

# **CAREERS 360**

## **PRACTICE** **Series**

# **AP EAPCET 2025**

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# **Sample Paper**

# Physics

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**Q. 1** The wrong statement about equipotential surface for uniform electric field is:

**Option 1:**  
for equipotential surface potential is same at every point

**Option 2:**  
for equipotential surface potential is different at every point

**Option 3:**  
electric lines are perpendicular to equipotential surface.

**Option 4:**  
work done is zero

**Correct Answer:**  
for equipotential surface potential is different at every point

**Solution:**

As we learn

Equipotential Surface -

All Points having same Potential.

-

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**Q. 2** Which of the following is true for mutual inductance  $M$  between two coils for rotation,  
$$M = K \sqrt{L_1 L_2}$$

**Option 1:**  
 $0 \leq k \leq 1$

**Option 2:**

A system cannot have mutual inductance without self inductance

**Option 3:**

$$K = \frac{\text{Magnetic flux linked to secondary}}{\text{Magnetic flux linked to primary}}$$

**Option 4:**

All of the above

**Correct Answer:**

All of the above

**Solution:**

As we have learnt,

If  $L=0$  -

$M = 0$

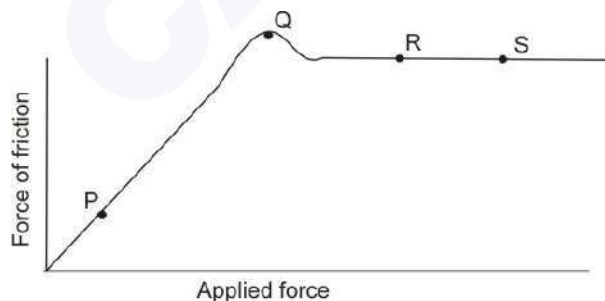
-

\* value of  $K$  is  $0 \leq k \leq 1$

\* if  $L = 0$  then  $M = 0$

$$* K = \frac{\phi_2}{\phi_1}$$

**Q. 3** The given graph is between applied force and force of friction. Which point show the limiting value of frictional force.



**Option 1:**

P

Option 2:

Q

Option 3:

R

Option 4:

S

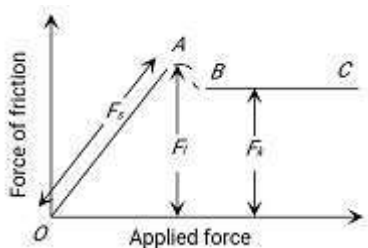
Correct Answer:

Q

**Solution:**

As we learn

Graph between Applied Force and Force of Friction -

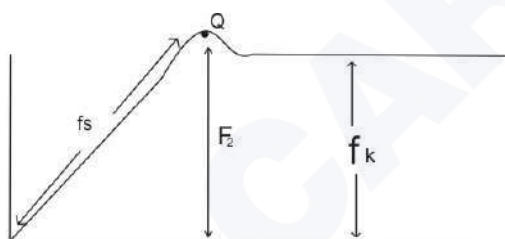


- wherein

At A static friction is maximum.

OA = Represents static friction

\* Beyond A force of friction decreases slightly



As shown in diagram front Q shows the limiting value of frictional force.

Correct option is 2.

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**Q. 4** If two vectors have equal magnitude and same direction then vectors are called

**Option 1:**

Equal vectors

**Option 2:**

Negative vectors

**Option 3:**

collinear vectors

**Option 4:**

co initial vectors

**Correct Answer:**

Equal vectors

**Solution:**

If two vectors have equal magnitude and same direction then vectors are called equal vectors

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**Q. 5** Which of the following is not a transverse wave

**Option 1:**

Waves set-up on the surface of water.

**Option 2:**

Movement of string of a violin.

**Option 3:**

Movement of kink on a rope.

**Option 4:**

Vibration of air column in organ pipe.

**Correct Answer:**

Vibration of air column in organ pipe.

**Solution:**

As we learned

Transverse wave -

Each disturbed element of string move in a direction perpendicular to the direction of propagation.

- wherein

e.g. wave on a string

EM wave

Vibration of air column in organ pipe is an example of longitudinal wave.

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**Q. 6** When no heat exchange happens during the process then the process is called

**Option 1:**

Isobaric process

**Option 2:**

Isochoric process

**Option 3:**

Adiabatic process

**Option 4:**

All of these

**Correct Answer:**

Adiabatic process

**Solution:**

As we learned

Adiabatic Process -

When a Thermodynamic System undergoes a change in such a way that no exchange of heat takes place.

- wherein

$$\Delta Q = 0$$

---

**Q. 7** Lines which represent place of constant angle of dip are called

**Option 1:**

Isobaric lines

**Option 2:**

Isogonic lines

**Option 3:**

isoclinic lines

**Option 4:**

isodynamic lines

**Correct Answer:**

isoclinic lines

**Solution:**

As we have learned

Isoclinic lines -

The lines which pass through different places having zero dip

-

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**Q. 8** Which of the following is the unit of the magnetic field?

**Option 1:**

weber/m

**Option 2:**

weber/m<sup>2</sup>

**Option 3:**

weber-m

**Option 4:**

weber-m<sup>2</sup>

**Correct Answer:**

weber/m<sup>2</sup>

**Solution:**

As we have learnt,

Magnetic field -

$$B = \frac{F}{m_0}$$

$$= B = \frac{\mu_0 m}{4\pi d^2}$$

$$B = \frac{\phi}{A} \Rightarrow \text{weber} / \text{m}^2$$

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**Q. 9** The thermo emf of a thermocouple varies with temperature as  $E = A\theta + B\theta^2$ .  
 $\frac{A}{B} = 600^\circ\text{C}$ . If the cold junction is kept at  $0^\circ\text{C}$ , the neutral temperature is

**Option 1:**  
 $0^\circ\text{C}$

**Option 2:**  
 $600^\circ\text{C}$

**Option 3:**  
 $150^\circ\text{C}$

**Option 4:**  
No neutral temperature is possible

**Correct Answer:**  
No neutral temperature is possible

**Solution:**

At neutral temperature

$$\frac{dE}{d\theta} = 0$$

$$\Rightarrow A + 2B\theta_n = 0$$

$$\Rightarrow 2B\theta_n = -A$$

$$\theta_n = \frac{-A}{2B} = \frac{-1}{2}600 = -300^\circ C$$

Since  $\theta_n = -300^\circ C$ ,

So, No neutral temperature is possible because Neutral temperature can never be negative hence no  $\theta$  is possible.

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**Q. 10** An electric dipole having dipole moment  $\vec{P}$  is lying along a uniform electric field  $\vec{E}$ . The workdone in rotating the dipole by  $90^\circ$  is:

**Option 1:**

$$\sqrt{2}PE$$

**Option 2:**

$$\frac{PE}{\sqrt{2}}$$

**Option 3:**

$$2PE$$

**Option 4:**

$$PE$$

**Correct Answer:**

$$PE$$

**Solution:**

As we have learn

Work done in rotation -

if  $\Theta_1 = 0^\circ$  and  $\Theta_2 = \Theta$

$$W = PE(1 - \cos \Theta)$$

In rotating through an angle  $\theta$

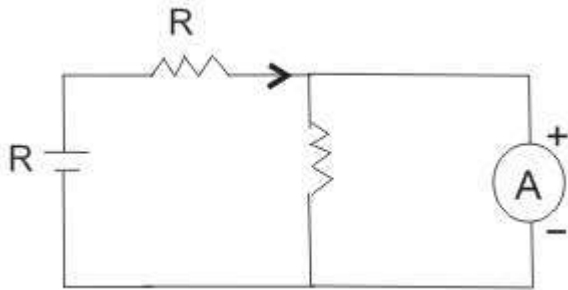
$$W = PE(1 - \cos \theta)$$

for  $\Theta = 90^\circ$

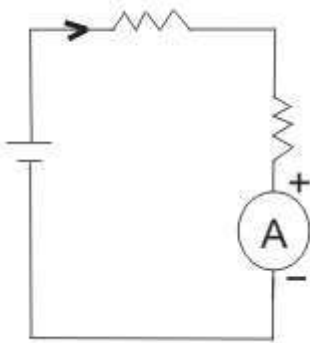
$$W = PE(1 - \cos 90) = PE$$

Q. 11 Which of the following circuit is true

Option 1:



Option 2:



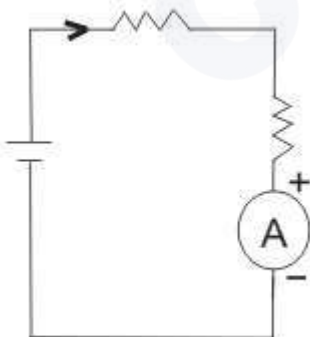
Option 3:

Both (1) and (2)

Option 4:

None of these

Correct Answer:



Solution:

As we learned

Ammeter -

It is a device used to measure current and always connected in series

Ammeter is always connected in series.

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**Q. 12** A uniform wire of resistance R is stretched to 20% of its length. The change in resistance is:

**Option 1:**

0.44 R

**Option 2:**

0.12 R

**Option 3:**

2.07 R

**Option 4:**

0.48 R

**Correct Answer:**

0.44 R

**Solution:**

As we learn

Dependence of Resistance -

i) Length of conductor -  $r \propto l$

ii) Area of cross-section -  $R \propto \frac{l}{A}$

iii) Temperature (for conductor)

-

$$Al = A'l'$$

$$Al = A' \times 1.2l$$

$$A' = \frac{A}{1.2}$$

$$R \propto \frac{l}{A}$$

$$R = \rho \frac{1.2l}{\frac{A}{1.2}} = 1.44 \frac{\rho l}{A} = 1.44R$$

So change in R is =0.44R

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**Q. 13** For thin film interference condition of destructive interference for normal incidence is

*Option 1:*

$$2\mu t = n\lambda$$

*Option 2:*

$$\mu t = n\lambda$$

*Option 3:*

$$\mu t = \frac{n\lambda}{2}$$

*Option 4:*

$$\mu t = \frac{n\lambda}{4}$$

**Correct Answer:**

$$2\mu t = n\lambda$$

**Solution:**

As we learn

Thin Film Interference in reflected light -

$$2\mu d = \begin{cases} n\lambda \\ (n + \frac{1}{2}) \lambda \end{cases}$$

- wherein

For destructive interference

For constructive interference

For destructive interference

$$2\mu \cos r = (2n) \frac{\lambda}{2}$$

for normal incidence  $2\mu t = n\lambda$

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**Q. 14** A 4 m long rod of radius 1cm which is fixed from one end is given a twist of 0.4 radians . The shear strain developed in a rod is -

**Option 1:**

0.002

**Option 2:**

0.004

**Option 3:**

0.008

**Option 4:**

0.001

**Correct Answer:**

0.001

**Solution:**

As we learn

Shearing strain -

$$\phi = \frac{x}{L}$$

- wherein

$\phi = \text{Shearing Strain}$

$x = \text{deformed position}$

$L = \text{length}$

So, shearing strain can also be written in terms of  $x = r\theta$

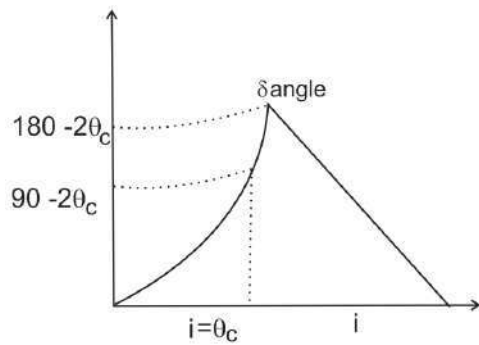
by equating both

$$r\theta = L\phi$$

$$\phi = \frac{r\theta}{L} = \frac{1 \times 10^{-2} \times 0.4}{4}$$

$$\phi = 0.001$$

**Q. 15** The graph between angle of deviation and angle of incidence as correct representation at when light ray



**Option 1:**

going from rarer to denser medium

**Option 2:**

going from denser to rarer medium

**Option 3:**

reflected from plane mirror

**Option 4:**

reflected from curved mirror

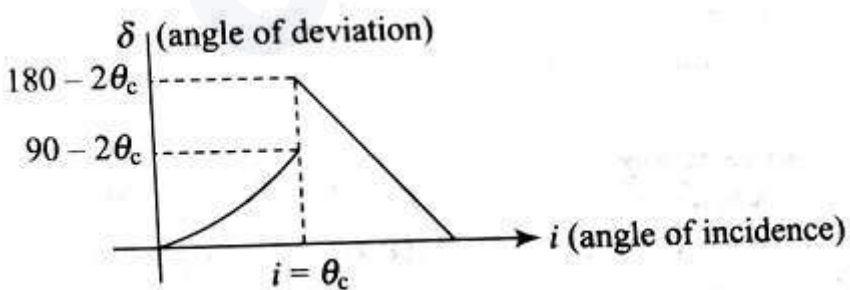
**Correct Answer:**

going from denser to rarer medium

**Solution:**

as we learn

Graph between angle of deviation ( $\delta$ ) and angle of incidence ( $i$ ) -



- wherein

Light ray going from denser to rarer medium.

This graph is correct when light going from denser medium to rarer medium

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**Q. 16** What is necessary condition for Beat phenomena when two sound wave A & B having same amplitude and travelling in a medium in the same direction

**Option 1:**  
 $f_A > f_B$

**Option 2:**  
 $f_B < f_A$

**Option 3:**  
 $f_A \neq f_B$

**Option 4:**  
 $f_A = f_B$

**Correct Answer:**  
 $f_A \neq f_B$

**Solution:**

As we learned from

Beat -

A phenomena results when two sound wave having equal amplitude and travelling in a medium in the same direction but having slightly different frequency.

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**Q. 17**  $ML^2T^{-3}A^{-1}$  is the dimension of

**Option 1:**  
electric field

**Option 2:**  
energy

**Option 3:**  
electric potential

**Option 4:**  
power

**Correct Answer:**  
electric potential

**Solution:**

As we learn

Unit and Dimensional formula -

$$\frac{J}{C} = \text{volt (S.I.)}$$

stat volt (C.G.S).

Dimension -  $mL^2T^{-3}A^{-1}$ .

- wherein

$$1\text{volt} = \frac{1}{300} \text{ stat volt.}$$

$$\text{Electric potential} = \frac{W}{q_0} = \frac{\text{joule}}{\text{coulomb}} = \frac{M^1L^2T^{-2}}{AT} = M^1L^2T^{-3}A^{-1}$$

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**Q. 18** Magnetic field for an axial point due to short bar magnet of magnetic moment M is given by

**Option 1:**

$$\frac{\mu_0 M}{4\pi d^3}$$

**Option 2:**

$$\frac{\mu_0 M}{4\pi d^2}$$

**Option 3:**

$$\frac{\mu_0 M}{2\pi d^3}$$

**Option 4:**

$$\frac{\mu_0 M}{2\pi d^2}$$

Correct Answer:

$$\frac{\mu_0 M}{2\pi d^3}$$

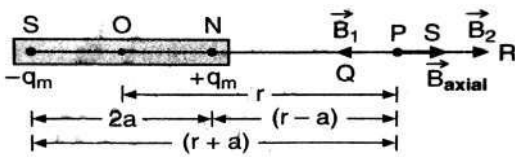
**Solution:**

As we learnt ,

Magnetic field on Axial Position of bar magnet -

$$B_{axial} = \frac{\mu_0 2M}{4\pi r^3}$$

- wherein



$$B_a = \frac{\mu_0}{4\pi} \frac{2Md}{(d^2 l^2)^2}$$

if  $l \ll d$

then

$$B_a = \frac{\mu_0}{4\pi} \frac{2M}{d^3} \Rightarrow \frac{\mu_0 M}{2\pi d^3}$$

- Q. 19** A compressive force,  $F$  is applied at the two ends of a long thin steel rod. It is heated, simultaneously, such that its temperature increases by  $T$ . The net change in its length is zero. Let  $l$  be the length of the rod,  $A$  its area of cross-section,  $Y$  its Young's modulus, and  $\alpha$  its coefficient of linear expansion. Then,  $F$  is equal to :

**Option 1:**

$$l^2 Y \propto \Delta T$$

**Option 2:**

$$l A Y \propto \Delta T$$

**Option 3:**

$$A Y \propto \Delta T$$

Option 4:

$$\frac{AY}{\alpha \Delta T}$$

Correct Answer:

$$AY\alpha \Delta T$$

**Solution:**

As we learnt in

Young Modulus -

Ratio of normal stress to longitudinal strain

it denoted by Y

$$Y = \frac{\text{Normal stress}}{\text{longitudinal strain}}$$

- wherein

$$Y = \frac{F/A}{\Delta l/L}$$

F - applied force

A - Area

$\Delta l$  - Change in length

L - original length

Here  $l = l_0(1 + \alpha \Delta T)$

$$l = l_0 + l_0 \alpha \Delta T$$

$$l - l_0 = l_0 \alpha \Delta T$$

$$\Rightarrow \Delta l = l_0 \alpha \Delta T$$

$$\Rightarrow \frac{\Delta l}{l_0} = \alpha \Delta T$$

$$Y = \frac{F l_0}{A \Delta l}$$

$$\Rightarrow F = \frac{Y A \Delta l}{l_0}$$

$$F = Y A \alpha \cdot \Delta T$$

Correct option is 3.

**Q. 20** Moment of inertia of a ring along its diameter is

**Option 1:**

$$\frac{3}{2} MR^2$$

**Option 2:**

$$\frac{1}{2} Mr^2$$

**Option 3:**

$$MR^2$$

**Option 4:**

$$2MR^2$$

**Correct Answer:**

$$\frac{1}{2} Mr^2$$

**Solution:**

As we learned

Perpendicular Axis theorem -

$$I_z = I_x + I_y$$

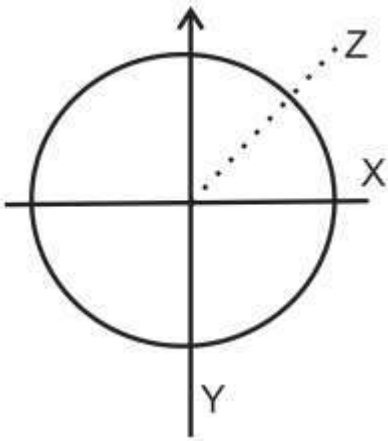
(for a body in XY plane )

- wherein

$I_z$  = moment of inertia about z axis

$I_X \cdot I_Y$  :moment of inertia about x & y axis in the plane of body respectively.

By perpendicular axis theorem



$$I_z = I_x + I_y$$

$$mR^2 = I + I$$

$$\Rightarrow 2I = MR^2$$

$$I = \frac{1}{2}MR^2$$

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**Q. 21** According to Torricelli's theorem velocity of efflux depends upon -

**Option 1:**

Nature of liquid

**Option 2:**

Quantity of liquid in the vessel

**Option 3:**

Area of orifice

**Option 4:**

Distance of hole from the free surface of liquid

**Correct Answer:**

Distance of hole from the free surface of liquid

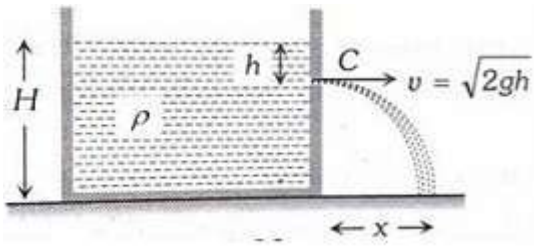
**Solution:**

As we learn

Torricelli's Theorem / Velocity of Efflux -

In fluid dynamics relating the speed of fluid flowing out of an orifice.

- wherein



Velocity of efflux only depends upon distance of hole from surface.

$$V \propto \sqrt{h}$$

**Q. 22** The direction of induced emf during electromagnetic induction is given by -

**Option 1:**

Newton's Law

**Option 2:**

Faraday's Law

**Option 3:**

Lenz's Law

**Option 4:**

Maxwell's Law

**Correct Answer:**

Lenz's Law

**Solution:**

As we have learnt,

Lenz's law -

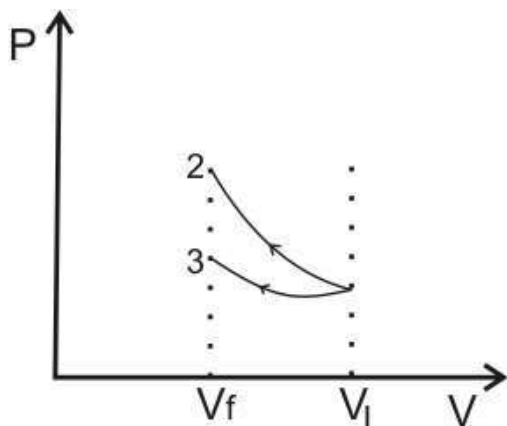
This law gives the direction of induced emf /induced current

- wherein

The direction of induced emf or current in a circuit is such as to oppose the cause that produces it.

Lenz's law gives the direction of induced emf.

**Q. 23** Choose the correct statement for the following graph. If gas is compressed either adiabatically or Isothermally.



**Option 1:**  
Process 1-2 is adiabatic.

**Option 2:**  
Process 1-2 is isothermal.

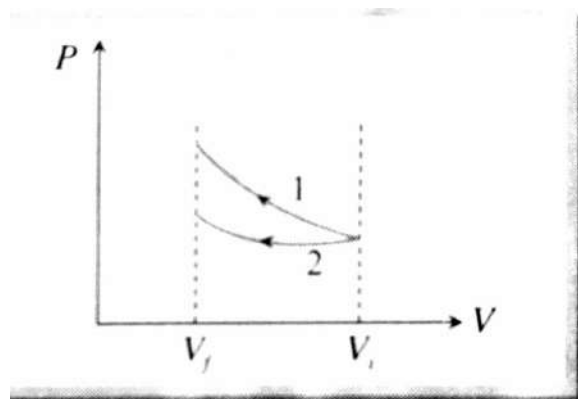
**Option 3:**  
Process 1-3 is adiabatic.

**Option 4:**  
Work done for (1-2) process and (1-3) process is same.

**Correct Answer:**  
Process 1-2 is adiabatic.

**Solution:**  
As we learned

Comparison between isothermal and adiabatic process in compression -



- wherein

$$\omega_{adia} > \omega_{isothermal}$$

$$P_{adia} > P_{isothermal}$$

$$T_{adia} > T_{isothermal}$$

During compression process from same state

$$P_{adiabatic} > P_{isothermal}$$

So (1-2) process is adiabatic

and (1-3) process is isothermal.

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**Q. 24** A positronium atom is a system that consists of a positron and an electron that orbit each other. Ratio of wavelength of spectral line of positronium to that of ordinary hydrogen is:

**Option 1:**

2:1

**Option 2:**

4:1

**Option 3:**

1:2

**Option 4:**

1:4

**Correct Answer:**

2:1

**Solution:**

As we learn

Effect of nucleus motion on energy of atom -

$$E_n^1 = E_n \left( \frac{m_N}{m_e + m_N} \right)$$

- wherein

$E_n^1$  = Energy of  $n^{\text{th}}$  orbital with nucleus motion

$E_n$  = Energy of  $n^{\text{th}}$  orbital without nucleus motion

$m_e$  = mass of electron

$m_N$  = mass of nucleus

since the two particle has same mass  $\mu = \frac{m * m}{m + m} = \frac{m}{2}$

since  $E_n \propto m$

$$\frac{E'_n}{E_n} = \frac{1}{2}$$

Hence energy level of positronium atom is half of the corresponding energy level in H-atom.

As a result the wavelength in the positronium atom spectral lines is twice those of corresponding lines in hydrogen spectrum.

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**Q. 25** The amount of active substance reduces to 1/64 of its initial value in 15 hours what is the half life ?

**Option 1:**  
5 hours

**Option 2:**  
30 hours

**Option 3:**  
15 hours

**Option 4:**  
2.5 hours

**Correct Answer:**  
2.5 hours

**Solution:**

As we learn

Half Life Time -

$$t_{1/2} = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda}$$

- wherein

Half life is time in which number of nuclei reduced to half of initial number of nuclei.

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{\frac{t}{T}} \Rightarrow \frac{1}{64} = \left(\frac{1}{2}\right)^{\frac{15}{T}}$$

$$\left(\frac{1}{2}\right)^6 = \left(\frac{1}{2}\right)^{\frac{15}{T}} \Rightarrow \frac{15}{T} = 6$$

$$\Rightarrow T = 2.5 \text{ hours}$$

---

**Q. 26** The difference between upper fix point and lower fix point in fahrenheit scale is

**Option 1:**

100<sup>0</sup>F

**Option 2:**

150<sup>0</sup>F

**Option 3:**

80<sup>0</sup>F

**Option 4:**

180<sup>0</sup>F

**Correct Answer:**

180<sup>0</sup>F

**Solution:**

As we learn

Fahrenheit Scale -

This scale of temperature has LFP as 32° f and UFP as 212°F.

-

$$VFP = 212^0F$$

$$LFP = 32^0F$$

$$VFP - LFP = (212 - 32) = 180^0F$$

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**Q. 27** n identical cells of internal resistance r is connected in series. The equivalent internal resistance is

**Option 1:**

$$nR$$

**Option 2:**

$$\frac{n}{r}$$

**Option 3:**

$$\frac{r}{n}$$

**Option 4:**

$$r$$

**Correct Answer:**

$$nR$$

**Solution:**

As we learned

Equivalent internal resistance -

$$R_{eq} = nR$$

-

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**Q. 28** Which of the following is true about ferromagnetic substance?

**Option 1:**

Magnetic moment is very high

**Option 2:**

example - aluminium

**Option 3:**

example - copper

**Option 4:**

value of relative permeability  $\mu < 1$

**Correct Answer:**

Magnetic moment is very high

**Solution:**

As we learn

Magnetic moment (m) -

Very high (In ferromagnetic substance)

-

Magnetic moment is very high for ferromagnetic substances.

---

**Q. 29** The electric field near a conducting surface having a uniform surface charge density  $\sigma$  is given by:

**Option 1:**

$\frac{\sigma}{\epsilon_0}$  and is parallel to the surface

**Option 2:**

$\frac{2\sigma}{\epsilon_0}$  and is parallel to the surface

**Option 3:**

$\frac{\sigma}{\epsilon_0}$  and is normal to the surface

**Option 4:**

$\frac{2\sigma}{\epsilon_0}$  and is normal to the surface

**Correct Answer:**

$\frac{\sigma}{\epsilon_0}$  and is normal to the surface

**Solution:**

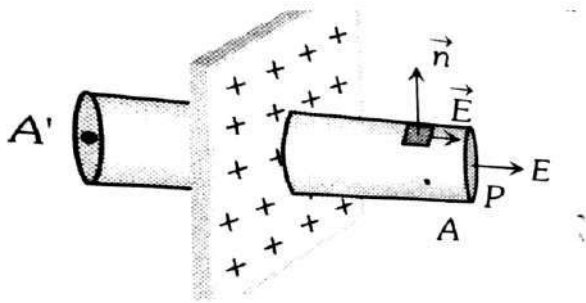
As we learn

Charge conducting surface -

$$E = \frac{\sigma}{\epsilon_0}$$

$$V = \frac{-\sigma r}{\epsilon_0} + c$$

- wherein



Electric field near a conducting surface.

$$E = \frac{\sigma}{\epsilon_0} \text{ [normal to the surface]}$$

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**Q. 30** The magnetic field of the earth is due to

**Option 1:**  
gravity of sun

**Option 2:**  
induction effect of sun

**Option 3:**  
motion and distribution of some material in and outside the earth

**Option 4:**  
interaction of cosmic rays

**Correct Answer:**  
motion and distribution of some material in and outside the earth

**Solution:**

As we have learned

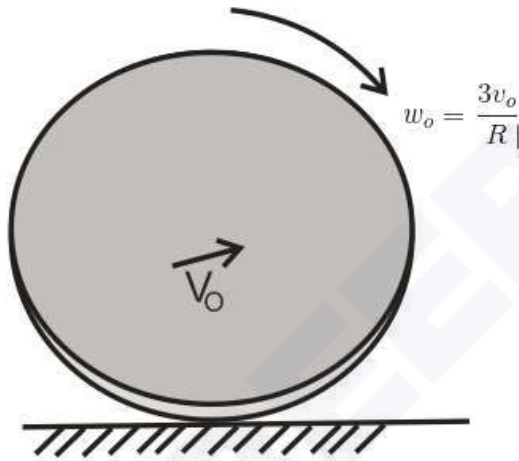
Earth's Magnetism -

The branch of Physics which deals with the study of Earth's magnetic field called Terrestrial magnetism.

- wherein

It is also known as geomagnetism.

- 
- Q. 31** The initial condition of the disc has shown in figure then the direction of friction on disc will be



**Option 1:**  
No friction

**Option 2:**  
forwards direction

**Option 3:**  
Backwards direction

**Option 4:**

upwards direction

**Correct Answer:**

forwards direction

**Solution:**

As we learned

Rolling motion -

$$V_{cm} = R\omega \rightarrow \text{pure rolling}$$

$$V_{cm} > R\omega \rightarrow \text{slipping motion}$$

$$V_{cm} < R\omega \rightarrow \text{skidding motion}$$

-

$$V_{cm} < R\omega$$

skidding motion so direction of friction will be in forwards direction

---

**Q. 32** The material which can be elastically stretched to the large value of strain are

**Option 1:**

Brittle material

**Option 2:**

Ductile material

**Option 3:**

Elastomer

**Option 4:**

Semi-plastic material

**Correct Answer:**

Elastomer

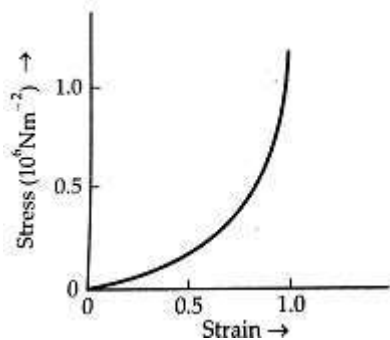
**Solution:**

As we learn

Elastomers -

The Materials which can be elastically stretched to large values of strain.

- wherein



**Q. 33** A resistance of  $40\ \Omega$  and inductance of  $\frac{1}{\pi}$  henry are connected in series in a 15 cycle/ second a.c circuit . The impedance of this combination is:

**Option 1:**

30 ohm

**Option 2:**

40 ohm

**Option 3:**

50 ohm

**Option 4:**

60 ohm

**Correct Answer:**

50 ohm

**Solution:**

As we learn

Impedence -

$$Z = \sqrt{R^2 + 4\pi^2\nu^2L^2}$$

-

$$\text{Impedance } Z = \sqrt{R^2 + L^2\omega^2} = \sqrt{(40)^2 + \left(\frac{1}{\pi} \times 2\pi \times 15\right)^2} = \sqrt{(40)^2 + (30)^2} = 50$$

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**Q. 34** The principle used in constant pressure gas thermometer is

*Option 1:*

$$P \propto T$$

*Option 2:*

$$P \propto V$$

*Option 3:*

$$V \propto T$$

*Option 4:*

$$P \propto n$$

*Correct Answer:*

$$V \propto T$$

**Solution:**

As we learn

Constant Pressure gas Temperature -

$$V \propto T \text{ (P=constant)}$$

$$t = \frac{V - V_0}{V_{100} - V_0} \times 100^\circ C$$

-

P is constant so  $V \propto T$

---

**Q. 35** For a perfect reflector the reflecting power is equal to-

**Option 1:**

Zero

**Option 2:**

Between 0 and 1

**Option 3:**

One

**Option 4:**

Infinite

**Correct Answer:**

One

**Solution:**

As we learn

$a = t = 0 -$

$r = 1$

- wherein

body is perfect reflection

For perfect reflection

$$r = \frac{Q_r}{Q} = 1$$

---

**Q. 36** A car starts from rest . Its velocity after 5 sec is 10 m/s then the average acceleration of car is

**Option 1:**

5 m/s

**Option 2:**

1 m/s

**Option 3:**

2 m/s

**Option 4:**

3 m/s

**Correct Answer:**

2 m/s

**Solution:**

As we have learned

Positive Acceleration -

If final velocity is greater than initial velocity.

For:  $V_2 > V_1$

- wherein

When a bus speeds up.

acceleration = change in velocity / time

$$v_2 - v_1 / t_2 - t_1$$

acceleration is positive

$$= v_2 > v_1$$

$$a = 10 - 0 / 5 = +2 \text{ m/s}$$

---

**Q. 37** Choose the correct statement regarding entropy

**Option 1:**

It is a measure of disorder of molecular motion of a system.

**Option 2:**

Greater the disorder, greater the entropy

**Option 3:**

It is given as  $\left( ds = \frac{dQ}{T} \right)$

**Option 4:**

All of these

**Correct Answer:**

All of these

**Solution:**

As we learned

Entropy -

It is a measure of disorder of molecular motion of a system.

- wherein

Greater is disorder greater is entropy

$$dS = \frac{dQ}{T}$$

---

**Q. 38** You are given that mass of  ${}^7_3\text{Li} = 7.0160u$

mass of  ${}^4_2\text{He} = 4.0020u$

mass of  ${}^1_1\text{H} = 1.0079u$

When 20g of  ${}^7_3\text{Li}$  is converted into  ${}^4_2\text{He}$  by proton capture, the energy liberated (in kWh), is:- (mass of nucleon =  $1 \frac{\text{GeV}}{c^2}$ )

**Option 1:**

$$8 \times 10^6$$

**Option 2:**

$$1.33 \times 10^6$$

**Option 3:**

$$4.5 \times 10^5$$

**Option 4:**

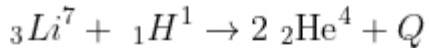
$$6.82 \times 10^5$$

**Correct Answer:**

$$1.33 \times 10^6$$

**Solution:**

The nuclear reaction is



Mass defect,  $\Delta m = m_{\text{Li}} + m_p + 2m_{\text{He}}$

$$\Rightarrow \Delta m = 7.0160 + 1.0079 - 2 \times 4.0026 = 0.0187 \text{ a.m.u}$$

$$Q = 0.0187 \times 931 \text{ MeV} = 17.40 \text{ MeV}$$

$$\text{Number of nuclei in 20g of } {}_3\text{Li}^7 = \frac{6.023 \times 10^{23}}{7} \times 20 = 1.72 \times 10^{24}$$

Total energy released when 20g of  ${}_3\text{Li}^7$  is converted into Helium,

$$Q = 17.40 \times 1.72 \times 10^{24} \text{ MeV} = 17.40 \times 1.72 \times 1.6 \times 10^{-13} \times 10^{24} \text{ J}$$

$$\text{As } 1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

$$\therefore E = \frac{17.40 \times 1.72 \times 1.6 \times 10^{11}}{3.6 \times 10^6} \text{ kWh}$$

$$E = 1.33 \times 10^6 \text{ kWh}$$

**Q. 39** The excess pressure inside a spherical drop of water is four times that of another drop. Then their respective radius ratio is

**Option 1:**

$$\frac{1}{2}$$

**Option 2:**

$$\frac{2}{1}$$

**Option 3:**

$$\frac{1}{4}$$

**Option 4:**

$$\frac{4}{1}$$

**Correct Answer:**

$$\frac{1}{4}$$

**Solution:**

As we learn

Pressure Difference in Water Droplet -

$$\Delta P = \frac{2T}{R}$$

- wherein

T- Temperature,

R- Radius

$$P_1 = \frac{2T}{R_1}$$

$$P_2 = \frac{P_1}{4} = \frac{2T}{R_2} \Rightarrow \frac{R_1}{R_2} = \frac{1}{4}$$

---

**Q. 40** Work done along a closed path will be zero for following forces.

**Option 1:**

Gravitational Force.

**Option 2:**

Elastic spring force

**Option 3:**

Electrostatic force.

**Option 4:**

All of these

**Correct Answer:**

All of these

**Solution:**

Work done by the Conservative Force depends only upon the initial and final position i.e. Gravitational Force, Electrostatic force, Elastic spring force.

All 3 forces are conservative forces and work done along a closed path for conservative force is zero.

## Chemistry

---

**Q. 1** Which of the following is not an use of  $H_2SO_4$

**Option 1:**

Used as an important lab reagent

**Option 2:**

Used in manufacture of pigments and paints intermediates

**Option 3:**

In lead storage battery

**Option 4:**

In fire extinguishers

**Correct Answer:**

In fire extinguishers

**Solution:**

Uses of Sulfuric acid -

In textile and paper industry

-

$H_2SO_4$  is not used in fire extinguishers. It is used in the manufacture of fertiliser, manufacture of pigments and paints intermediates, in lead storage battery.

Correct option is 4.

---

**Q. 2** The common name of  $C_6H_5COCH_3$  is

**Option 1:**

Benzophenone

**Option 2:**

Acetone

**Option 3:**

Acetophenone

**Option 4:**

Anisole

*Correct Answer:*  
Acetophenone

**Solution:**

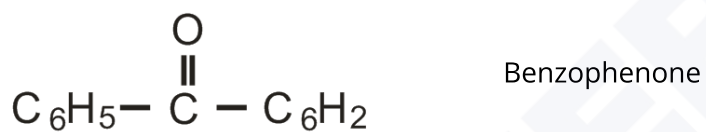
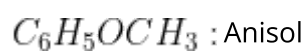
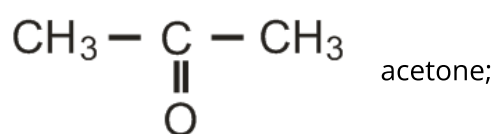
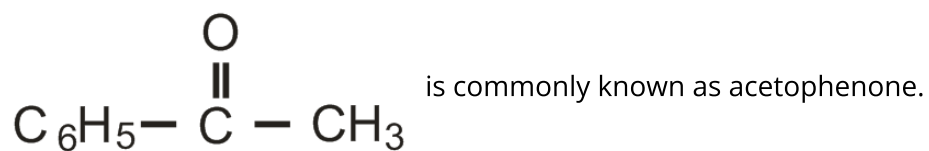
As we learned

Functional group -

## Priority or Seniority Table

Group	Prefix	Suffix
-COOH	carboxy	oic acid
-COOR	alkoxy carbonyl	oate
-SO <sub>3</sub> H	sulpho	sulphonic acid
-COX	halo formyl	oyl halide
-CONH <sub>2</sub>	carbamoyl	amide
-CHO	formyl or aldo	al
-CN	cyano	nitrile
-NC	isocyano	isonitrile
>C=O	keto or oxo	one
-OH	hydroxy	ol
-NH <sub>2</sub>	amino	amine
-OR	alkoxy	-
>C=C<	-	ene
-C≡C-	-	yne
-NO <sub>2</sub>	nitro	-
-X	halo(chloro, bromo, iodo)	-
-R	alkyl	-

- wherein



---

**Q. 3** The hybridisation and shape of  $\text{NH}_3$  molecule, are respectively.

**Option 1:**  
 $sp^2$ , tetrahedral

**Option 2:**  
 $sp^3$ , tetrahedral

**Option 3:**  
 $sp^2$ , Planar

**Option 4:**  
 $sp^3$ , pyramidal

**Correct Answer:**  
 $sp^3$ , pyramidal

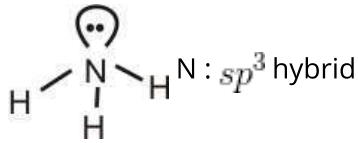
**Solution:**

As we learn

Structure of Ammonia -

N atom is  $sp^3$  hybridized with lone pair of electrons. Pyramidal in shape.

-



Shape: Pyramidal

---

**Q. 4** As it passes into the foodchain the concentration of DDT

**Option 1:**

Remains same

**Option 2:**

Decreases

**Option 3:**

Increases

**Option 4:**

Unpredictable

**Correct Answer:**

Increases

**Solution:**

As we learned from

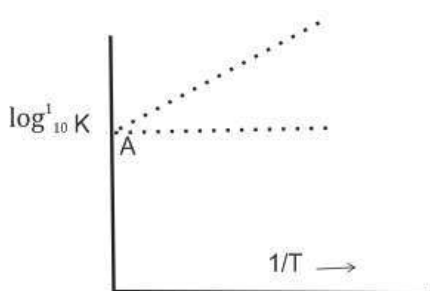
Insecticides -

used to control insects thus curbing diseases and protecting crops.

- wherein

(DDT) Dichloro diphenyl-trichloro ethane, Aldrin, dieldrin.

**Q. 5** Variation of  $\log_{10} K$  with  $\frac{1}{T}$  is shown by the following graph in which straight line is at  $45^\circ$ , hence  $\Delta H$  will be



**Option 1:**  
+4.606 cal

**Option 2:**  
-4.606 cal

**Option 3:**  
2 cal

**Option 4:**  
-2 cal

**Correct Answer:**  
-4.606 cal

**Solution:**  
as we learn

Thermodynamics of the reaction -

$$\Delta G < 0$$

- wherein

The reaction is spontaneous and proceeds in the forward direction.

$$\log K = \frac{-\Delta H^0}{2.303RT} + \frac{\Delta S^0}{R}$$

so

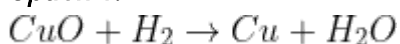
$$\frac{-\Delta H^0}{2.303R} = \tan 45^\circ$$

$$\Delta H^0 = -4.606 \text{ cal}$$

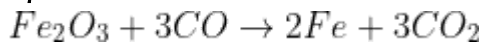
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**Q. 6** Which of the following is not an example of redox reaction ?

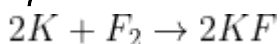
**Option 1:**



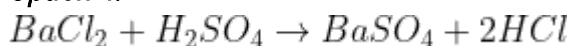
**Option 2:**



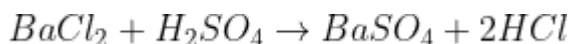
**Option 3:**



**Option 4:**



**Correct Answer:**



**Solution:**

As we learned

Redox Couple -

It is defined as having together the oxidized and reduced forms of a substance taking part in an oxidation or reduction half-reaction.

-

$\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$  is not an example of Redox Reaction.

---

**Q. 7** The correct order of acidic strength is

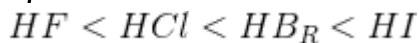
**Option 1:**



**Option 2:**



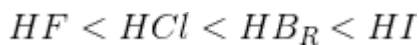
**Option 3:**



**Option 4:**



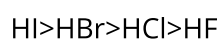
**Correct Answer:**



**Solution:**

As we learned

Acidic strength of Hydride -



- wherein

Increases down the group

As size of halogen atom increases the acidity of HX increases due to weaker bond. HI is most acid in this series.

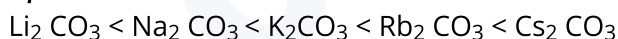
---

**Q. 8** The correct order of thermal stability of metal carbonates is :

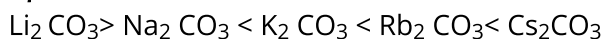
**Option 1:**



**Option 2:**



**Option 3:**



**Option 4:**



**Correct Answer:**



**Solution:**

As we learn

Nature of carbonates of alkali metals -

Thermal stability and solubility of carbonates increases on moving down the group

- wherein



Polarizing power ( $\phi$ ) of alkali metal cations decreases down the group so the stability of alkali metal carbonates increases down the group.

---

**Q. 9** Reaction of  $Cl_2$  with  $KI$  is a type of

**Option 1:**

Acid base reaction

**Option 2:**

Non redox reaction

**Option 3:**

A redox reaction

**Option 4:**

A disproportionation reaction

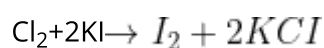
**Correct Answer:**

A redox reaction

**Solution:**

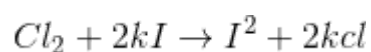
As we learned

Reaction of Chlorine with Potassium Iodide -



- wherein

$Cl_2$  oxidise the  $I^-$  into  $I_2$



$Cl_2$  is oxidising agent in this reaction .

This is a relax reaction

**Q. 10** Which of the following compound is prepared by Dow's process?

**Option 1:**

Benzene

**Option 2:**

Phenol

**Option 3:**

Aniline

**Option 4:**

Iodoform

**Correct Answer:**

Phenol

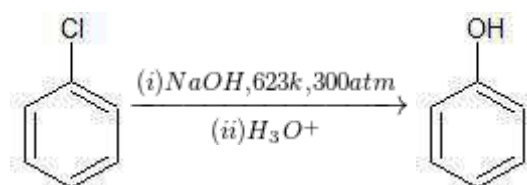
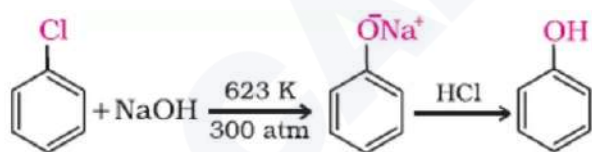
**Solution:**

As we learn

Dow's Reaction -

In this reaction, chlorobenzene is treated with NaOH at 573K 300 atm pressure.

- wherein



**Q. 11** What is the bond order of CO<sup>+</sup> molecules

**Option 1:**

2

**Option 2:**

2.5

**Option 3:**

3

**Option 4:**

3.5

**Solution:**

as we learn

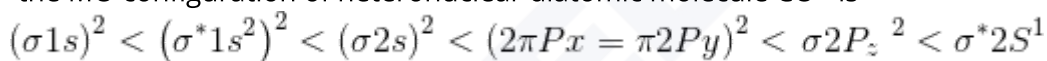
Bond Order -

Bond order is defined as one half the difference between the number of electrons present in the bonding and the antibonding orbitals.

- wherein

$$\text{Bond Order} = \frac{N_b - N_a}{2}$$

the MO configuration of heteronuclear diatomic molecule  $\text{CO}^+$  is



$$= \frac{1}{2 [N_b - N_a]} = \frac{[10 - 3]}{2} = 3.5$$

---

**Q. 12** Acetoxy benzoic acid is used as :

**Option 1:**

Antiseptic

**Option 2:**

Antidepressant

**Option 3:**

Antimalarial

**Option 4:**

Antipyretic

**Correct Answer:**

Antipyretic

**Solution:**

As we learn

Antipyretics -

Chemicals used to bring down the body temperature.

- wherein

Eg: Aspirin, Paracetamol

The chemicals which are used to bring down the body temperature are called Antipyretics.

---

**Q. 13** Which of the following property is shown by d-block elements

**Option 1:**  
paramagnetic compound

**Option 2:**  
coloured compound

**Option 3:**  
complex compound

**Option 4:**  
All of these

**Correct Answer:**  
All of these

**Solution:**

As we learn

Other properties of f - block elements. -

1. They are paramagnetic.
2. They form a coloured compound.
3. They have tendency to form complexes.

-

All of the given properties show by D- block elements.

---

**Q. 14** A reaction was found to be second order w.r.t the concentration of sulphur dioxide, if the concentration is double, with everything else kept same, the rate of reaction will be

**Option 1:**

Remain unchanged

**Option 2:**

Doubles

**Option 3:**

Tripled

**Option 4:**

Increased by a factor of 4

**Correct Answer:**

Increased by a factor of 4

**Solution:**

As we have learned

nth order reaction -

The rates of the reaction are proportional to the nth power of reactant

- wherein

Differential rate law

$$= \frac{dx}{dt} = k(a - x)^n$$

Integrated rate laws,

$$= \frac{1}{n-1} [(a-x)^{1-n} - a^{(1-n)}] = k_n t$$

a= initial, concentration of reactant at t=0 sec

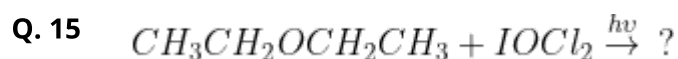
x= concentration of product formed at t= tsec

$$t_{\frac{1}{2}} = \frac{1}{(n-1)(a^{n-1})(k_n)} [2^{n-1} - 1]$$

Formulae for all the order except n=1

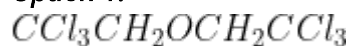
$$\text{rate} = dx/dt = k[SO_2]^2$$

change in concentration by 2 times , will increase the rate by 4 times

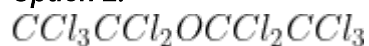


The product formed is

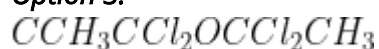
Option 1:



Option 2:



Option 3:



Option 4:

None of these

Correct Answer:



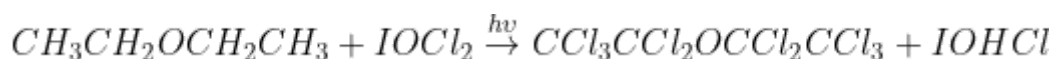
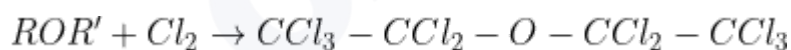
**Solution:**

As we learned

Perchlorodiethylether formation -

Ether reacts with  $Cl_2$  under sunlight.

- wherein



Pereblorodiethylether

Q. 16 Which of the following is an incorrect statement ?

**Option 1:**

A zero order reaction is always elementary reaction

**Option 2:**

Chemical kinetics predicts the rate and mechanism of the reaction

**Option 3:**

A zero order reaction is controlled by factor other than concentration of reactants

**Option 4:**

none

**Correct Answer:**

A zero order reaction is controlled by factor other than concentration of reactants

**Solution:**

As we have learned

Chemical Kinetics -

The branch of chemistry which predicts the rate and mechanism of a process

-

A zero order reaction is always elementary reaction of zero order reaction

$$\text{Rate} = k_0[A]^0[B]^0$$

---

**Q. 17** Which one correct regarding catalyst

**Option 1:**

a catalyst cannot participate in the secondary reaction

**Option 2:**

Catalyst helps to achieve the equilibrium faster

**Option 3:**

Enzymes are naturally occurring catalyst responsible for many essential reactions

**Option 4:**

Both B and C

**Correct Answer:**

Enzymes are naturally occurring catalyst responsible for many essential reactions

**Solution:**

As we have learned

Catalyst -

A catalyst is a substance that increases the rate of a chemical reaction without itself being used up. It remains unchanged chemically providing an alternate path for the reaction at an accelerated rate by lowering the activation energy.

properties of catalyst

---

**Q. 18** The metal can be twisted and drawn into wires because the metallic bond is

**Option 1:**  
directional

**Option 2:**  
non-directional

**Option 3:**  
not kernel

**Option 4:**  
none of these

**Correct Answer:**  
non-directional

**Solution:**

As we learn

Malleability and ductility -

Since the metallic bond is non-directional, metals can be twisted, drawn into wires. This is because the kernels can slip over each other when a deforming / force is applied.

-

Due to metallic bond is non-directional the kernels can slip over each other

---

**Q. 19** Quartz and Cristobalite are :

**Option 1:**  
Allotropes

**Option 2:**  
Polymorphs

**Option 3:**  
Amorphous silica

**Option 4:**  
Isotopes

**Correct Answer:**  
Polymorphs

**Solution:**

As we have learnt,

Polymorphism -

Usually referred to as solid allotropes

-

Silica is a solid material which is found in many forms. Quartz is the most common form of silica. Silica shows polymorphism. Quartz and cristobalite are two different forms of silica.

---

**Q. 20** Which of the following product will form , when alkyl halide is heated with silver cyanide in aqueous ethanolic solution?

**Option 1:**  
Alkyl cyanide

**Option 2:**  
Alkene

**Option 3:**  
Alkyl isocyanide

**Option 4:**  
Alkane

**Correct Answer:**  
Alkyl isocyanide

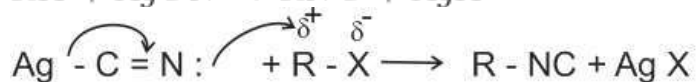
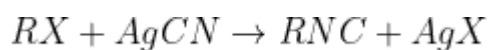
**Solution:**

As we learn:

Method of preparation of isocyanide from alkyl halide -

By heating an alkyl halide with silver cyanide in aqueous ethanolic solution.

- wherein



As CN is an ambident nucleophile and in case of AgCN, AgCN is covalent and CN is not free, hence attack takes place through nitrogen to give isocyanide.

---

**Q. 21** What are Si lanes

**Option 1:**  
Hydrocarbons

**Option 2:**  
Silicones

**Option 3:**  
Silicates

**Option 4:**  
Saturated hydrides of silicon

**Correct Answer:**  
Saturated hydrides of silicon

**Solution:**

As we learn

Silanes -

Hydrides of silicon, having general formula  $Si_n H_{2n+2}$

-

Saturated hydrides of silicon are called Silanes. general formula:  $Si_n H_{2n+2}$

Ex.  $SiH_4$ ,  $Si_2H_6$  etc

Correct option is 4

---

**Q. 22** Which of the following is an acidic amino acid?

**Option 1:**

Arginine

**Option 2:**

Valine

**Option 3:**

leucine

**Option 4:**

Glutamate

**Correct Answer:**

Glutamate

**Solution:**

As we learn

Classification of amino acids on the basis of side chain nature -

Acidic—*E, D*

Basic—*R, K, H*

Neutral- All the rest

-

Arginine is a basic amino acid.

Valine and leucine are neutral amino acids.

Glutamate is an acidic amino acid.

---

**Q. 23** For an adiabatic process, which is not correct

**Option 1:**

$$\Delta V = w$$

**Option 2:**

During adiabatic expansion, temp. of gas decreases

**Option 3:**

During adiabatic expansion, Temp. of gas increases

**Option 4:**

All are correct

**Correct Answer:**

During adiabatic expansion, Temp. of gas increases

**Solution:**

As we learn

Adiabatic Process -

Heat exchange between system and surrounding is zero i.e.  $q = 0$

- wherein

$$\Delta E = q + w$$

$$q = 0$$

$$\Delta E = w$$

During adiabatic compression temperature of gas increases.

---

**Q. 24** The hybridisation state of 'Be' in  $\text{BeCl}_2$  (solid) is:

**Option 1:**

Sp

**Option 2:**

$Sp^2$

**Option 3:**

$Sp^3$

**Option 4:**

$Sp^3d$

**Correct Answer:**

$Sp^3$

**Solution:**

Chlorides of Beryllium and aluminium -

Both have  $Cl^-$  bridged chloride structure in vapour phase, soluble in organic solvents and are strong Lewis acids

- wherein

They are used as Friedel-Crafts catalysts

$BeCl_{2(s)}$  exist in polymeric form as shown:

Hybridisation state of 'Be' is  $Sp^3$  in it.

---

**Q. 25** Which of the following elements impart 'apple green' colour in flame test?

**Option 1:**

Be

**Option 2:**

Mg

**Option 3:**

Ca

**Option 4:**

Ba

**Correct Answer:**

Ba

**Solution:**

As we learn

Flame colouration of alkaline earth metals -

Except Be and Mg, they impart colour to the flame

Ca- Brick red

Sr - Crimson red

Ba- Grassy green

Ra- Crimson

- wherein

Be and Mg require higher energies to excite electrons

Be and Mg do not give flame test

Ca → Brick red

Ba → Apple green colour

Flame colouration of alkaline earth metals -

Except Be and Mg, they impart colour to the flame

Ca- Brick red

Sr - Crimson red

Ba- Grassy green

Ra- Crimson

- wherein

Be and Mg require higher energies to excite electrons

**Q. 26** Catalyst used for the formation of Polyacrylonitrile

**Option 1:**  
organic peroxide

**Option 2:**  
sulphur dioxide

**Option 3:**  
ferrous sulphate

**Option 4:**  
polymerase

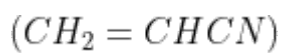
**Correct Answer:**  
ferrous sulphate

**Solution:**

As we have learned

Polyacrylonitrile -

- Addition polymerization of acrylonitrile



- Copolymer

- wherein

- Hard and horny



---

**Q. 27** Which of the following is not the characteristic of  $S_N^1$  reaction?

**Option 1:**

Inversion

**Option 2:**

Racemisation

**Option 3:**

Carbocation reaction intermediate

**Option 4:**

First order kinetics

**Correct Answer:**

Inversion

**Solution:**

As we learn

In  $S_N1$  reaction -

Racemisation take place

- wherein

The mixture of 50% dextro and 50% Laevo is called Racemic mixture.

Racemisation takes place in  $S_N^1$  reaction while inversion takes place in  $S_N^2$  reaction.

---

**Q. 28** The molarity of 0.006 moles of NaCl in 100 ml solutions in -

**Option 1:**

0.6

**Option 2:**

0.06

**Option 3:**

0.006

**Option 4:**

0.066

**Correct Answer:**

0.06

**Solution:**

As we learn

Molarity -

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Vol. of solution(L)}}$$

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Vol. of solution(L)}}$$

$$M = \frac{n}{V(l)} = \frac{0.006}{0.1} = 0.06$$

---

**Q. 29** For a isochoric process correct expression will be -

**Option 1:**

$$\Delta E = 0$$

**Option 2:**

$$q = 0$$

**Option 3:**

$$w = 0$$

**Option 4:**

All of these

**Correct Answer:**

$$w = 0$$

**Solution:**

As we learn

Reversible and Irreversible Isochoric process -

$$dv = 0$$

- wherein

$$W = -P_{ext} dV = 0$$

For Isochoric process

$$W = 0 \text{ (Zero)}$$

---

**Q. 30** Which is the most abundant metal on earth's crust?

**Option 1:**

Mg

**Option 2:**

Ca

**Option 3:**

Al

**Option 4:**

Fe

**Correct Answer:**

Al

**Solution:**

As we have learnt,

The occurrence of Aluminium -

Most abundant metal and third most abundant element on earth's crust.

- wherein

Important minerals are:

*Bauxite* –  $Al_2O_3 \cdot 2H_2O$

*Cryolite* –  $Na_3AlF_6$

*Corundum* –  $Al_2O_3$

*Diaspore – Al<sub>2</sub>O<sub>3</sub> · H<sub>2</sub>O*

'Al' is the most abundant metal and third most abundant element on earth's crust.

---

**Q. 31** Sucrose can be obtained largely from:

**Option 1:**

Sugar canes

**Option 2:**

Honey

**Option 3:**

Sugar beet

**Option 4:**

None of these

**Correct Answer:**

Sugar canes

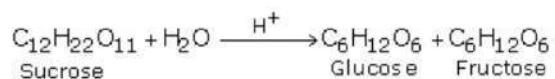
**Solution:**

As we learn

Preparation of glucose and fructose from sucrose ( cane sugar ) -

Sucrose is boiled with dilute *HCl* or *H<sub>2</sub>SO<sub>4</sub>* in alcoholic solution , glucose (dextrorotatory) and fructose (laevorotatory) are obtained in equal amount.

- wherein



Sugar canes are the largest raw material source for sucrose production.

---

**Q. 32** Which method is used for the quantitative estimation of halogen in an organic compound.

**Option 1:**

Dumas Method

**Option 2:**

Kjeldahl's Method

**Option 3:**

Carius Method

**Option 4:**

None

**Correct Answer:**

Carius Method

**Solution:**

As we learned

Carius method test for halogens -

$$\text{percentage of } X = \frac{\text{Atomic mass} \times m_1 \times 100}{\text{molecular mass of } AgX \times m}$$

- wherein

$$\% \text{ of Chlorine} = \frac{35.5 \times x}{143.5} \times \frac{100}{W}$$

$$\% \text{ of Bromine} = \frac{80 \times x}{188} \times \frac{100}{W}$$

$$\% \text{ of Iodine} = \frac{127}{235} \times \frac{\text{Mass of AgI}}{\text{Mass of substance taken}} \times 100$$

Carius method is used for the quantitative estimation of halogen in an organic compound.

**Q. 33** Which of the following metal hydride is covalent in nature?

**Option 1:**

BeH<sub>2</sub>

**Option 2:**

NaH

**Option 3:**

KH

**Option 4:**

CaH<sub>2</sub>

**Correct Answer:**

BeH<sub>2</sub>

**Solution:**

As we learn

Nature of hydride of alkaline earth metals -

Beryllium and magnesium hydride are covalent .

Ca, Sr and Ba hydrides are ionic

-

Hydrides of Be and Mg form covalent due to high charge density and polarizing power of Be<sup>+2</sup> and Mg<sup>+2</sup>.

---

**Q. 34**  $H_2 + 2Mg \rightarrow 2MH$ ; M is metal

This reaction is possible at

**Option 1:**

Low temperature

**Option 2:**

room temperature

**Option 3:**

High temperature

**Option 4:**

Not possible

**Correct Answer:**

High temperature

**Solution:**

As we learnt

Chemical Properties -

Reaction with metal.

It reacts with metal to form metal hydride.

Hydrogen combines with many metals at a high temperature to yield the corresponding Hydrides.

---

**Q. 35** Which of the aqueous solution is coloured?

**Option 1:**

$Zn(NO_3)_2$

**Option 2:**

$LiNO_3$

**Option 3:**

$Co(NO_3)_2$

**Option 4:**

Potassium

**Correct Answer:**

$Co(NO_3)_2$

**Solution:**

As we learn

Color of 'd' block elements complexes -

Generally,  $d^1$ - $d^9$  electronic configured metal complex show color according to the

$$E = hv$$

$$\therefore v = \frac{c}{\lambda}, E = \frac{hc}{\lambda}$$

-

Generally,  $d^{1-9}$  electronic configured metal complex show color according to the

$$E = hv$$

$$\therefore v = \frac{c}{\lambda}, E = \frac{hc}{\lambda}$$

---

**Q. 36** Calculate the mole fraction of HCl in a solution of HCl in water, containing 36 % HCl by weight

**Option 1:**

0.78

**Option 2:**

0.22

**Option 3:**

0.44

**Option 4:**

0.56

**Correct Answer:**

0.22

**Solution:**

As we learned from

Mole Fraction -

It is ratio of moles of solute or moles of solvent to moles of solution.

- wherein

If a substance 'A' dissolves in substance 'B' and their number of moles are  $n_A$  and  $n_B$  respectively; then the mole fractions of A and B are given as

Mole fraction of A = (number of moles of A)/(number of moles of solution) =  $n_A/(n_A + n_B)$

Moles of HCl = 36 g of HCl  $\times$  1 mole of HCl /36.5 g of HCl

= 0.99 moles of HCl

Moles of water = 64 g of H<sub>2</sub>O  $\times$  1 mole of water / 18 g of H<sub>2</sub>O

= 3.6 moles of H<sub>2</sub>O

mole fraction of HCl = 0.99 / 0.99 + 3.6 = 0.22

---

**Q. 37** Which statement is correct?

**Option 1:**

Synthesis of Buna-S needs nascent oxygen

**Option 2:**

Buna -S is a synthetic and linear thermosetting polymer

**Option 3:**

Buna -N is a natural polymer

**Option 4:**

Neoprene is an addition copolymer used in plastic bucket manufacturing

**Correct Answer:**

Synthesis of Buna-S needs nascent oxygen

**Solution:**

Synthesis of Buna-S needs nascent oxygen.

Buna -S is a synthetic and Elastomers.

Buna -N is a Synthetic polymer

Neoprene is an addition copolymer used for manufacturing conveyor belts, gaskets and hoses.

**Therefore, option 1 is correct.**

---

**Q. 38** Which of the following is not applicable to Chemisorption ?

**Option 1:**

Effect of pressure is given by Freundlich adsorption isotherm

**Option 2:**

It occurs at light temperature

**Option 3:**

these is formation of mononuclear layer

**Option 4:**

If involves the formation of chemical bond

**Correct Answer:**

Effect of pressure is given by Freundlich adsorption isotherm

**Solution:**

As we learned from

Characteristics of Chemisorption -

High specificity

- wherein

Chemisorption is highly specific and it will only occur if there is some possibility of chemical bonding between adsorbent and adsorbate.

---

**Q. 39** The most convenient laboratory method for the preparation of diborane is

**Option 1:**

Reduction of  $BF_3$  with  $LiAlH_4$

**Option 2:**

Reduction of  $BCl_3$  with  $LiAlH_4$

**Option 3:**

Reduction of  $BF_3$  with  $NaH$

**Option 4:**

Oxidation of  $NaBH_4$  with Iodine.

**Correct Answer:**

Oxidation of  $NaBH_4$  with Iodine.

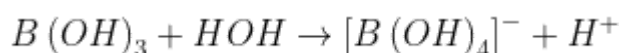
**Solution:**

As we have learnt,

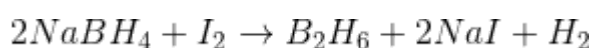
Boric Acid as Lewis Acid -

Weak monobasic acid. Does not liberate hydrogen ion but accepts a hydroxyl ion.

- wherein



$LiAlH_4$  is expensive and difficult to handle. The convenient method of preparation  $B_2H_6$  is oxidation of  $NaBH_4$  with  $I_2$



---

**Q. 40** The correct formul of % ionic character

**Option 1:**

$$\frac{2 \times \text{observed ipole moment}}{\text{Expected dipole moment}}$$

**Option 2:**

$$\frac{2 \times \text{Expected dipole moment}}{\text{Observed dopole moment}}$$

**Option 3:**

$$\frac{\text{Expected dipole moment}}{\text{Observed dopole moment}} \times 100$$

**Option 4:**

$$\frac{\text{Observrd dipole moment}}{\text{Expected dipole moment}} \times 100$$

**Correct Answer:**

$$\frac{\text{Observrd dipole moment}}{\text{Expected dipole moment}} \times 100$$

**Solution:**

as we learn

Percentage ionic character -

$$\% \text{ ionic character} = \frac{\text{Observed dipole moment}}{\text{Expected dipole moment}} \times 100$$

## Maths

**Q. 1** The greatest coefficient in the expansion of  $(1 + x)^{2n+2}$  is

**Option 1:**  

$$\frac{(2n)!}{n!^2}$$

**Option 2:**  

$$\frac{(2n + 2)!}{[(n + 1)!]^2}$$

**Option 3:**  

$$\frac{(2n + 2)!}{n!(n + 1)!}$$

**Option 4:**  

$$\frac{(2n)!}{n!(n + 1)!}$$

**Correct Answer:**  

$$\frac{(2n + 2)!}{[(n + 1)!]^2}$$

**Solution:**

As we learned

Greatest Binomial Coefficient -

In Binomial expansion of  $(x + a)^n$  greatest coefficient is  ${}^n C_{\frac{n}{2}}$  when  $n$  is even

and  ${}^n C_{\frac{n+1}{2}}$  &  ${}^n C_{\frac{n-1}{2}}$  When  $n$  is odd.

- wherein

$$\therefore {}^n C_{\frac{n+1}{2}} = {}^n C_{\frac{n-1}{2}}$$

∴  $n$  is even so greatest coefficient in

$$(1+x)^{2n+2} \text{ is } {}^{2n+2}C_{n+1} = \frac{(2n+2)!}{[(n+1)!]^2}$$

**Q. 2** What is the perpendicular from origin on the line given by:

$$x - y + 2 = 0$$

**Option 1:**

$$\sqrt{3}$$

**Option 2:**

$$2$$

**Option 3:**

$$\sqrt{2}$$

**Option 4:**

None of these

**Correct Answer:**

$$\sqrt{2}$$

**Solution:**

As we learned

General form of the equation of a line -

$$\text{In } Ax + By + C = 0$$

$$\cos \omega = \frac{\pm A}{\sqrt{A^2 + B^2}}; \sin \omega = \frac{\pm B}{\sqrt{A^2 + B^2}} \text{ and}$$

$$\rho = \frac{\pm C}{\sqrt{A^2 + B^2}}$$

- wherein

$\rho$  is the length of perpendicular segment from origin and  $\omega$  is the angle made by this perpendicular with +ve  $x$ -axis.

We have  $P = \frac{\pm C}{\sqrt{A^2 + B^2}}$

$$P = \frac{\pm 2}{\sqrt{1+1}} = \pm\sqrt{2}$$

---

**Q. 3** Order of the family of the curve  $y = c_1x + (c_2 + c_3)e^x + c_4e^{x+c_5}$

**Option 1:**  
2

**Option 2:**  
3

**Option 3:**  
4

**Option 4:**  
5

**Correct Answer:**  
2

**Solution:**

As we learnt

Differential Equation of order n -

$$f(x, y, c_1, c_2, c_3 \dots, c_n) = 0$$

where  $c_1, c_2, c_3 \dots c_n$  are n arbitrary constants, we have to eliminate the n constants for which we require (n+1) equations

-

Here the no of arbitrary constants is 4

But the order of D.E is not 4

Eqn can be written as

$$y = c_1x + (c_2 + c_3 + c_4e^{c_5}) e^x$$

$$y = c_1x + Ae^x$$

Hence the order of D.E is 2

---

**Q. 4** What is the name of the description in which the value of a random variable together with the corresponding probabilities are given

**Option 1:**

Probability distribution of the random variables

**Option 2:**

Probability of a random variable

**Option 3:**

Distribution table of a random variable

**Option 4:**

None of these

**Correct Answer:**

Probability distribution of the random variables

**Solution:**

As we learned

Probability Distribution of the Random Variable -

If the value of a random variable together with the corresponding probabilities are given then this description is called a probability distribution of the random variable.

-

---

**Q. 5** One of the root of eq  $x^3 - 3x^2 - 3x + 1 = 0$  is

**Option 1:**

$\tan 15^\circ$

**Option 2:**

$\tan 20^\circ$

**Option 3:**

$$\tan 30^\circ$$

**Option 4:**

none of these

**Correct Answer:**

$$\tan 15^\circ$$

**Solution:**

As we have learned

Trigonometric Ratios of Submultiples of an Angle -

$$\sin A = 3 \sin \frac{A}{3} - 4 \sin^3 \frac{A}{3}$$

$$\cos A = 4 \cos^3 \frac{A}{3} - 3 \cos \frac{A}{3}$$

$$\tan A = \frac{3 \tan \frac{A}{3} - \tan^3 \frac{A}{3}}{1 - 3 \tan^2 \frac{A}{3}}$$

- wherein

This shows the formulae for one-third angles and their triples.

$$\tan A = \frac{3 \tan A/3 - \tan^3 A/3}{1 - 3 \tan^2 A/3}$$

$$\text{put } A/3 = 15^\circ$$

$$A = 45^\circ$$

Hence we will get the given equation

**Q. 6** Find the cumulative relative frequency distribution of the following and hence find it for  $x=2$

x	0	1	2	3
f	2	7	6	5
$f_r$	$\frac{2}{20}$	$\frac{7}{20}$	$\frac{6}{20}$	$\frac{5}{20}$

**Option 1:**

0.6

**Option 2:**

0.3

**Option 3:**

0.75

**Option 4:**

None of these

**Correct Answer:**

0.75

**Solution:**

As we learned

Cumulative relative frequency distribution -

The cumulative relative frequency of any value is similarly defined as the relative frequency of the value plus the relative frequencies of all smaller values.

ex:	x	$1/N=f_r$	c.r.f
	0	0.08	0.08
	1	0.16	0.24
	2	0.16	0.40
	3	0.24	0.64

for  $x=2$ ,  $C \cdot R \cdot F = \frac{2}{20} + \frac{7}{20} + \frac{6}{20}$

0.75

---

**Q.7**  $\frac{d}{dx} \left( \frac{\sin x \cos x + 9}{\cos x} \right)$

**Option 1:**

$$\cos x + 9 \sec x \tan x$$

**Option 2:**

$$-\cos x - 9 \sec x$$

**Option 3:**

$$\cos x - 9 \sec x \tan x$$

**Option 4:**

$$\cos x + 9 \tan^2 x$$

**Correct Answer:**

$$\cos x + 9 \sec x \tan x$$

**Solution:**

As we learned

Trigonometric functions -

$$\frac{d}{dx}(\sin x) = \cos x$$

$$\frac{d}{dx}(\sec x) = \sec x \tan x$$

$$\frac{d}{dx}(\operatorname{cosec} f(x)) = -\operatorname{cosec} \{f(x)\} \cot \{f(x)\} f'(x)$$

$$\frac{d}{dx} \left( \frac{\sin x \cos x + 9}{\cos x} \right)$$

$$\frac{d}{dx} (\sin x + 9 \sec x)$$

$$= \cos x + 9 \sec x \tan x$$

---

**Q. 8** Find the inverse of the matrix  $ABDC$ . Where  $A, B, C$  and  $D$  are square matrix of order 3.

**Option 1:**

$$A^{-1}B^{-1}C^{-1}D^{-1}$$

**Option 2:**

$$D^{-1}C^{-1}B^{-1}A^{-1}$$

**Option 3:**

$$C^{-1}D^{-1}B^{-1}A^{-1}$$

**Option 4:**

$$C^{-1}D^{-1}B^{-1}A^{-1}$$

**Correct Answer:**

$$C^{-1}D^{-1}B^{-1}A^{-1}$$

**Solution:**

As we have learnt

Reversal law -

$$(AB)^{-1} = B^{-1}A^{-1}$$

- wherein

$A$  and  $b$  are invertible matrices of same order

$$(ABDC)^{-1} = C^{-1}D^{-1}B^{-1}A^{-1}$$

---

**Q. 9** If  $\sin \frac{A}{3} = \frac{1}{5}; 0^\circ < A < 90^\circ$ , then  $\tan A =$

**Option 1:**

$$\frac{71}{48\sqrt{6}}$$

**Option 2:**

$$\frac{1}{2\sqrt{6}}$$

**Option 3:**

$$\frac{71}{42\sqrt{6}}$$

**Option 4:**

$$\frac{71}{\sqrt{6}}$$

**Correct Answer:**

$$\frac{71}{42\sqrt{6}}$$

**Solution:**

As we have learnt

Trigonometric Ratios of Submultiples of an Angle -

$$\sin A = 3 \sin \frac{A}{3} - 4 \sin^3 \frac{A}{3}$$

$$\cos A = 4 \cos^3 \frac{A}{3} - 3 \cos \frac{A}{3}$$

$$\tan A = \frac{3 \tan \frac{A}{3} - \tan^3 \frac{A}{3}}{1 - 3 \tan^2 \frac{A}{3}}$$

- wherein

This shows the formulae for one-third angles and their triples.

$$\cos \frac{A}{3} = \sqrt{1 - \sin^2 \frac{A}{3}} = \sqrt{1 - \frac{1}{25}} = \frac{2\sqrt{6}}{5}; \tan \frac{A}{3} = \frac{1}{2\sqrt{6}}; \text{ So } \tan A = \frac{3 \times \frac{1}{2\sqrt{6}} - \frac{1}{8 \times 6\sqrt{6}}}{1 - 3 \times \frac{1}{24}} = \frac{71}{42\sqrt{6}}$$

**Q. 10** Position vector of P is (where O is the origin):

*Option 1:*

$$\vec{PO}$$

*Option 2:*

$$\vec{OP}$$

*Option 3:*

$$-\vec{PO}$$

*Option 4:*

$$\vec{OP} - \vec{PO}$$

**Correct Answer:**

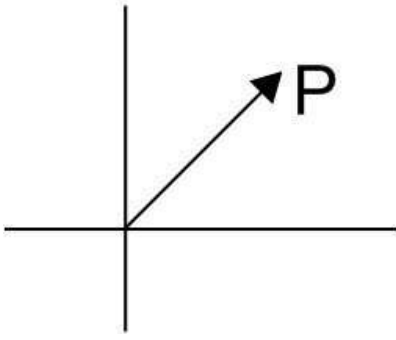
$$\vec{OP}$$

**Solution:**

As we have learnt

Position vector -

Let O be a fixed origin, then position vector of P is  $\vec{OP}$



Q. 11

Which one of the following is the factor of the determinant  $\begin{vmatrix} x & 7 & 3 \\ x^2 & 11 & 9 \\ x^3 & 13 & 27 \end{vmatrix}$

**Option 1:**

x-3

**Option 2:**

x+3

**Option 3:**

x-4

**Option 4:**

both (a) and (c)

**Correct Answer:**

x-3

**Solution:**

As we have learnt

Property of determinant -

If a determinant  $d$  become 0 for  $x = a$ , then  $(x - a)$  is a factor of  $d$ , in other words if two rows ( or two columns ) becomes identical for  $x = a$ , Then  $(x - a)$  is a factor of  $d$

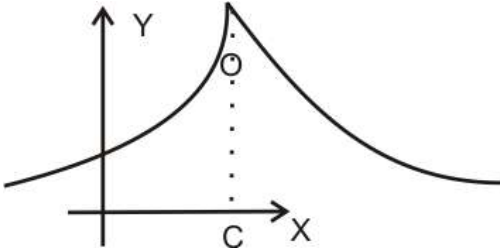
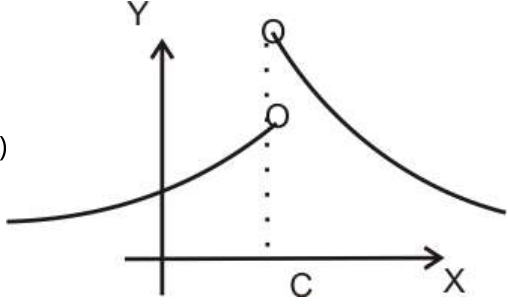
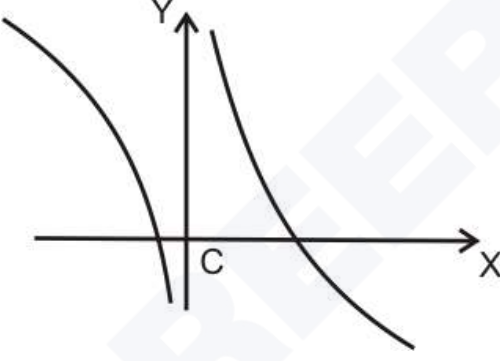
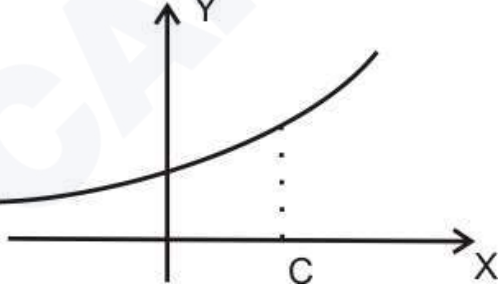
If you put  $x = 3$  then  $C_1$  and  $C_3$  will be same.

So,  $\Delta = 0$

Hence (x-3) is a factor.

correct option a.

Q. 12 Match the column

<p>(i)</p> 	<p>(p)</p> <p>function is defined at <math>x=c</math></p>
<p>(ii)</p> 	<p>(q) function is not defined at <math>x=c</math></p>
<p>(iii)</p> 	
<p>(iv)</p> 	

**Option 1:**

(i) – (p), (ii) – (q), (iii) – (p), (iv) – (q)

**Option 2:**

(i) – (p), (ii) – (q), (iii) – (q), (iv) – (p)

**Option 3:**

(i) – (q), (ii) – (p), (iii) – (q), (iv) – (p)

**Option 4:**

None of these

**Correct Answer:**

(i) – (p), (ii) – (q), (iii) – (q), (iv) – (p)

**Solution:**

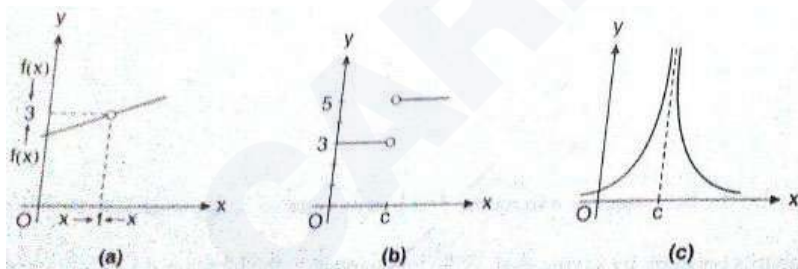
As we learned

Condition for Geometrical Limit -

In fig(a),  $f(x)$  is not defined at  $x = 1$ , for  $f(x) = \frac{x^2 + x - 2}{x - 1}$ .

Fig(b) & Fig(c) show the graphs of two functions that do not possess a limit as  $x$  approaches  $c$ .

- wherein



**Q. 13**  $\vec{a}, \vec{b}, \vec{c}$  are three vectors, such that  $\vec{a} + \vec{b} + \vec{c} = 0$ ,  $|\vec{a}| = 1$ ,  $|\vec{b}| = 2$ ,  $|\vec{c}| = 3$ , then  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$  is equal to

**Option 1:**

-7

**Option 2:**

7

**Option 3:**

1

**Option 4:**

0

**Correct Answer:**

-7

**Solution:**

$$\vec{a} + \vec{b} + \vec{c} = 0$$

$$|\vec{a}| = 1; |\vec{b}| = 2; |\vec{c}| = 3$$

$$(\vec{a} + \vec{b} + \vec{c})^2 = 0$$

$$|\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{a} \cdot \vec{c}) = 0$$

$$1 + 4 + 9 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0$$

$$2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = -14$$

$$(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = -7$$

---

**Q. 14** A is skew-symmetric matrix of order n and X is 1xn column matrix, then  $XAX^T$  is

**Option 1:**

Identity matrix

**Option 2:**

Null matrix

**Option 3:**

Matrix is invertible.

**Option 4:**

$-I$  (Identity matrix)

**Correct Answer:**

Null matrix

**Solution:**

As we have learnt

Property of Transpose -

$$(\alpha A)' = \alpha A'$$

$$(AB)' = B' A'$$

- wherein

$\alpha$  being scalar ;  $A'$  is transpose of A

X is 1 x n matrix ,  $X^T$  is n x 1 matrix and A is n x n matrix so,  $XAX^T$  is 1 x 1 matrix.

$$\text{Let } XAX^T = \lambda$$

$$(XAX^T)^T = (X^T)^T(A)^T(X)^T \text{ (Since } A^T = -A)$$

$$= X(-A)X^T = -XAX^T$$

$$[\lambda] = -[\lambda]$$

$$\lambda = 0$$

$XAX^T$  is null matrix.

**Q. 15**  $a(n) = 1 + 1/2 + 1/3 + 1/4 + \dots + 1/2^n - 1$  then

**Option 1:**

$$a(100) < 100$$

**Option 2:**

$$a(100) > 100$$

**Option 3:**

$$a(200) < 100$$

**Option 4:**

$$a(200) > 100$$

**Correct Answer:**

$$a(100) < 100$$

**Solution:**

As we have learned

Divisibility -

To show that an expression is divisible by an integer.

We write

$$\begin{aligned} a^{pn+r} &= a^{pn} \cdot a^r \\ &= (a^p)^n \cdot a^r \end{aligned}$$

- wherein

If a, p, n, r are positive integers.

with the help of mathematical induction

$$n/2 > a(n) < n$$

$$200/2 < a(2a)$$

$$a(200) > 100$$

$$\text{and } a(100) < 100$$

---

**Q. 16** A vector of magnitude 3 units in y-axis is :

**Option 1:**

$$3\hat{i}$$

**Option 2:**

$$3\hat{j}$$

**Option 3:**

$$3\hat{k}$$

**Option 4:**

$$-3\hat{j}$$

**Correct Answer:**

$$3\hat{j}$$

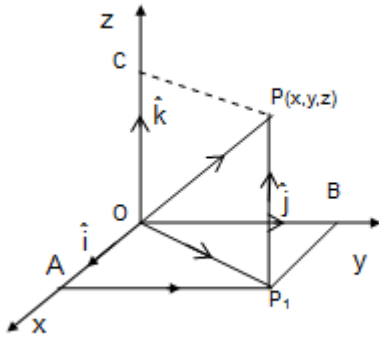
**Solution:**

As we have learnt

Regular Cartesian System -

In three dimensional co-ordinate system, unit vectors in direction of positive x, y, z axis are  $\hat{i}$ ,  $\hat{j}$  and  $\hat{k}$  respectively.

- wherein



**Q. 17** While withdrawing a card from deck of 52 cards

A = set of face cards ,

B = set of numbered cards ,

C = set of red cards ,

D = set of black cards

which are exhaustive sets

**Option 1:**

A,B,and C

**Option 2:**

C , D

**Option 3:**

B ,D

**Option 4:**

A,C,D

**Correct Answer:**

A,B,and C

**Solution:**

As we learned that

Exhaustive events -

A set of events is said to be exhaustive if one them must necessarily happen every time the experiment performed.

Let

$S = \{1, 2, 3, 4, 5, 6\}$  then  $A = \{1, 2\}$ ,  $B = \{3, 4, 5, 6\}$  therefore  $A \cup B = \{1, 2, 3, 4, 5, 6\} = S$

---

**Q. 18** In  $\Delta ABC$ ;  $A = (3, 5)$ ,  $B = (1, 2)$ ,  $C = (8, 8)$  find the centroid of this  $\Delta ABC$

**Option 1:**

(1,2)

**Option 2:**

(4,5)

**Option 3:**

(5,4)

**Option 4:**

(2,2)

**Correct Answer:**

(4,5)

**Solution:**

As we have learned

Centroid formula -

$$\left( \frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$$

- wherein

$A(x_1, y_1)$ ;  $B(x_2, y_2)$  and  $C(x_3, y_3)$  are the vertices of  $\Delta ABC$ .

Centroid of a ABC

$$\begin{aligned} & ((x_A + x_B + x_C)/3, (y_A + y_B + y_C/3)) \\ &= \left( \frac{3 + 1 + 8}{3}, \frac{5 + 2 + 8}{3} \right) = (4, 5) \end{aligned}$$

**Q. 19** The value of  $C_0 + 3C_1 + 5C_2 + \dots + (2n + 1)C_n$  is equal to

**Option 1:**

$$2^n$$

**Option 2:**

$$2^n + n \cdot 2^{n-1}$$

**Option 3:**

$$2^n(n + 1)$$

**Option 4:**

None of these

**Correct Answer:**

$$2^n(n + 1)$$

**Solution:**

As we learted

Properties of Binomial Theorem -

$${}^n C_r = \frac{n}{r} {}^{n-1} C_{r-1} = \frac{n}{r} \cdot \frac{n-1}{r-1} {}^{n-2} C_{r-2} \text{ and so on...}$$

We have

$$\begin{aligned} & C_0 + 3C_1 + 5C_2 + \dots + (2n + 1)C_n \\ &= \sum_{r=0}^n (2r + 1)C_r = \sum_{r=0}^n (2r + 1)^n C_r = \sum_{r=0}^n 2r {}^n C_r + \sum_{r=0}^n {}^n C_r \\ &= 2 \cdot \sum_{r=1}^n r \cdot \frac{n}{r} \cdot {}^{n-1} C_{r-1} + \sum_{r=0}^n {}^n C_r = 2n \sum_{r=1}^n {}^{n-1} C_{r-1} + \sum_{r=0}^n {}^n C_r \\ &= 2n[(1 + 1)^{n-1}] + [1 + 1]^n = 2n \cdot 2^{n-1} + 2^n = 2^n \cdot [n + 1]. \end{aligned}$$

Trick : Put  $n = 1$  in given expansion  ${}^1C_0 + 3.{}^1C_1 = 1 + 3 = 4$ .

Which is given by option (c)  $2^n.(n + 1) = 2^1(1 + 1) = 4$

---

**Q. 20** Find  $k$  and  $l$  such that  $f(x) = x^2 - 1$  is written as  $k \leq f(x) \leq l$  for  $x \in [-1, 2]$ .

**Option 1:**

$$k = 1, l = 3$$

**Option 2:**

$$k = 0, l = 4$$

**Option 3:**

$$k = -1, l = 3$$

**Option 4:**

$$k = l = 2$$

**Correct Answer:**

$$k = -1, l = 3$$

**Solution:**

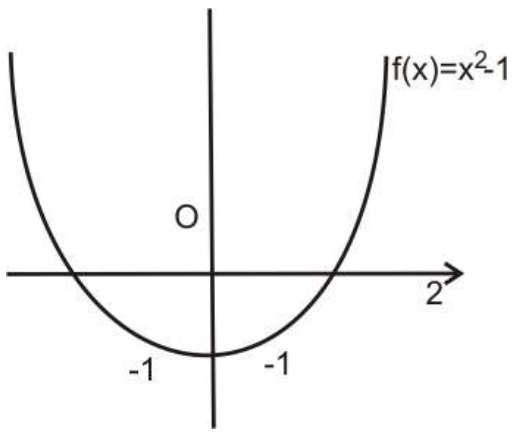
As we have learnt,

Properties of Continuous function -

If a function  $f$  is continuous on a closed interval  $[a, b]$ , then it is bounded on  $(a, b)$  and there exists real number  $k$  and  $K$  such that

$$k \leq f(x) \leq K \text{ for all } x \in [a, b]$$

-



So,

$$k = 0^2 - 1 = -1$$

$$l = 2^2 - 1 = 3$$

**Q. 21** Find the equation of plane bisecting the angle b/w the plane  
 $r \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 5$  and  $r \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 3$

**Option 1:**

$$r \cdot (2\hat{i} - 3\hat{j} + \hat{k}) = 1/\sqrt{14}$$

**Option 2:**

$$r \cdot (\hat{i} + \hat{j}) = \sqrt{3}/14$$

**Option 3:**

$$r \cdot (3\hat{i} - 2\hat{j} + \hat{k}) = \sqrt{14}$$

**Option 4:**

none of them

**Correct Answer:**

none of them

**Solution:**

As we have learnt

Angle bisector of planes (Vector form) -

Equation of plane bisecting the angle between the planes

$$\vec{r} \cdot \vec{n} = d \text{ and } \vec{r} \cdot \vec{n}_1 = d_1 \text{ is}$$

$$\frac{\vec{r} \cdot \vec{n} - d}{|\vec{n}|} = \pm \frac{\vec{r} \cdot \vec{n}_1 - d_1}{|\vec{n}_1|}$$

-

$$|r(\hat{i} - 2\hat{j} + 3\hat{k}) - 5/\sqrt{1+4+9}| = |r(\hat{i} - 2\hat{j} + 3\hat{k})/\sqrt{1+4+9}|$$

Both the plane are parallel to each other

so, option d is correct.

---

**Q. 22** These are how many roots of quadratic equation :  $kx^2 - 2x + 7 = 0$  between  $(-1, 2)$  such that  $f(-1) \cdot f(2) < 0$ , where  $f(x) = kx^2 - 2x + 7$

**Option 1:**

0

**Option 2:**

1

**Option 3:**

2

**Option 4:**

3

**Correct Answer:**

1

**Solution:**

As we learned

Number of roots of polynomial equation -

For a polynomial equation  $P(x) = 0$  if  $P(a)$  and  $p(B)$  are of opposite sign then odd number of roots lie between  $A$  and  $b$ , if they are of same sign then either no root or even number of roots lie between them.

-

Since, quadratic equation can have maximum number of roots=2

So, odd number of roots =1

---

**Q. 23** Find the no. of bijective functions from  $X$  to  $Y$ , where  $n(X) = 5 = n(Y)$ .

**Option 1:**

120

**Option 2:**

3125

**Option 3:**

625

**Option 4:**

5

**Correct Answer:**

120

**Solution:**

As we have learnt,

Number of Bijective Function -

If A & B are Bijective then  $n(A) = n(B) = m$  (Say)

So number of Bijective functions =  $m!$

-

$5! = 120$

---

**Q. 24** Find the arithmetic mean by shortcut method of the following observation.

class Interval	0-10	10-20	20-30	30-40
Frequency	30	25	28	33

**Option 1:**

18.72

**Option 2:**

20.52

**Option 3:**

21.92

**Option 4:**

21.2

**Correct Answer:**

20.52

**Solution:**

As we learned

Short cut Method for A.M -

Let

$$u_i = \frac{x_i - A}{h}$$

$$\bar{x} = A + \frac{h \sum f_i u_i}{\sum f_i}$$

- wherein

Where A is assumed mean h is width of class interval

$X_i$	$f_i$	$u_i = \frac{x_i - 15}{10}$	$f_i u_i$
5	30	-1	-30
15	25	0	0
25	28	1	28
35	33	2	66
	116		64

$$\bar{x} = 15 + 10 \times \frac{64}{116}$$

$\approx 20.52$

---

**Q. 25** Find geometric mean of the following observations

2, 7, 9, 14

**Option 1:**

8

**Option 2:**

$$(42)^{\frac{1}{4}}$$

**Option 3:**

$$(42)^{\frac{1}{2}}$$

**Option 4:**

None of these

**Correct Answer:**

$$(42)^{\frac{1}{2}}$$

**Solution:**

As we learned

Geometric Mean -

If  $x_1, x_2, x_3, \dots, x_n$  are the  $n$  Geometric Means then

$$G = (x_1 x_2 x_3 \cdots x_n)^{\frac{1}{n}}$$

-

$$G = (2 \times 7 \times 9 \times 14)^{\frac{1}{4}}$$

$$= 2^{\frac{1}{2}} \times 7^{\frac{1}{2}} \times 3^{\frac{1}{2}}$$

$$= \sqrt{42}$$

---

**Q. 26** The value of  $5 \cos \theta + 3 \cos \left( \theta + \frac{\pi}{3} \right) + 3$  lies between:

**Option 1:**

-4 and 4

**Option 2:**

-4 and 6

**Option 3:**

-4 and 8

**Option 4:**

-4 and 10

**Correct Answer:**

-4 and 10

**Solution:**

As we learn

Addition Formulae -

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

- wherein

A and B are two angles.

$$5 \cos \theta + 3 \cos \left( \theta + \frac{\pi}{3} \right) + 3 = 5 \cos \theta + 3 \left[ \cos \theta \cos \frac{\pi}{3} - \sin \theta \cdot \sin \frac{\pi}{3} \right] + 3 =$$
$$\left[ 5 \cos \theta + \frac{3}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta \right] + 3 = \left[ \frac{13}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta \right] + 3$$

$$\therefore -\sqrt{\left(\frac{13}{2}\right)^2 + \left(\frac{3\sqrt{3}}{2}\right)^2} \leq \left(\frac{13}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta\right) \leq \sqrt{\left(\frac{13}{2}\right)^2 + \left(\frac{3\sqrt{3}}{2}\right)^2}$$

$$-7 \leq \left(\frac{13}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta\right) \leq +7$$

$$\therefore -7+3 \leq \left(\frac{13}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta\right) + 3 \leq +7+3 \Rightarrow -4 \leq \left(\frac{13}{2} \cos \theta - \frac{3\sqrt{3}}{2} \sin \theta\right) + 3 \leq 10$$

So the value lies between -4 and 10.

---

**Q. 27** What is the value of  $(\bar{z})if\bar{z} = 3 + 4i$

**Option 1:**

$$3 + 4i$$

**Option 2:**

$$3 - 4i$$

**Option 3:**

$$-3 + 4i$$

**Option 4:**

$$-3 - 4i$$

**Correct Answer:**

$$3 - 4i$$

**Solution:**

As we learned

Properties of Conjugate of Complex Number -

$$\bar{\bar{z}} = z$$

- wherein

$\bar{z}$  denotes conjugate of  $z$

$$\bar{z} = 3 + 4i$$

$$z = 3 - 4i$$

$$\bar{z} = 3 + 4i$$

---

---

**Q. 28** If  $|\vec{a}| = 5$ , find  $\vec{a} \cdot \vec{a}$

**Option 1:**

5

**Option 2:**

$\sqrt{5}$

**Option 3:**

25

**Option 4:**

-25

**Correct Answer:**

25

**Solution:**

As we have learnt

Scalar Product of two vectors -

$$\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$$

$$\vec{a} \cdot \vec{a} = a^2 = |\vec{a}|^2$$

- wherein

Dot product is commutative for  $\theta = 0$ , where  $\theta$  is the angle between the vectors  $\vec{a}$  and  $\vec{b}$

$$\vec{a} \cdot \vec{a} = |\vec{a}|^2 = 25$$

---

**Q. 29**  $\int \frac{1}{(x+1)\ln(x+1)} dx = ?$

**Option 1:**

$$\frac{1}{\ln[\ln(x+1)]} + C$$

**Option 2:**

$$\frac{\ln(\ln(x+1))}{(x+1)} + C$$

**Option 3:**

$$\ln(x + 1) + C$$

**Option 4:**

$$\ln[\ln(x + 1)] + C$$

**Correct Answer:**

$$\ln[\ln(x + 1)] + C$$

**Solution:**

As we have learned

Type of integration by substitution -

$$\int \frac{f'(x)}{f(x)} dx = \ln(f(x)) + c$$

- wherein

Let  $f(x) = t$  such that  $f'(x)dx = dt$

$$\frac{d}{dx}[\ln(x + 1)] = \frac{1}{x + 1} = f'(x)$$

Above integration in the form of

$$\int \frac{f'(x)}{f(x)} dx \text{ where } f'(x) = \frac{1}{(x + 1)}$$

$$f(x) = \ln(x + 1)$$

$$\int \frac{f'(x)}{f(x)} dx = \ln(f(x)) + c$$

$$= \ln[\ln(x + 1)] + C$$

---

**Q. 30** For  $A = \{H, T, 1, 2, 3\}$  how many event points are present ?

**Option 1:**

3

**Option 2:**

6

**Option 3:**

5

**Option 4:**

None of these

**Correct Answer:**

5

**Solution:**

As we learned

Event Point -

Each element of the sample space is called a sample point or an event point.

ex:  $s = \{1, 2, 3, 4, 5, 6\}$  where 1, 2, 3, 4, 5, and 6 are the sample space.

-

---

**Q. 31** Find the correct G.M of the following :

x	2	3	4	5
f	2	1	3	2

**Option 1:**

$e^{\log(19200)}$

**Option 2:**

$\frac{19200}{8}$

8

**Option 3:**

$e^{\frac{1}{8} \log(19200)}$

**Option 4:**

$\frac{29}{8}$

8

**Correct Answer:**

$$e^{\frac{1}{8} \log(19200)}$$

**Solution:**

As we learned

Geometric Mean -

In case of discrete frequency distribution.

- wherein

$$G = e^{\left| \frac{\sum_{i=1}^n f_i \log(n_i)}{\sum f_i} \right|}$$

$$\begin{aligned} G.M &= e^{\left| \frac{2 \log 2 + 1 \times \log 3 + 3 \log 4 + 2 \log 5}{2+1+3+2} \right|} \\ &= e^{\frac{1}{8} \log(19200)} \end{aligned}$$

---

**Q. 32** For  $\cos \theta \geq \frac{1}{2}$ , find the correct general solution :  $(n \in I)$

**Option 1:**

$$\theta \in \left[ 2n\pi - \frac{\pi}{6}, 2n\pi + \frac{\pi}{6} \right]$$

**Option 2:**

$$\theta \in [0, (2n + 1)\pi]$$

**Option 3:**

$$\theta \in \left[ 2n\pi - \frac{\pi}{3}, 2n\pi + \frac{\pi}{3} \right]$$

**Option 4:**

$$\theta \in \left[ (2n - 1)\frac{\pi}{2}, (2n + 1)\frac{\pi}{2} \right]$$

**Correct Answer:**

$$\theta \in \left[ 2n\pi - \frac{\pi}{3}, 2n\pi + \frac{\pi}{3} \right]$$

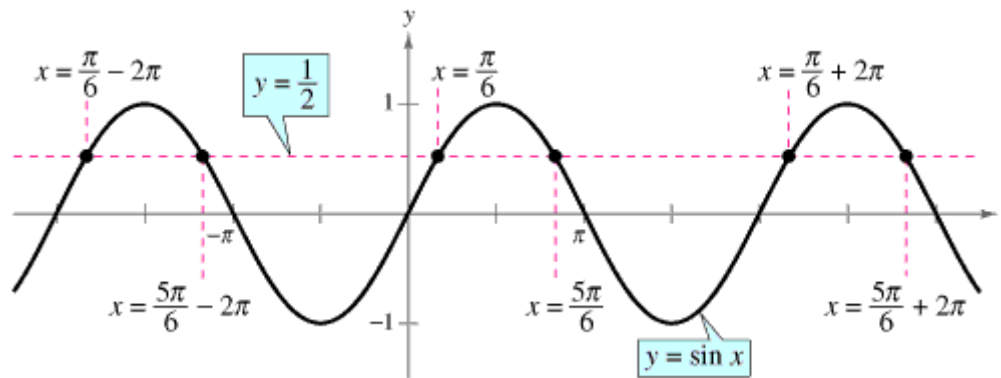
**Solution:**

As we have learnt

## Trigonometric Inequality -

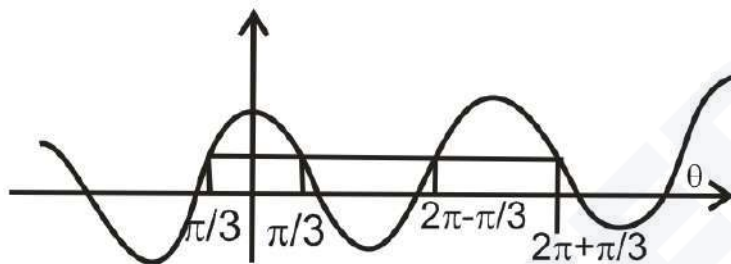
We can solve the inequalities with the help of graphs

- wherein



$$\sin x > \frac{1}{2}$$

$$x \in \left( 2n\pi + \frac{\pi}{6}, 2n\pi + \frac{5\pi}{6} \right)$$



$$2n\pi - \frac{\pi}{3} \leq \theta \leq 2n\pi + \frac{\pi}{3}, n \in I$$

**Q. 33**  $f, g$  are continuous at ' $a$ '. Then which of the following is true?

**Option 1:**

$f \pm g$  is continuous at  $x = A$

**Option 2:**

$f \cdot g$  is continuous at  $x = A$

**Option 3:**

$\frac{f}{g}$  is continuous at  $x = A$  &  $g(a) \neq 0$

**Option 4:**

All of the above

**Correct Answer:**

All of the above

**Solution:**

As we have learnt,

Properties of Continuous function -

If  $f, g$  are two continuous functions at a point  $a$  of their common domain  $D$ . Then  $f \pm g$   $fg$  are continuous at  $a$  and if  $g(a) \neq 0$  then

$\frac{f}{g}$  is also continuous at  $x = a$ .

-

---

**Q. 34**

If matrix  $A = \begin{bmatrix} 1 & 0 & \omega^2 \\ 0 & \omega & 0 \\ 1 & 0 & \omega^2 \end{bmatrix}$ . Then matrix  $A + A^\theta$  is (where  $\omega$  is the cube root of unity).

**Option 1:**

Hermition matrix

**Option 2:**

Skew hermition matrix

**Option 3:**

Unit matrix

**Option 4:**

None of the above

**Correct Answer:**

Hermition matrix

**Solution:**

As we have learnt

Hermitian matrices -

$$A^\theta = A$$

- wherein

$A^\theta$  is complex conjugate transpose matrix of matrix  $A$

$$\begin{bmatrix} a & b+ic \\ b-ic & d \end{bmatrix}, \begin{bmatrix} 3 & 3-4i & 5+2i \\ 3+4i & 5 & -2+1 \\ 5-2i & -2-i & 2 \end{bmatrix}$$

$$(A + A^\theta)^\theta = A^\theta + (A^\theta)^\theta = A^\theta + A$$

$$A^\theta = A \Rightarrow \text{Hermitian matrix}$$

---

**Q. 35** For set of observations with 12 & 9 as no. of observations respectively, means as 5 and 7 respectively and 2 and 4 are standard deviations respectively, then find the combined variance of two series.

**Option 1:**  
12.52

**Option 2:**  
10.12

**Option 3:**  
13.72

**Option 4:**  
9.24

**Correct Answer:**  
10.12

**Solution:**  
As we learned

Properties of Standard deviation -

Let  $n_1, n_2$  be the number of observations of two series and their means and S.D are  $\bar{x}_1, \bar{x}_2$  and  $\sigma_1, \sigma_2$  respectively.

Let  $\bar{X}$  denote the combined mean of two series then

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

∴ The combined variance of two series is given by

$$\sigma^2 = \frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}$$

- wherein

where

$$d_1 = \bar{x}_1 - \bar{x} \text{ and } d_2 = \bar{x}_2 - \bar{x}$$

$$\begin{aligned}\bar{x} &= \frac{12 \times 5 + 9 \times 7}{12 + 9} \\ &= \frac{60 + 63}{21} = \frac{123}{21} = \frac{41}{7}\end{aligned}$$

$$d_1 = 5 - \frac{41}{7} = \frac{-6}{7}$$

$$d_2 = 7 - \frac{41}{7} = \frac{8}{7}$$

$$\begin{aligned}\therefore \sigma^2 &= \frac{12\left(4 + \frac{36}{49}\right) + 9\left(16 + \frac{64}{49}\right)}{12 + 9} \\ &= \frac{2784 + 7632}{49 \times 21} \\ &= \frac{10416}{1029} \approx 10.12\end{aligned}$$

---

**Q. 36** Find the values of 'k' so that  $-2x^2 + 4x - k$  has completely below the  $x - axis$

**Option 1:**

$$k = -2$$

**Option 2:**

$$k = 2$$

**Option 3:**

$$k > 2$$

**Option 4:**

$$k < 2$$

**Correct Answer:**

$$k > 2$$

**Solution:**

As we learned

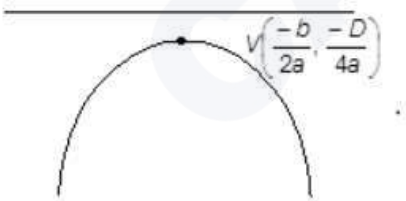
Quadratic Expression Graph when  $a < 0$  &  $D < 0$  -

No real root of

$$f(x) = ax^2 + bx + c$$

$$\& D = b^2 - 4ac$$

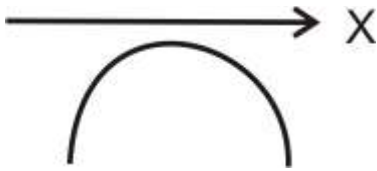
- wherein



$$a = -2 < 0$$

$$d = 16 - 8k < 0$$

$$k > 2$$



**Q. 37** Angle b/w 2 lines L and M is  $11/2$

L is  $m_1$  then slope of line m is

**Option 1:**

$-m_1$

**Option 2:**

$1/m_1$

**Option 3:**

$m_1 + n/2$

**Option 4:**

$-1/m_1$

**Solution:**

As we have learned

Condition for perpendicular lines -

$$m_1 m_2 = -1$$

- wherein

Here  $m_1, m_2$  are the slope of perpendicular lines.

$$\tan \theta_1 = m_1$$

$$\text{slope of } M = \tan(90 + \theta)$$

$$= \frac{\sin(90 + \theta)/\cos(90 + \theta)}$$

$$\frac{\cos \theta}{-\sin \theta} = -\cot \theta$$

$$= -1/m_1$$

**Q. 38** Find local maxima and minima for  $f(x) = x^3 - 4x$

**Option 1:**

$x = \pm \frac{2}{\sqrt{3}}$ : Points of local maxima

**Option 2:**

$x = 2, -2$  are points of maxima and minima respectively

**Option 3:**

$x = -\frac{2}{\sqrt{3}}$  local maxima and  $x \rightarrow \frac{2}{\sqrt{3}} \rightarrow$  local minima

**Option 4:**

None of these

**Correct Answer:**

$x = -\frac{2}{\sqrt{3}}$  local maxima and  $x \rightarrow \frac{2}{\sqrt{3}} \rightarrow$  local minima

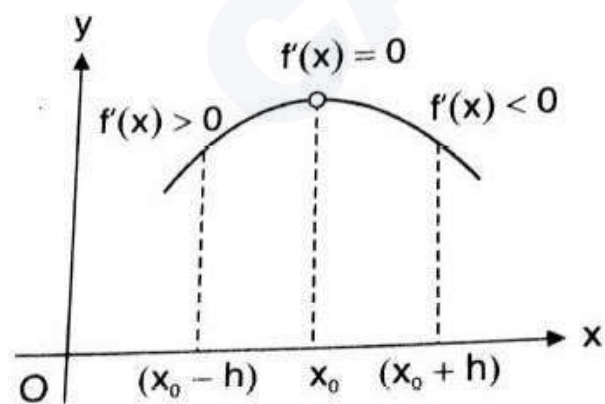
**Solution:**

As we learn

Methods to find points of Local maxima and Local minima -

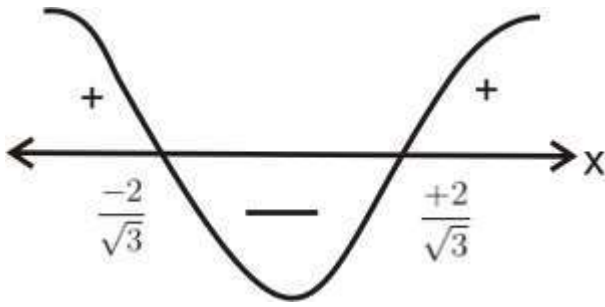
At points of local maxima and local minima the slope of tangent drawn to the curve is zero. For local maximum  $dy/dx$  changes from positive to negative and for local minimum  $dy/dx$  change negative to positive.

- wherein



$$f'(x) = 3x^2 - 4 = 0$$

$$\Rightarrow x = \pm \frac{2}{\sqrt{3}}$$



$f'(x)$  versus  $x$  graph

**Q. 39** Which of the following is true for any point  $P(x,y)$  on the curve  $y=f(x)$ .  $X>C, Y>C$

**Option 1:**

Eq. of tangent at P is  $y - y_1 = \frac{dy}{dx} (x + x_1)$

**Option 2:**

Eq. of normal at P is  $\frac{dy}{dx} (y - y_1) = (x_1 - x)$

**Option 3:**

Both (a) and (b)

**Option 4:**

None of these

**Correct Answer:**

Eq. of normal at P is  $\frac{dy}{dx} (y - y_1) = (x_1 - x)$

**Solution:**

As we learnt

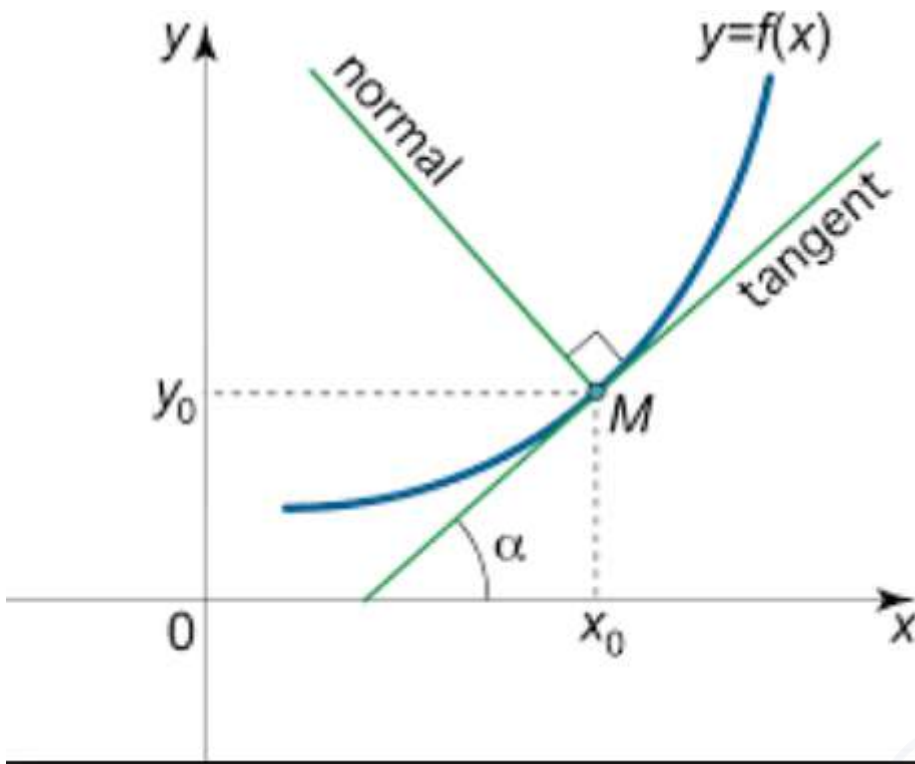
Geometrical Applications -

$P(x, y)$  be any point on

$y = f(x)$ . Let tangent and normal at  $P(x, y)$  meets

X - axis, Y - axis at T and N.

- wherein



Eq of Normal at point P

is  $\frac{dy}{dx}(y - y_1) = (x_1 - x)$

**Q. 40** If  $(A^2 - 3A + 2I)' = 0$ , Then A is :

**Option 1:**

$i$

**Option 2:**

$2i$

**Option 3:**

$3I$

**Option 4:**

Both a and b

**Correct Answer:**

Both a and b

**Solution:**

As we have learnt

Property of Transpose -

$$(\alpha A)' = \alpha A'$$

$$(AB)' = B' A'$$

- wherein

$\alpha$  being scalar ;  $A'$  is transpose of A

Conformable matrices for addition -

Matrices with same number of rows and same number of columns

-

$$(A^2)' - (3A)' + (2I)' = 0$$

$$A' A' - 3A' I + 2I = 0$$

$$(A' - I)(A' - 2I) = 0$$

$$A' = I = A$$

$$A' = 2I = A$$

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**Q. 41** Find variance for the following about the mean

x	f
3	2
5	4
7	1
9	3
11	4

Option 1:

$$\frac{425}{7}$$

Option 2:

$$\frac{525}{49}$$

Option 3:

$$\frac{425}{9}$$

Option 4:

$$\frac{515}{7}$$

Correct Answer:

$$\frac{425}{9}$$

**Solution:**

As we learned

Short cut Method for Variance -

In case of discrete frequency distribution

$$\sigma^2 = \frac{1}{N} \sum_{i=1}^n f_i d_i^2 - \left( \frac{1}{N} \sum_{i=1}^n f_i d_i \right)^2$$

-

$X_i$	$f_i$	$f_i x_i$	$d_i = x_i - \bar{x}$	$f_i d_i^2$	$f_i d_i$
3	2	6	$\frac{-31}{7}$	$\frac{1922}{49}$	$\frac{-62}{7}$
5	4	20	$\frac{-17}{7}$	$\frac{1156}{49}$	$\frac{-68}{7}$
7	1	7	$\frac{-3}{7}$	$\frac{9}{49}$	$\frac{-3}{7}$
			$\frac{7}{7}$	$\frac{49}{49}$	$\frac{7}{7}$

9	3	27	$\frac{11}{7}$	$\frac{363}{49}$	$\frac{33}{7}$
11	4	44	$\frac{25}{7}$	$\frac{2500}{49}$	$\frac{100}{7}$
Total	14	104		$\frac{5950}{49}$	0

where,  $\bar{x} = \frac{104}{14} = \frac{52}{7}$

$$\text{so, } \sigma^2 = \frac{1}{4} \times \frac{5950}{49} - 0 = \frac{2975}{7 \times 9}$$

$$= \frac{425}{9}$$

**Q. 42**  $a * (b + c) =$

**Option 1:**

$$(a + b) * (a + c)$$

**Option 2:**

$$(a * b) + c$$

**Option 3:**

$$a + (b * c)$$

**Option 4:**

$$(a * b) + (a * c)$$

**Correct Answer:**

$$(a * b) + (a * c)$$

**Solution:**

As we learnt

Distributive Binary operation -

$$a*(b+c)=(a*b)+(a*c)$$

- wherein

Two binary operation \* and + on a set A are functions  $* : A \times A \rightarrow A$  and  $+: A \times A \rightarrow A$ , such that,  $A \times A \rightarrow A$  is said to be distributive, If  $a*(b+c)=(a*b)+(a*c)$

**Q. 43** Find arithmetic mean of the following observations

x	2	9	7	5
f(frequency)	5	2	5	2

**Option 1:**

3.7

**Option 2:**

5.2

**Option 3:**

9

**Option 4:**

7

**Correct Answer:**

5.2

**Solution:**

As we learned

ARITHMETIC Mean -

In case of discrete frequency distribution:

If the observations  $x_1, x_2, \dots, x_n$  occur with frequencies  $f_1, f_2, \dots, f_n$  then

$$\begin{aligned}\bar{x} &= \frac{f_1x_1 + f_2x_2 + \dots + f_nx_n}{f_1 + f_2 + f_3 + \dots + f_n} \\ &= \frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i} = \frac{1}{N} \sum_{i=1}^n f_i x_i\end{aligned}$$

- wherein

where

$$N = \sum_{i=1}^n f_i$$

$$\bar{x} = \frac{2 \times 5 + 9 \times 2 + 7 \times 5 + 5 \times 2}{5 + 2 + 5 + 2}$$

$$= \frac{73}{14} \approx 5.2$$

**Q. 44** If the vectors  $4i + 11j + mk$ ,  $7i + 2j + 6k$  and  $i + 5j + 4k$  are coplanar, then m is :

**Option 1:**  
38

**Option 2:**  
0

**Option 3:**  
10

**Option 4:**  
-10

**Correct Answer:**  
10

**Solution:**

As we learn

Coplanar vectors -

$$x\hat{a} + y\hat{b} + z\hat{c} = 0$$

- wherein

$\hat{a}, \hat{b}, \hat{c}$  are coplanar and  $x, y, z$  are scalars (not all zero)

As the three vectors are coplanar, one will be a linear combination of the other two.

$$\therefore 4i + 11j + mk = x(i + 2j + 6k) + y(i + 5j + 4k) \Rightarrow 4 = 7x + y \quad \dots(i)$$

$$11 = 2x + 5y \quad \dots(ii)$$

$$m = 6x + 4y \quad \dots(iii)$$

From (i) and (ii),  $x = \frac{3}{11}$ ,  $y = \frac{23}{11}$ ; from (iii),  $m = 6 \times \frac{3}{11} + 4 \times \frac{23}{11} = 10$

**Trick :**  $\therefore$  Vectors  $4i + 11j + mk$ ,  $7i + 2j + 6k$  and  $i + 5j + 4k$  are coplanar.

$$\therefore \begin{vmatrix} 4 & 11 & 3 \\ 7 & 2 & 6 \\ 1 & 5 & 4 \end{vmatrix} = 0$$

$$\Rightarrow 4(8 - 30) - 11(28 - 6) + m(35 - 2) = 0 \Rightarrow -88 - 11 \times 22 + 33m = 0 \Rightarrow -8 - 22 + 3m = 0 \Rightarrow 3m = 30 \Rightarrow m = 10$$

**Q. 45** Equation of the curve for which is such that its length of subnormal is equal to length of its subtangent.

**Option 1:**

$$y^{2/3} = \frac{2}{3}x + c$$

**Option 2:**

$$y^{3/2} = \frac{2}{3}x + c$$

**Option 3:**

$$y^3 = \frac{2}{3}x^2 + c$$

**Option 4:**

$$y^{3/2} = \frac{3}{2}x + c$$

**Correct Answer:**

$$y^{3/2} = \frac{2}{3}x + c$$

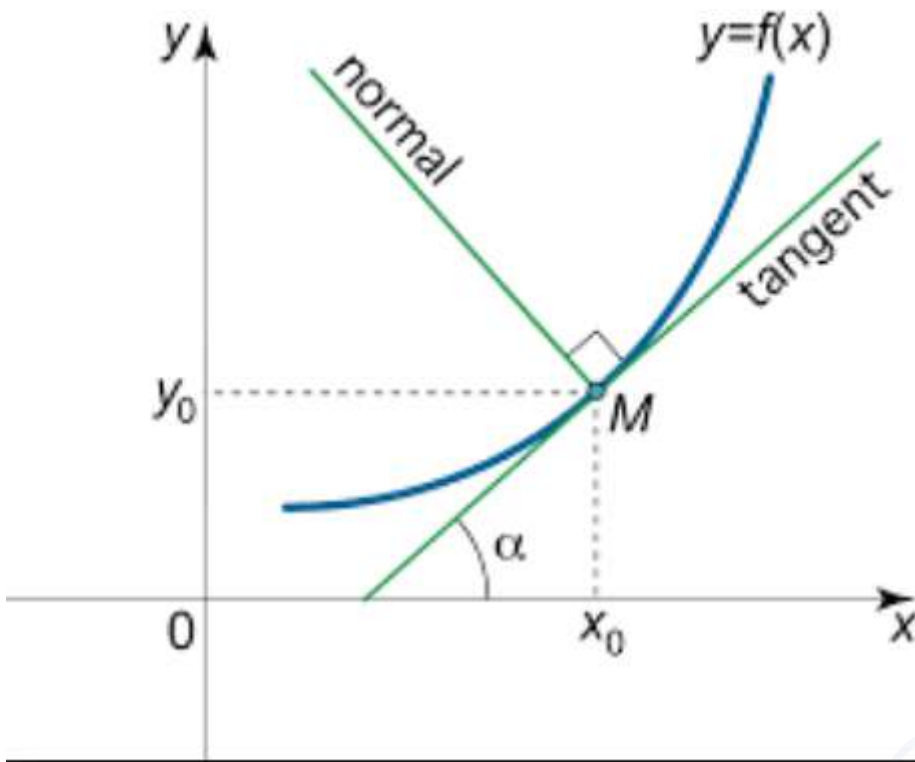
**Solution:**

As we learnt

Subnormal -

$$\text{Length} = y \tan \alpha = y \frac{dy}{dx}$$

- wherein



According to the given que

$$y \frac{dy}{dx} = y^2 \left( \frac{dy}{dx} \right)^2$$

$$\left( \frac{dy}{dx} \right)^3 = y \Rightarrow \frac{dy}{y^{1/3}} = dx$$

Integrate both side

$$3y^{3/2} = 2x + C \Rightarrow y^{3/2} = \frac{2}{3}x + C$$

**Q. 46**  $[\vec{a} - \vec{b} \quad \vec{b} - \vec{c} \quad \vec{c} - \vec{a}] =$

**Option 1:**

$$[\vec{a} \quad \vec{b} \quad \vec{c}]$$

**Option 2:**

$$\frac{1}{2} [\vec{a} \quad \vec{b} \quad \vec{c}]$$

**Option 3:**

0

**Option 4:**

None of these

**Correct Answer:**

0

**Solution:**

As we have learnt

Properties of Scalar Triple Product -

$$[\vec{a} - \vec{b} \vec{b} - \vec{b} \vec{c} - \vec{a}] = 0$$

- wherein

$\vec{a}, \vec{b}, \vec{c}$  are three vectors.

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**Q. 47** If  $\tan x = \frac{b}{a}$ , then  $\sqrt{\frac{a+b}{a-b}} + \sqrt{\frac{a-b}{a+b}}$  equal to:

**Option 1:**

$$\frac{2 \sin x}{\sqrt{\sin 2x}}$$

**Option 2:**

$$\frac{2 \cos x}{\sqrt{\cos 2x}}$$

**Option 3:**

$$\frac{2 \cos x}{\sqrt{\sin 2x}}$$

**Option 4:**

$$\frac{2 \sin x}{\sqrt{\cos 2x}}$$

**Correct Answer:**

$$\frac{2 \cos x}{\sqrt{\cos 2x}}$$

**Solution:**

As we learn

Results of Compound Angles -

$$\cot(A + B) = \frac{\cot A \cot B - 1}{\cot A + \cot B}$$

- wherein

Where A and B are two angles.

$$\tan x = \frac{b}{a} \Rightarrow \sqrt{\frac{a+b}{a-b}} + \sqrt{\frac{a-b}{a+b}} = \sqrt{\frac{1+\frac{b}{a}}{1-\frac{b}{a}}} + \sqrt{\frac{1-\frac{b}{a}}{1+\frac{b}{a}}} = \sqrt{\frac{1+\tan x}{1-\tan x}} + \sqrt{\frac{1-\tan x}{1+\tan x}} = \frac{2}{\sqrt{1-\tan^2 x}}$$

Now multiplying by  $\frac{\sqrt{1+\tan^2 x}}{2}$  in Nr and Dr =

$$\frac{\sqrt{1-\tan^2 x}}{1+\tan^2 x} \cdot \frac{\sqrt{1+\tan^2 x}}{2} = \frac{\sqrt{\cos 2x} \cdot \sqrt{\sec^2 x}}{2} = \frac{2 \cos x}{2\sqrt{\cos 2x}}$$

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**Q. 48** General solution of the D.E is

$$Y'' = \sin x$$

**Option 1:**

$$-\sin x + C_1x + C_2$$

**Option 2:**

$$\sin x + C_1x + C_2$$

**Option 3:**

$$\sin x - C_1x + C_2$$

**Option 4:**

none

**Correct Answer:**

$$-\sin x + C_1x + C_2$$

**Solution:**

As we have learned

Solution of differential equations -

In order to obtain the solution of differential equation, we integrate it as many times as the order of the differential equation

-

$$y'' = \sin x$$

$$y' = \int \sin x dx = -\cos x + c_1$$

$$y = \int (-\cos x + c_1) dx = -\sin x + c_1x + c_2$$

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**Q. 49** Find  $f'(7)$  for  $f(x) = x^2 - 13x + 1$

**Option 1:**

0

**Option 2:**

1

**Option 3:**

-13

**Option 4:**

-1

**Correct Answer:**

1

**Solution:**

As we have learnt,

Derivative at a point -

The value of  $f'(x)$  obtained by putting  $x = a$  is called the derivative of  $f(x)$  at  $x = a$  and it is denoted by  $f'(a)$  or

$$\frac{dy}{dx} \text{ at } x = a.$$

-

$$f'(x) = 2x - 13$$

$$\Rightarrow f'(7) = 2(7) - 13 = 14 - 13 = 1$$

**Q. 50** Find modulus of  $\frac{z_1}{z_2}$ , if  $|z_1| = 3$  &  $|z_2| = 2$

**Option 1:**

$$\frac{3}{2}$$

**Option 2:**

2.5

**Option 3:**

$$\frac{1}{2}$$

**Option 4:**

$$\frac{2}{3}$$

**Correct Answer:**

$$\frac{3}{2}$$

**Solution:**

As we learned

Property of Modulus of z(Complex Number) -

$$\left| \frac{z_1}{z_2} \right| = \frac{|z_1|}{|z_2|}$$

- wherein

$|\cdot|$  denotes modulus of complex number

**Q. 51** Which of the following can be solved using variable separable method?

**Option 1:**

$$\frac{dy}{dx} = 1 + x^2y$$

**Option 2:**

$$\frac{dy}{dx} = xy^2$$

**Option 3:**

$$\frac{dy}{dx} = \sin(x - y)$$

**Option 4:**

$$\frac{dy}{dx} = x^{2y}$$

**Correct Answer:**

$$\frac{dy}{dx} = xy^2$$

**Solution:**

As we learnt

Variable Separation Method -

If the coefficient of dx is only a function of x and that of dy is only function of y in the given differential equation

-

In a,c,d ;x and y can't be completely separated

For b;  $\frac{dy}{y^2} = xdx$

**Q. 52** Which of the following is a monotonous function?

**Option 1:**

$$f(x) = x^2, x \in \mathbb{R}$$

**Option 2:**

$$f(x) = x^3, x \in \mathbb{R}$$

**Option 3:**

$$f(x) = \sin x, x \in \mathbb{R}$$

**Option 4:**

All of the above

**Correct Answer:**

$$f(x) = x^3, x \in \mathbb{R}$$

**Solution:**

As we have learnt,

proof of one-one -

Increasing or decreasing

i.e. Monotonous

- wherein

$$\frac{dy}{dx} > 0$$

$$\text{or } \frac{dy}{dx} < 0$$

in the domain.

A)  $f'(x) = 2x$ ,  $2x > 0$  for  $x > 0$  &  $2x < 0$  for  $x < 0$

B)  $f'(x) = 3x^2 \geq \forall x \in \mathbb{R}$

c)  $f'(x) = \cos x$ ;  $\cos x > 0$  for  $x \in \left( (4n - 1)\frac{\pi}{2}, (4n + 1)\frac{\pi}{2} \right)$

and  $\cos x < 0$  for  $x \in \left( (4n + 1)\frac{\pi}{2}, (4n + 3)\frac{\pi}{2} \right)$

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**Q. 53** Find the equation of line perpendicular to  $x - 2y + 3 = 0$  and passing through  $(1, 0)$ .

**Option 1:**

$$2x + y - 2 = 0$$

**Option 2:**

$$x + 2y - 2 = 0$$

**Option 3:**

$$2x + y + 2 = 0$$

**Option 4:**

$$x + 2y + 2 = 0$$

**Correct Answer:**

$$2x + y - 2 = 0$$

**Solution:**

As we learned

Equation of a line perpendicular to a given line -

$Bx - Ay + \lambda = 0$  is the line perpendicular to  $Ax + By + C = 0$ .

- wherein

$\lambda$  is some other constant than  $C$ .

Line perpendicular to  $x - 2y + 3 = 0$  is

$$2x + y + \lambda = 0$$

Now it passes through  $(1, 0)$ .

$$\therefore 2 \times 1 + 0 + \lambda = 0$$

$$\lambda = -2$$

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**Q. 54** In group of 5 girls and 8 boys . In how many ways a team of 5 members selected if the team has atleast 1 boy and 1 girl

**Option 1:**

1230

**Option 2:**

1300

**Option 3:**

1210

**Option 4:**

1570

**Correct Answer:**

1230

**Solution:**

As we have learned

Theorem of Combination -

Each of the different groups or selection which can be made by taking r things from n things is called a combination.

$${}^n C_r = \frac{(n)!}{r!(n-r)!}$$

- wherein

Where  $1 \leq r \leq n$

a) 1B and 4G =  ${}^8 C_1 \times {}^5 C_4$

b) 2 B and 3 G =  ${}^8 C_2 \times {}^5 C_3$

c) 3B and 2 G =  ${}^8 C_3 \times {}^5 C_2$

d) 4B and 1 G =  ${}^8 C_4 \times {}^5 C_1$

= 1230

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**Q. 55**  $\lim_{x \rightarrow 2} \text{Log} [x] = ?$  Where [ ] stands for greatest integer function

**Option 1:**

Log1=0

**Option 2:**

Log2

**Option 3:**

Doesn't Exist

**Option 4:**

-log2

**Correct Answer:**

Doesn't Exist

**Solution:**

As we learned

Limits of composite functions -

$$\lim_{x \rightarrow a} f \circ g(x) = \lim_{x \rightarrow a} f(g(x))$$

$$= \lim_{x \rightarrow b} f(x)$$

$$\text{Where } b = \lim_{x \rightarrow a} g(x)$$

- wherein

f(x) is continuous at x=b

$$\text{We have } \lim_{x \rightarrow 2} \log [x] \neq \log \left( \lim_{x \rightarrow 2} [x] \right)$$

as [x] is not continuous at integral points (Here, x=2)

So, [2+] = 2 & [2-] = 1

LHL = log 1 = 0

RHL = log 2

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**Q. 56** What is the polar term of  $z = -4 + 4i$

**Option 1:**

$$4 \left( \cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4} \right)$$

**Option 2:**

$$4\sqrt{2} \left( \cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4} \right)$$

**Option 3:**

$$4\sqrt{2} \left( \cos \frac{\pi}{4} - i \sin \frac{\pi}{4} \right)$$

**Option 4:**

$$4 \left( \cos \frac{3\pi}{4} - i \sin \frac{3\pi}{4} \right)$$

**Correct Answer:**

$$4\sqrt{2} \left( \cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4} \right)$$

**Solution:**

As we learned

Polar Form of a Complex Number -

$$z = r(\cos\theta + i\sin\theta)$$

- wherein

r= modulus of z and  $\theta$  is the argument of z

$$\text{Here, } |z| = \sqrt{16 + 16} = 4\sqrt{2}$$

$$\&, \text{Arg}(z) = \frac{3\pi}{4}$$

(2nd quadrant and  $\tan\Theta = 1$ )

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**Q. 57** For disjoint sets A & B,  $n(A \cup B) = 10$  and  $n(A) = 5$  then  $n(B) = ?$

**Option 1:**

5

**Option 2:**

15

**Option 3:**

0

**Option 4:**

10

**Correct Answer:**

5

**Solution:**

As we learnt

Number of Element in Union A & B -

If  $(A \cap B) = \varphi$ , then  $n(A \cup B) = n(A) + n(B)$

- wherein

Given A and B be any finite sets. then the Number of Elements in intersection A & B is given by this formula.

$10 = 5 + n(B)$

as  $n(A \cap B) = 0$  for disjoint sets

$\Rightarrow n(B) = 5$

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**Q. 58**  $(a.i)i + (a.j)j + (a.k)k =$

**Option 1:**

a

**Option 2:**

2a

**Option 3:**

3a

**Option 4:**

0

**Correct Answer:**

a

**Solution:**

As we learn

Properties of Scalar Product -

$$\vec{a} \cdot \vec{a} = |\vec{a}|^2 = \vec{a} \cdot \vec{a} \text{ Commutative Property}$$

$$\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a} \text{ Distributive Property}$$

-

$$\text{Let } \vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$$

$$\therefore \vec{a} \cdot \vec{i} = (a_1\vec{i} + a_2\vec{j} + a_3\vec{k}) \cdot \vec{i} = a_1, \vec{a} \cdot \vec{j} = a_2, \vec{a} \cdot \vec{k} = a_3$$

$$\therefore (\vec{a} \cdot \vec{i})\vec{i} + (\vec{a} \cdot \vec{j})\vec{j} + (\vec{a} \cdot \vec{k})\vec{k} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k} = \vec{a}$$

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**Q. 59** Three point  $\vec{a}, \vec{b}, \vec{c}$  are collinear if  $\lambda\vec{a} + \mu\vec{b} + \nu\vec{c} = \vec{0}$  where

**Option 1:**

$$\lambda + \mu + \nu = 1$$

**Option 2:**

$$\lambda + \mu + \nu = 2$$

**Option 3:**

$$\lambda + \mu + \nu = -1$$

**Option 4:**

$$\lambda + \mu + \nu = 0$$

**Correct Answer:**

$$\lambda + \mu + \nu = 0$$

**Solution:**

As we have learnt

Test of Collinearity -

$$\vec{a}, \vec{b}, \vec{c} \text{ are collinear iff } x\vec{a} + y\vec{b} + z\vec{c} = \vec{0} \text{ where } x + y + z = 0$$

-

$$x(\vec{b} - \vec{a}) = y(\vec{c} - \vec{b})$$

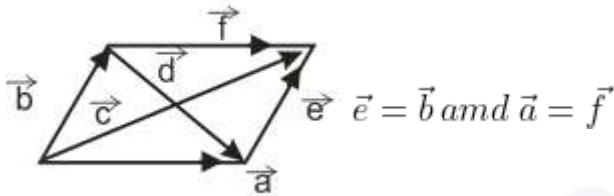
$$(x + y)\vec{b} - x\vec{a} - y\vec{c} = 0$$

$$-x\vec{a} + (x + y)\vec{b} - y\vec{c} = 0$$

$$\lambda\vec{a} + \mu\vec{b} + \nu\vec{c} = 0$$

$$\text{where } \lambda + \mu + \nu = -x + (x + y) - y = 0$$

**Q. 60** In the following figure, identify  $\vec{a} + \vec{b}$



**Option 1:**

$\vec{c}$

**Option 2:**

$\vec{d}$

**Option 3:**

$\vec{E}$

**Option 4:**

$\vec{F}$

**Correct Answer:**

$\vec{c}$

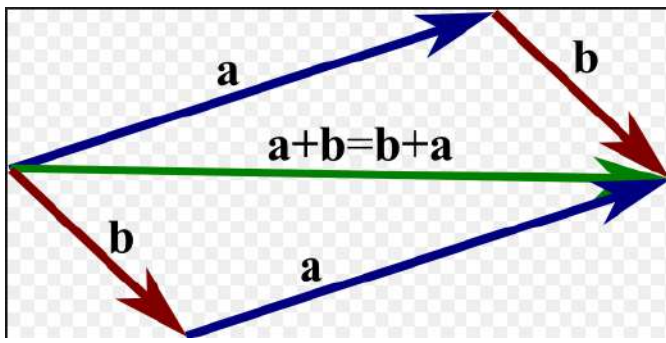
**Solution:**

As we have learnt

Parallelogram law of addition -

If two vectors  $\vec{A}$  and  $\vec{B}$  are represented by  $\vec{OA}$  and  $\vec{OB}$ , then their sum  $\vec{a} + \vec{b}$  is represented by  $\vec{OC}$ , diagonal of the parallelogram OACB

- wherein



**Q. 61** what is the equation of the tangent at(1,-2) on the curve;

$$x^2 - 2y^2 + xy - x + y + 12 = 0$$

**Option 1:**

$$x - 10y - 21 = 0$$

**Option 2:**

$$2x - y - 4 = 0$$

**Option 3:**

$$x + y + 1 = 0$$

**Option 4:**

None of these

**Correct Answer:**

$$x - 10y - 21 = 0$$

**Solution:**

As we learned

Equation of tangent -

Let  $(x_0, y_0)$  is the point on the curve  $y = f(x)$  then for equation of tangent at  $(x_0, y_0)$  on the curve, we can do following replacements in the equation of curve and get the equation of tangent :

$$x^2 \rightarrow xx_0, \quad x \rightarrow \frac{x + x_0}{2}$$

$$y^2 \rightarrow yy_0, \quad y \rightarrow \frac{y + y_0}{2}$$

$$xy \rightarrow \frac{xy_0 + yx_0}{2}$$

for  $x^2 + y^2 = 2$ , equation of tangent at  $(1, 1)$  is  $x \times 1 + y \times 1 = 2$

$$\therefore x + y = 2$$

$$x + 4y + \frac{1}{2}(-2x + y) - \frac{1}{2}(x + 1) + \frac{1}{2}(y - 2) + 12 = 0$$

$$\Rightarrow -\frac{1}{2}x + 5y + \frac{21}{2} = 0$$

$$\Rightarrow x - 10y - 21 = 0$$

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**Q. 62** If A is scalar matrix of order 3 and  $|A^2| = 64$ . Then unknown element of matrix A is:

**Option 1:**

2

**Option 2:**

-2

**Option 3:**

4

**Option 4:**

both a and b

**Correct Answer:**

both a and b

**Solution:**

As we have learnt

Scalar Matrix -

A diagonal matrix whose all the elements are equal is called a scalar matrix

- wherein

$$\begin{bmatrix} k & 0 & 0 & \dots & 0 \\ 0 & k & 0 & \dots & 0 \\ 0 & 0 & k & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & \dots & k \end{bmatrix}$$

Since A is scalar matrix so, let  $A = \begin{bmatrix} x & 0 & 0 \\ 0 & x & 0 \\ 0 & 0 & x \end{bmatrix}$

$$|A| = x^3$$

given  $|A^2| = 64$

$$|A.A| = |A| |A| = 64$$

$$x^3 \cdot x^3 = 64$$

$$x^6 = 64$$

$$x = \pm 2$$

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**Q. 63** If  $|x - 3| = 5$ , then  $x =$

**Option 1:**

8, -2

**Option 2:**

8

**Option 3:**

-2

**Option 4:**

-8.2

**Correct Answer:**

8, -2

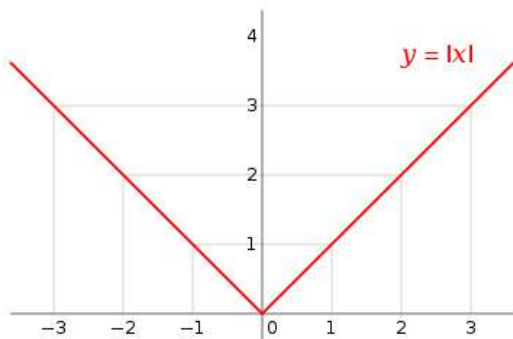
**Solution:**

As we have learnt,

Modulus Function -

$$|x|, x \in R = \begin{cases} x, x \geq 0 \\ -x, x < 0 \end{cases}$$

- wherein



Range  $\in [0, \infty)$

$$\Rightarrow x - 3 = \pm 5 \Rightarrow x = 8, -2$$

---

**Q. 64** Find the value of  $f'(0)$ . If  $f(x)$  is even function and  $f'(0)$  exist

**Option 1:**

0

**Option 2:**

-1

**Option 3:**

1

**Option 4:**

none

**Correct Answer:**

0

**Solution:**

As we have learned

Differentiability -

Let  $f(x)$  be a real valued function defined on an open interval  $(a, b)$  and  $x \in (a, b)$ . Then the function  $f(x)$  is said to be differentiable at  $x_0$  if

$$\lim_{h \rightarrow 0} \frac{f(x_0 + h) - f(x_0)}{(x_0 + h) - x_0}$$

$$\text{or } \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

-

$f'(0)$  exist so , RHL = LHL at  $x = 0$

$$\lim_{h \rightarrow 0} \frac{f(h) - f(0)}{h} = \lim_{h \rightarrow 0} \frac{f(-h) - f(0)}{-h}$$

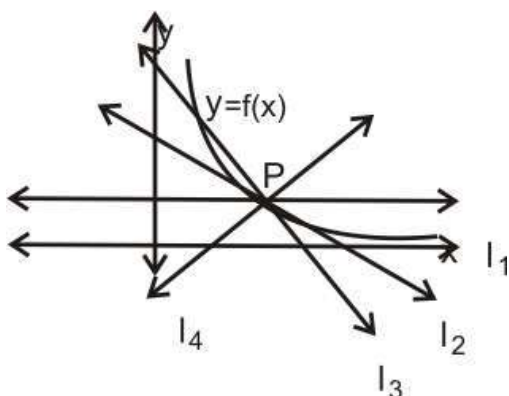
$f$  is even function ,  $f(x) = f(-x)$

$$\text{so, } \lim_{h \rightarrow 0} \frac{f(h) - f(0)}{h} = - \lim_{h \rightarrow 0} \frac{f(h) - f(0)}{h}$$

$$2 \lim_{h \rightarrow 0} \frac{f(h) - f(0)}{h} = 0 \Rightarrow 2f'(0) = 0$$

$$f'(0) = 0$$

**Q. 65** which of the following is a tangent to the curve at (p).



**Option 1:**

$l_1$

**Option 2:**

$l_2$

**Option 3:**

$L_3$

**Option 4:**

$l_4$

**Correct Answer:**

$l_2$

**Solution:**

As we learned

Tangent -

The tangent to a curve at a point P on it is defined as the limiting position of the secant PQ as the point Q approaches the point P provided such a limiting position exists.

- wherein



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**Q. 66**  $R = \{(1, 1), (1, 2), (2, 2), (3, 3)\}$  is a/an

**Option 1:**

Reflexive relation over  $A = \{1, 2, 3, 4\}$

**Option 2:**

Symmetric relation over  $A = \{1, 2, 3\}$

**Option 3:**

Anti-Symmetric relation over  $A = \{1, 2, 3\}$

**Option 4:**

None of these

**Correct Answer:**

Anti-Symmetric relation over  $A = \{1, 2, 3\}$

**Solution:**

As we have learnt,

Anti - Symmetric Relation -

$$(a, b) \in R \text{ and } (b, a) \in R \Rightarrow a = b$$

Here, R is relation in A

-

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**Q. 67**

For any  $2 \times 2$  matrix A,  $A(\text{adj}A) = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$ , then  $|A|$  is equal to.

**Option 1:**

5

**Option 2:**

-5

**Option 3:**

25

**Option 4:**

Both (a) and (b)

**Correct Answer:**

5

**Solution:**

As we have learnt

Theorem of adjoint of a matrix -

$$A(\text{adj } A) = |A| I$$

$$|A| I = A(\text{adj } A)$$

- wherein

$\text{adj } A$  is adjoint of  $A$ ,  $|A|$  is determinant of  $A$ ,  $i$  is the identity matrix

$$A(\text{adj } A) = |A| I$$

$$A(\text{adj } A) = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$

$$= 5 \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = |A| \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$|A| = 5$$

Correct option A

---

**Q. 68** Throwing of two dice, considered as 2 different experiments where A is coming of even no. in first dice & B is coming of prime no in second dice are

**Option 1:**

Mutually Exclusive events

**Option 2:**

Independents events

**Option 3:**

Dependent events

**Option 4:**

Disjoint events

**Correct Answer:**

Independents events

**Solution:**

From this we learned that

Independent events -

Two or more events are said to be independent if occurrence or non occurrence of any of them does not affect the probability of occurrence of or non - occurrence of other events.

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**Q. 69**  $\frac{1 - 2i}{2 + i} + \frac{4 - i}{3 + 2i} =$

**Option 1:**  
 $\frac{24}{13} + \frac{10}{13}i$

**Option 2:**  
 $\frac{24}{13} - \frac{10}{13}i$

**Option 3:**  
 $\frac{10}{13} + \frac{24}{13}i$

**Option 4:**  
 $\frac{10}{13} - \frac{24}{13}i$

**Correct Answer:**  
 $\frac{10}{13} - \frac{24}{13}i$

**Solution:**

As we learn

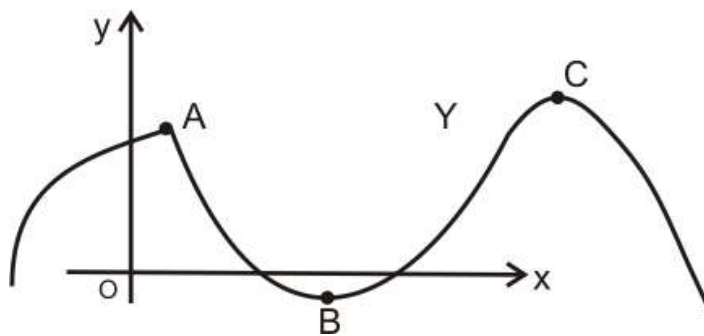
Division of Complex Numbers -

$$\frac{a + ib}{c + id} = \frac{ac + bd}{c^2 + d^2} + i \frac{bc - ad}{c^2 + d^2}$$

-

$$\frac{1 - 2i}{2 + i} + \frac{4 - i}{3 + 2i} = \frac{(1 - 2i)(3 + 2i) + (4 - i)(2 + i)}{(2 + i)(3 + 2i)} = \frac{50 - 120i}{65} = \frac{10}{13} - \frac{24}{13}i$$

**Q. 70** Which is the correct for the following figure



**Option 1:**

A - Local maximum, B - Local minimum, C - Local minimum

**Option 2:**

A - Local maximum, B - Local minimum, C - Local maximum

**Option 3:**

A & C - Local minimum, B - Local maximum

**Option 4:**

None of these

**Correct Answer:**

A - Local maximum, B - Local minimum, C - Local maximum

**Solution:**

As we learn

Local maximum and Local minimum -

Let  $y = f(x)$  be the given function then  $x = x_0$  is a point of local maximum if there exists an open interval containing  $x_0$  such that  $f(x_0) > f(x)$

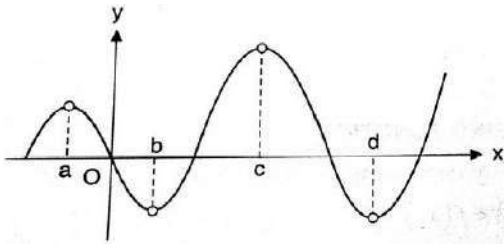
for all values of  $x$  lying in that interval and for  $f(x_0) < f(x)$  then it is local minimum.

In fig.

$x = a, x = c$  Local maxima

and at  $x = b, x = d$  Local minima

- wherein



**Q. 71**

Which of the following matrix can be obtained row elementary row operation on

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

**Option 1:**

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

**Option 2:**

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 10 & 0 \\ 2 & 4 & 3 \end{bmatrix}$$

**Option 3:**

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

**Option 4:**

Both (b) and (c)

**Correct Answer:**

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 10 & 0 \\ 2 & 4 & 3 \end{bmatrix}$$

**Solution:**

As we have learnt

Elementary row (column) transformation -

Multiplying all elements of a row (column) of a matrix by a non-zero scalar

- wherein

$$R_i \rightarrow kR_i [C_i \rightarrow kC_i]$$

$$R_2 = SR_2$$

So the correct option B

---

**Q. 72**  $\csc^{-1}\left(\csc\left(-\frac{2\pi}{3}\right)\right) =$

**Option 1:**  
 $-\frac{2\pi}{3}$

**Option 2:**  
 $\frac{\pi}{3}$

**Option 3:**  
 $\frac{2\pi}{3}$

**Option 4:**  
 $-\frac{\pi}{3}$

**Correct Answer:**  
 $-\frac{\pi}{3}$

**Solution:**

As we have learnt

Important Results of Inverse Trigonometric Functions -

$$\operatorname{cosec}^{-1}(\operatorname{cosec}\Theta) = \Theta$$

- wherein

$$\text{if } -\frac{\pi}{2} \leq \Theta < 0$$

$$\text{or } 0 < \Theta \leq \frac{\pi}{2}$$

$$\csc^{-1}\left(\csc\left(-\frac{2\pi}{3}\right)\right) = \csc^{-1}\left(\csc\left(-\frac{\pi}{3}\right)\right) = -\frac{\pi}{3}$$

**Q. 73**  $|\sin \theta - \cos \theta| = \sqrt{1-x}$   
if  
 $1-x^2 = \cos^2 \phi$ ;  $\tan 2\phi = ?$  if  $\theta = 15^\circ$

**Option 1:**

$$\sqrt{3}$$

**Option 2:**

$$1/\sqrt{3}$$

**Option 3:**

$$1$$

**Option 4:**

none of these

**Correct Answer:**

$$\sqrt{3}$$

**Solution:**

As we have learned

Results from Submultiples of an angle -

$$\left| \sin \frac{A}{2} - \cos \frac{A}{2} \right| = \sqrt{1 - \sin A}$$

-

$$\left| \sin \frac{A}{2} + \cos \frac{A}{2} \right| = \sqrt{1 + \sin A}$$

$$x = \sin 30$$

$$\phi = 30^\circ$$

$$\tan 2\phi = \sqrt{3}$$

---

**Q. 74** The domain of the function

$$f(x) = \frac{1}{\sqrt{|x| - x}}$$

**Option 1:**  
 $(-\infty, 0)$

**Option 2:**  
 $(-\infty, \infty) - \{0\}$

**Option 3:**  
 $(-\infty, \infty)$

**Option 4:**  
 $(0, \infty)$

**Correct Answer:**  
 $(-\infty, 0)$

**Solution:**

$$f(x) = \frac{1}{\sqrt{|x| - x}}$$

$$|x| - x > 0$$

$$x < |x|$$

which is true only for -ve numbers.

Correct option is 1.

---

**Q. 75**  $A = \{(x, y) : x - y = 2n, \text{ where, } x = 2k \text{ \& } y = 2m + 1, k, m, n \in \mathbb{N}\}$  is an

**Option 1:**  
Reflexive relation over  $\mathbb{N}$

**Option 2:**  
Symmetric relation over  $\mathbb{N}$

**Option 3:**  
Void relation

**Option 4:**  
Universal relation

**Correct Answer:**  
Void relation

**Solution:**

As we have learnt,

Void relation -

No element in the relation.

- wherein

$$\phi \subseteq A \times A$$

Difference of even & odd nos. is never even

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**Q. 76** What is called the middle of a distribution arranged in ascending/descending order?

**Option 1:**

Mean

**Option 2:**

Mode

**Option 3:**

Median

**Option 4:**

Range

**Correct Answer:**

Median

**Solution:**

As we learned

MEDIAN -

The median is the middle of a distribution. Half the scores are above the median and half are below the median.

- wherein

The median is the middle of a distribution arranged in ascending or descending order.

**Q. 77** if  $f(x) = \begin{cases} \frac{\sin[x]}{[x]}, & [x] \neq 0 \\ 0 & [x] = 0 \end{cases}$ , then  $\lim_{x \rightarrow 0} f(x)$  equals

**Option 1:**

1

**Option 2:**

0

**Option 3:**

-1

**Option 4:**

Does not exist

**Correct Answer:**

Does not exist

**Solution:**

As we learned

Condition for Trigonometric limit -

$$\lim_{x \rightarrow a} \frac{\sin(x - a)}{x - a} = 1$$

It must be  $\frac{\sin(\text{angle})}{(\text{angle})_{(\text{in radian})}}$

-

In closed interval of  $x=0$  at right hand side  $[x]=0$  and at left hand side  $[x]=-1$  Also  $[0]=0$ .

Therefore function is defined as  $f(x) = \begin{cases} \frac{\sin[x]}{[x]}, & (-1 \leq x < 0) \\ 0, & (0 \leq x < 1) \end{cases}$

$$\text{Left hand limit} = \lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} \frac{\sin[x]}{[x]} = \frac{\sin(-1)}{-1} = \sin 1$$

Right hand limit = 0, Hence, limit doesn't exist

**Q. 78**  $I = \int 6x \sin(3x^2 + 3) dx$

value of I is ?

**Option 1:**

$$-\cos(3x^2 + 3) + C$$

**Option 2:**

$$-36 \cos(3x^2 + 3) + C$$

**Option 3:**

$$-1/6 \cos(3x^2 + 3) + C$$

**Option 4:**

$$-36 \cos(x^3 + 3x) + C$$

**Correct Answer:**

$$-\cos(3x^2 + 3) + C$$

**Solution:**

As we have learned

Integration by substitution -

The functions when on substitution of the variable of integration to some quantity gives any one of standard formulas.

- wherein

Since  $\int f(x) dx = \int f(t) dt = \int f(\theta) d\theta$  all variables must be converted into single variable, (t or  $\theta$ )

$$3x^2 + 3 = t \Rightarrow 6x dx = dt$$

$$\begin{aligned}\therefore I &= \int \sin(t) dt = -\cos t + c \\ &= -\cos(3x^2 + 3) + C\end{aligned}$$

**Q. 79** The value of  $\alpha$  for which system of equation is inconsistent

$$\alpha x + \alpha y + z = \alpha - 1$$

$$x + \alpha y + z = \alpha - 1$$

$$\alpha x + y + \alpha z = \alpha - 1$$

**Option 1:**

1

**Option 2:**

-1

**Option 3:**

-1/2

**Option 4:**

Both a and b

**Correct Answer:**

-1/2

**Solution:**

As we have learnt

Inconsistent system of linear equation -

If the system of equations has no solutions

System of linear eq. is inconsistent. So system has no solution

$$\begin{vmatrix} \alpha & \alpha & 1 \\ 1 & \alpha & \alpha \\ \alpha & 1 & \alpha \end{vmatrix} = 0$$

$$R_1 = R_1 + R_2 + R_3 \quad \text{and take common } (1 + 2\alpha)$$

$$\begin{bmatrix} 1 + 2\alpha & \alpha & 1 \\ 1 + 2\alpha & \alpha & \alpha \\ 1 + 2\alpha & 1 & \alpha \end{bmatrix} = (1 + 2\alpha) \begin{bmatrix} 1 & \alpha & 1 \\ 1 & \alpha & \alpha \\ 1 & 1 & \alpha \end{bmatrix} = 0$$

$$R^1 \rightarrow R_1 - R_2 \quad \text{and} \quad R^2 \rightarrow R_2 - R_3$$

we get,

$$(1 + 2\alpha)(\alpha - 1)^2 = 0$$

$$-\alpha = -1/2, 1$$

$$\alpha \neq -1$$

**Q. 80** The no. value of k for which the linear equation possess a non - zero solution is

$$2x + ky + z = 0$$

$$kx + 2y + 2z = 0$$

$$x + y + 2z = 0$$

**Option 1:**

0

**Option 2:**

1

**Option 3:**

2

**Option 4:**

3

**Correct Answer:**

2

**Solution:**

As we have learned

Cramer's rule for solving system of linear equations -

When  $\Delta = 0$  and atleast one of  $\Delta_1, \Delta_2$  and  $\Delta_3$  is non-zero, system of equations has no solution

- wherein

$$a_1x + b_1y + c_1z = d_1$$

$$a_2x + b_2y + c_2z = d_2$$

$$a_3x + b_3y + c_3z = d_3$$

and

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

non zero sol. means non trivial sol. For non trivial sol. of the given equation

$$\begin{vmatrix} 2 & k & 1 \\ k & 2 & 2 \\ 1 & 1 & 2 \end{vmatrix} = 0 \Rightarrow 4 - 2k^2 + 2k + k - 2 = 0$$

$$k = 2, -1/2$$

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