **Elucidate why the Green Revolution was born?**
 1. The main cause for the Green Revolution is the growth of population in India after independence.
 2. Food security of people is also related to a country's overall development process.

3. An initial focus on agriculture, industrialisation was given priority.
4. The recurrent droughts experienced by India pushed her to be dependent on imports of food grains.
5. The available foreign exchange reserve could not permit open market purchases and import of grains.
6. India had to plead for food grains from richer countries (USA) concessional rates.
7. So, Green Revolution was born in the country to achieve self sufficiency in food grains production.

Direct Taxes:

1. **Income tax :**

- Most important tax levied on an individual in India
- Based on the income of a person.

2. **Corporate tax:**

- Tax is levied on companies.
- Charged on royalties, interest gains from sale of capital assets.

3. **Wealth tax:**

- Tax is levied on the individuals and companies.
- Charged on the benefits derived from property ownership.

Indirect taxes:

1. **Stamp duty:**

- Tax is paid on official documents like marriage registration.
- Documents related to a property.

2. **Entertainment tax:**

- Charged by the government on any source of entertainment provided.

3. **Excise duty:**

- It is any duty on manufactured goods levied at the movement of manufacture. (Sales Tax).

3. **What are the main objectives of the new Agricultural policy?**

1. **Raising the productivity of inputs :**

- One of the important objectives of India's agricultural policy.
- Purchasing HYV seeds, fertilisers, pesticides, irrigation projects etc.

2. **Raising value added per hectare :**

- To increase per hectare value -added by raising the productivity of agriculture.

3. **Protecting the interests of poor farmers :**

- Abolishing intermediaries through land reforms, expanding institutional credit support to poor farmers.

4. **Modernising agricultural sector:**
- Introduction of modern technology in agricultural operations. (HYV Seeds, fertilizers etc.)
5. **Environmental degradation :**
- To check environmental degradation of natural base of Indian agriculture.
6. **Removing bureaucratic obstacles :**
- To remove bureaucratic obstacles on the farmers cooperative societies and self-help institutions.
5. **Briefly explain various terms associated with measuring of National Income?**
1. **Gross National Product (GNP)**
GNP is the total value of goods and Services Produced in a Country in a Year
 $GNP = C + I + G + (X - M) + NFIA$
2. **Gross Domestic Product (GDP)**
GDP is the total value of goods and Produced within the geographical boundaries of a country in a year
3. **Net National Product (NNP)**
 $NNP = GNP - \text{Depreciation}$
4. **Net Domestic Product (NDP)**
 $NDP = GDP - \text{Depreciation}$
5. **Per Capita Income (PCI)**
 $PCI = \text{National Income} / \text{Population}$
6. **Personal Income (PI)**
7. **Disposable Income (DI)**
 $DPI = PI - \text{Direct Taxes}$
6. **What is black money ? Write the causes of black money? Black Money:**
- Black money is funds earned on the black market on which income and other taxes have not been paid.
 - The unaccounted money that is concealed from the tax administrator is called black money.
- Causes of Black Money :**
1. Shortage of goods.
 - Root cause of black money.
 2. Licensing proceeding.
 - Generation of black money.
 3. Contribution of the industrial sector.
 - Major contribution to black money.
 4. Smuggling.
 - Major source of black money.
 5. Tax structure.
 - Tax increased, more black money generated.

ECONOMICS - FIVE MARKS

7. **Elaborate the Public Distribution System?**
1. Tamilnadu adopted the Universal PDS, other states Targeted PDS

2. All the family ration card holders can get food supplies under this system
 3. Union and state governments give subsidies to the PDS (Varies between states)
 4. The MFSA Covers 50% urban households and 75% rural household
 5. The priority house hold get food supply through PDS
8. **Write the structure of GST?**
- GST-Goods and Service Tax.
 - One of the Indirect taxes.
 - GST Act came into effect on 1st July 2017.
 - Motto : One nation, One market, One tax.
- I. State Goods and Service Tax (SGST):**
1. Intra tax (within the state)
 2. VAT / sales tax purchase tax, entertainment tax, luxury tax, Lottery tax and state surcharge and cesses.
- II. Central Goods and Service Tax (CGST):**
1. Intra tax (within the state)
 2. Central Excise Duty, service tax, counter vailing duty, additional duty of customs, surcharge, education and secondary / higher secondary cess.
- III. Integrated Goods and Service Tax (IGST):**
1. Inter State (integrated GST)
 2. There are four major GST rates: (5% , 12% , 18 % and 28%)
 3. Almost all the necessities of life like vegetables and food grains are exempted from this tax.
9. **Write about the composition of GDP in India**
1. **Primary sector (Agricultural Sector)**
 - i. Agricultural operations are under taken
 - ii. Allied activities - Cattle Farm, Fishing, Mining and Forestry
 2. **Secondary sector (Industrial sector)**
 - i. Raw materials are transformed into finished products
 - ii. Iron, Steel, Jute, Sugar, Cement Industry and Textile Industry.
 3. **Tertiary Sector (Service Sector)**
 - i. It is the Service Sector
 - ii. Education, Banking, Entertainment, Trade, Transport, IT
10. **What are the methods of calculating Gross Domestic Product? And explain its?**
- I. Expenditure Approach :**
- We get GDP by adding the expenditure on all final goods and services produced in a country in a year $Y = C + I + G + (X - M)$

2. The Income Approach :

We get GDP by adding the income producing goods and services. $Y = \text{Wages} + \text{Rent} + \text{Interest} + \text{Profit}$

3. Value added Approach

In this method,

The value of intermediate goods used in production
= The value of the final goods Tea powder + Milk + Sugar = Tea

11. What are the important characteristics of successful industrial clusters?

1. Geographical proximity of Small and Medium Enterprises. (SMEs)
2. Sectoral specification.
3. Close inter-firm collaboration.
4. Inter-firm competition based on innovation.
5. A socio-cultural identity, which facilitates trust
6. Multi-skilled workforce.
7. Active self-help organisations.
8. Supportive regional and municipal governments.

12. Write about the positive impact and the negative impact of Globalisation?**Positive Impact:**

1. Standard of living has increased.
2. Increasing the GDP of a country.
3. Increasing better trade, more people are employed.
4. Introduced new technologies and new scientific research.

Negative Impact:

1. Too much flow of capital among Countries.
2. Introduces unfair and immoral distributors of income.
3. Losing national integrity. Increases negative ecological and social costs.

13. Briefly explain the advantages and disadvantages of MNC?**Advantages**

1. They produce quality goods at lower cost
2. Due to low prices, purchasing power increased
3. Advantage of tax variation
4. Job growth in the local economy

Disadvantages

1. MNC Develop monopoly
2. They affect the environment
3. Downfall in small and local business
4. They breach ethical standards

HISTORY - TIME LINE

S.No.	YEAR	INDIA EVENTS
1.	1914	OUT BREAK OF WORLD WAR I
2.	1916	HOME RULE LEAGUE
3.	1917	CHAMPARAN SATYAGRAHA
4.	1918	KHEDA SATYAGRAHA
5.	1919	ROWLATT ACT
6.	1920	KHILAFAT MOVEMENT
7.	1922	CHAURI CHAURA INCIDENT
8.	1927	THE APPOINTMENT OF THE SIMON COMMISSION
9.	1929	THE LAHORE CONGRESS SESSION
10.	1935	THE GOVERNMENT OF INDIA ACT
11.	1939	OUT BREAK OF WORLD WAR II
12.	1940	AUGUST OFFER
13.	1942	CRIPPS MISSION
14.	1945	SIMLA CONFERENCE
15.	1947	INDIA GOT INDEPENDENCE

S.No.	YEAR	INDIA EVENTS
16.	1914	OUT BREAK OF WORLD WAR I
17.	1916	BATTLE OF VERDUN
18.	1917	RUSSIAN REVOLUTION
19.	1918	END OF THE WORLD WAR I
20.	1919	PARIS PEACE CONFERENCE
21.	1920	LEAGUE OF NATION
22.	1922	MUSSOLINI'S MARCH ON ROME
23.	1927	FORMATION OF VIETNAM NATIONALIST PARTY
24.	1929	THE GREAT DEPRESSION
25.	1935	MUSSOLINI INVADED ETHIOPIA
26.	1939	OUTBREAK OF WORLD WAR II
27.	1940	BATTLE OF BRITAIN
28.	1942	BATTLE OF STALINGRAD
29.	1945	END OF WORLD WAR II
30.	1947	ISRAEL PEACE TREATY

DRAW TIME LINE USING FOLLOWING YEARS

1. 1900 to 1920 Write any 5 Indian Events.
2. 1910 to 1930 Write any 5 World & Indian Events.
3. 1920 to 1940 Write any 5 World & Indian Events.
4. 1930 to 1950 Write any 5 World & Indian Events
5. 1910 to 1940 Write any 5 World & Indian Events.

MAP - HISTORY - WORLD

S.No.	1	2	3	4	5	6
1.	Great Britain (England)	Germany	Austria - Hungary	Morocco	Rumania	Ukraine
2.	Russia	Greece.	America	Serbia	Canada	Saudi Araia
3.	France	China	Poland	Hawai Island	Hiroshima	San Francisco
4.	Japan	India	Bulgaria	Australia	Nagasaki	Belgium
5.	Italy	Pacific Ocean	Turkey	Newzealand	Brazil	Narway

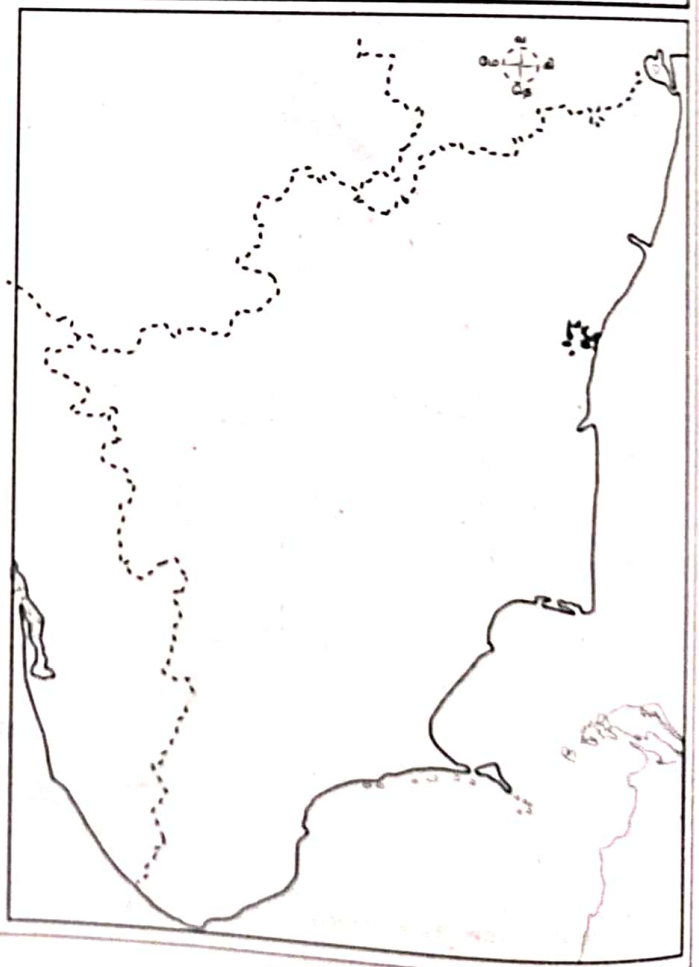
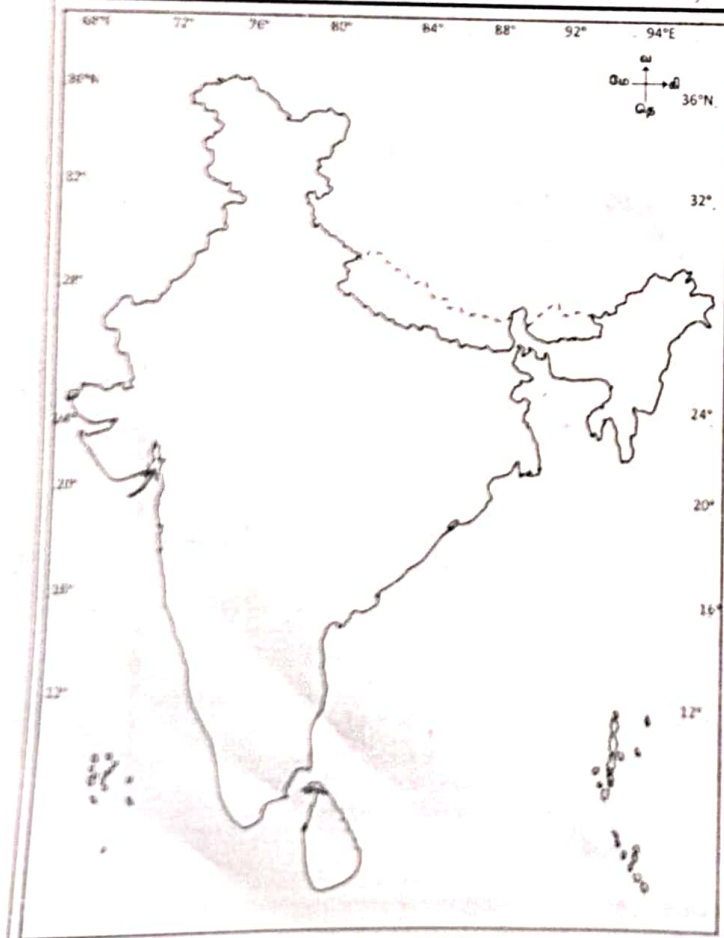
MAP - HISTORY - INDIA

S.No.	1	2	3	4	5	6	7
1.	Delhi	Vedaranyam	Meerut	Kheda	Allahabad	Kashmir	Lahore
2.	Banaras (Varanasi)	Madras (Chennai)	Barrackpore	Bardoli	Patna	Assam	Ghorakpur
3.	Calcutta	Gwalior	Dandi	Wardha	Vellore	Satara	Chittagong
4.	Kanpur	Bombay (Mumbai)	Chauri Chaura	Lucknow	Poona	Bengal	Ambala
5.	Champaran	Jallian Walabagh (Amristar)	Jhansi	Bareilly	Ahmedabad (Sabarmati Ashram)	Agra	Nagpur

COMPULSORY QUESTION

1. What are the main objectives of india's foreign policy ?
2. Write short note on step (terrace), farming method ?
3. What is meant by corporate tax ?
4. List any four guiding principles of panchasheel ?
5. What do you know about the renewable resources ?
6. What is the socio - economic factors for the uneven distribution of population ?
7. What is meant by geological codes ?
8. Define methods of conservation & management of soil ?
9. List out india's important software centres .
10. what is the longitudinal and latitudinal extent of india ?
11. Mention the role of mangroves in coastal zone management ?
12. What is meant by gold standard monetary system ?
13. Name the four important multi purpose projects and mention the states benefits byt hat ?
14. List out the important mode of transport in the world
15. Name the books wrote by annie besant and the journals started by her ?
16. Ship gateway incident - define .
17. What is the difference between the religious and reforms movement?
18. Define iminerals and its types
19. Define : mandamus writ .
20. Name some hill resorts in himalayas ?
21. List out some methods to conserve water resources ?
22. Why chennai is called as detroit of asia ?
23. What is meant by universal adult franchise ?
24. Mention any two reforms made to adopt globalization ?
25. Define : Cold War.
26. What is total value added ?
27. Write about world trade organisation (WTO)
28. What is meant by minimum support price ? (MSP)
29. What is meant by purchasing power parity (PPP) ?
30. Define Sez?

PRACTICE MAP



Entertain



Annual Day

Experience



ED Cell

Explore



Sports Day



Innovation Day



I Club



NSS

Student Amenities



NANDHA HOSPITAL



Yoga / Meditation



Auditorium



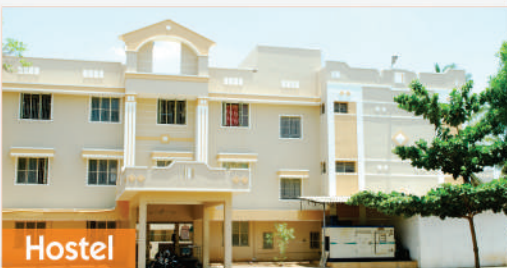
Bank with ATM inside Campus



Bakery & Canteen



Gym



Hostel



Sports Complex



Transport



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Tech Campus

Medical Campus

Science Campus



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Our Institutions

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- ✦ Medical College & Hospital

Dental Campus (☎ : 97507 70555)

- ✦ Dental College & Hospital

Indian Medicine Campus (☎ : 76677 11200)

- ✦ Ayurveda Medical College & Hospital
- ✦ Siddha Medical College & Hospital
- ✦ Naturopathy and Yoga Medical College & Hospital

Arts Campus (☎ : 73737 24422)

- ✦ Arts & Science College(Autonomous)
- ✦ College of Education
- ✦ Teacher Training Institute

Science Campus (☎ : 73737 12299)

- ✦ College of Pharmacy
- ✦ College of Physiotherapy
- ✦ College of Nursing
- ✦ School of Nursing
- ✦ College of Allied Health Sciences
- ✦ Academy of Allied Health Sciences
- ✦ Institute of Health / Sanitary Inspector

School Campus (☎ : 99655 51313)

- ✦ Central School (CBSE)
- ✦ Central City School (CBSE)

Tech Campus (☎ : 73737 14477)

- ✦ Engineering College (Autonomous)
- ✦ College of Technology (Autonomous)
- ✦ Polytechnic College



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