# MOCK TEST JEE-2020
# TEST-01 SOLUTION

**Test Date :01-01-2020**

## [PHYSICS]

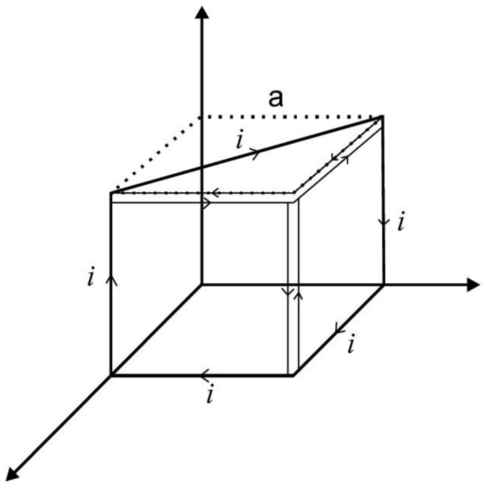
1.

**Ans. 4**

$$f_{mix} = \frac{(n\alpha)(3)(3)+(n-n\alpha)(6)}{(n\alpha)(3)+(n-n\alpha)} = \frac{3\alpha+6}{2\alpha+1}$$

2.

**Ans. (1)**




Here $\vec{M} = -ia^2\hat{i} - i\frac{a^2}{2}\hat{j} - ia^2\hat{k}$

$$\vec{M} = -ia^2\left(\hat{i} + \frac{\hat{j}}{2} + \hat{k}\right)$$

$$\Rightarrow |\vec{M}| = \frac{3}{2}ia^2$$

$$= \frac{3}{2}\times 3\times 1 \quad |\vec{M}| = \frac{9}{2} \text{ amphere - meter}^2$$

3.

**Ans. (1)**

$$V_A = \frac{-GM}{3R},$$

$$V_B = \frac{-GM}{2R^3}\left(3R^2 - \frac{R^2}{4}\right) = \frac{-11GM}{8R}$$

By conservation of energy

$$mV_A = mV_B + \frac{1}{2}mv^2$$

$$\Rightarrow \quad \frac{-GMm}{3R} = \frac{-11GMm}{8R} + \frac{1}{2}mv^2$$

$$\Rightarrow \quad v = \frac{5}{2}\sqrt{\frac{GM}{3R}}$$

4. (3)

5.

**Ans. (1)**

$$(\mu-1)t = n\beta$$

$$\frac{(\mu_1-1)\times 1.8\times 10^{-5}}{(\mu_2-1)\times 3.6\times 10^{-5}} = \frac{18\beta}{9\beta}$$

$$(\mu_1-1) = 4(\mu_2-1)$$

$$4\mu_2 - \mu_1 = 3$$

6.

**Ans. (1)**

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}} \Rightarrow K = \frac{h^2}{2m\lambda^2}$$

Wavelength,

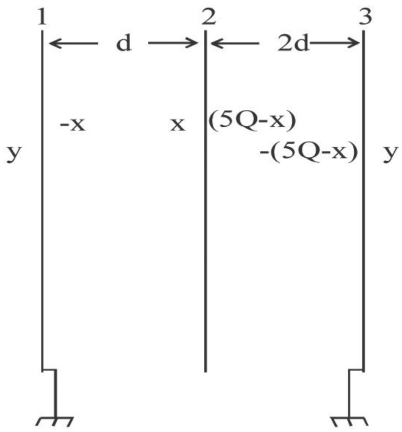
$$\lambda_0 = \frac{hc}{K}$$

$$= \frac{hc}{\left(h^2/2m\lambda^2\right)} = \frac{2mc\lambda^2}{h}$$

7. (2)

8.

**Ans. (4)**




y = 0

$\because$ the potential of both the extreme plates has to be zero

further $V_2 - V_1 = V_2 - V_3$

$$\left(\frac{x}{A\varepsilon_o}\right)d = \left(\frac{5Q - x}{A\varepsilon_o}\right)(2d)$$

$$x = 10Q - 2x$$

$$x = \frac{10Q}{3}$$

Final charge on plate (1) is = $-\frac{10Q}{3}$.

Initial charge on plate (1) is was = Q.

Charge flown through

$$S_1 = Q - \left(-\frac{10Q}{3}\right) = \frac{13Q}{3}$$

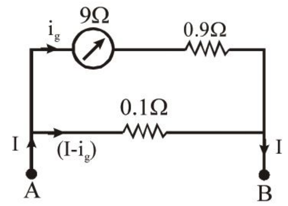
9.

**Ans. (3)**

$i_g = 10mA = 0.01A$

$V_A - V_B = (I - i_g)0.1 = i_g \times 9.9$

or $I \times 0.1 = 10 i_g$




or $I = \frac{10 \times 0.01}{0.1} = 1A$.

10.

**Ans. (4)**

$$SL_1 - SL_2 = 10\log_{10}\left(\frac{I_{max}}{I_{min}}\right)$$

$$= 10\log_{10}\left(\frac{A_1 + A_2}{A_1 - A_2}\right)^2$$

$$\Rightarrow SL_1 - SL_2 = 20\log_{10}\left[\frac{\frac{A_1}{A_2} + 1}{\frac{A_1}{A_2} - 1}\right]$$

$$= 20\log_{10} 10 = 20dB$$

11.

**Ans. (2)**

Apparent frequency $f^1 = f_0\left(1 \pm \frac{u_{rel}}{v}\right)$

$$\therefore 10 = 680\left(1 + \frac{u}{340}\right) - 680\left(1 - \frac{u}{340}\right)$$

$$\Rightarrow u = 2.5m/s$$

12. **Ans. (2)**

Let x be the desired length

Potential gradient in the first case $=\frac{E_0}{\ell}$

$\therefore \quad E=\left(\frac{\ell}{3}\right).\left(\frac{E_0}{\ell}\right)=\frac{E_0}{3} \ldots(i)$

Potential gradient in second case $=\frac{E_0}{3\ell/2}=\frac{2E_0}{3\ell}$

$\therefore \quad E=(x)\frac{2E_0}{3\ell} \qquad \ldots(ii)$

From equations (i) and (ii),

$\frac{E_0}{3}=\left(\frac{2E_0}{3\ell}\right)x \qquad x=\frac{\ell}{2}.$

13. **Ans. (1)**

$L=\frac{nh}{2\pi}$ and $r \alpha n^2$

$\Rightarrow \quad n \alpha \sqrt{r} \qquad$ so $L \alpha \sqrt{r}$

14. **Ans. (2)**

Reflection through $M_1$

$\frac{1}{v}+\left(\frac{-1}{15}\right)=\frac{-1}{10}$

$\frac{1}{v}=\frac{+1}{15}-\frac{1}{10}=\frac{2-3}{30}$

$v=-30\,cm$

Reflection through $M_2$

$\frac{1}{v}+\frac{1}{10}=-\frac{1}{10}$

$\frac{1}{v}=\frac{-2}{10}\Rightarrow v=-5$

$M=\frac{-v}{u}=\frac{5}{10}=\frac{1}{2}$

$m=\frac{h_i}{h_o}, \qquad \frac{1}{2}=\frac{h_i}{h_o}$

$\Rightarrow h_i=\frac{3}{2} \qquad h_i=1.5\,cm$

$\therefore$ Distance of image from AB = 3 - 1.5 = 1.5 cm

15.

**Ans. (1)**

path difference $=\frac{yd}{D}=900nm$

Condition for missing lines

Path Difference $=\frac{(2n-1)\lambda}{2}\Rightarrow \lambda=\frac{2\Delta x}{2n-1}$

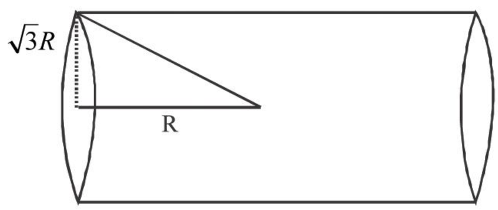
$\lambda=\frac{1800}{2n-1}$ put $n=1,2,3$

$\lambda=1800nm, 600nm, 360nm$

16. (3)

17.

**Ans. (3)**




$\tan\theta=\frac{\sqrt{3}R}{R} \qquad \theta=60^\circ$

$\Omega=2\pi(1-\cos 60)=\pi$ str.

$\Omega^y=4\pi-2(\pi)=2\pi$ str.

$\phi=\frac{\Omega^1}{4\pi}\left(\frac{q}{\varepsilon_o}\right)=\frac{q}{2\varepsilon_o}$

18. (2)

19. (2)

20.

**Ans. (4)**

We need to check whether they are rolling or sliding.

21. 2

22. 2

23. 2

24. 3

25. 5

$$2A\sin kx = 3\sqrt{2}$$
$$2\times 3\sin kx = 3\sqrt{2}$$
$$\sin kx = \frac{1}{\sqrt{2}}$$
$$\frac{2\pi}{\lambda}x = \frac{\pi}{4};\frac{3\pi}{4}$$
$$x = \frac{\lambda}{8};\frac{3\lambda}{8}.......$$

Distance between consecutive points

$$= \frac{3\lambda}{8} - \frac{\lambda}{8} = \frac{\lambda}{4}$$
$$\frac{\lambda}{4} = 20\,\text{cm}$$
$$\Rightarrow \lambda = 80\,\text{cm}$$

So, $(n+1)\frac{\lambda}{2} = 240$

# [CHEMISTRY]

26.

**Ans. (3)**

Probability of finding the electron is

$\psi^2 = 0$ or $\psi = 0$ $\quad \sigma = \frac{2Zr}{a_0}$

$(\sigma - 1) = 0 \Rightarrow \sigma = 1$ $\quad r = \frac{\sigma a_0}{2Z}$

or $r = \frac{a_0}{2Z}$ or $\sigma^2 - 8\sigma + 12 = 0$

$\sigma = 6;\quad \sigma = 2$

if $\sigma = 6 \Rightarrow r = \frac{6a_0}{2Z} = \boxed{\frac{3a_0}{Z}}$

$\sigma = 2 \quad r = \frac{2a_0}{2Z} = \frac{a_0}{Z}$

$\sigma = 1 \quad r = \frac{a_0}{2Z} = \boxed{\frac{a_0}{2Z}}$

27.

**Ans. (3)**

Only correct match.

28.

**Ans. (4)**

Birch reduction of aromatic ring system gives mainly unconjugated dihydroderivatives.

29. (4)

30. (4)

31.

**Ans. (2)**

$$H^+ + e^- \rightarrow \frac{1}{2}H_2$$
$$E = E^\circ - \frac{0.059}{1}\log\frac{1}{\left[H^+\right]} = -0.59V$$

32.

**Ans. (3)**

The product formed is $MnO_4^-$

$$2Mn^{+2} + 5S_2O_8^{-2} + 8H_2O \rightarrow 2MnO_4^- + 10SO_4^{-2} + 16H^+$$

33. (4)

34.

**Ans. (2)**

Aromatic aldehydes that do not have $\alpha$ hydrogen atoms on treatment with concentrated alkali undergo self oxidation and reduction to give alcohol and salt of the corresponding carboxylic acid during Cannizzaro's reaction.

35.

**Ans . (4)**

Isotones have same number of neutrons

$17 - 9 = B - 8$

$B = 16$

Isobars have same mass number

$A = B = 16$

No of neutrons $= 16 - 8 = 8$

36. (4)

37.

**Ans. (3)**

For monoclinic & orthorhombic, end centered unit cell is possible.

38.

**Ans. (2)**

Hydrolysis of $XeF_6$ gives

$$XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$$

$$XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$$

In above two reactions there is no change in oxidation number

39. (1)

40.

**Ans. (4)**

All are valid statements for the reaction shown

41.

**Ans. (1)**

It reats with both strong acids and strong bases.

42.

**Ans. (2)**

1 mole of XO loses =

$$\frac{1.806\times10^{23}}{0.1\times6.02\times10^{23}} = 3\text{moles of electrons}$$

43.

**Ans. (4)**

Silicons are good insulators , on methylation of dibrane we get $B_2H_2(CH_3)_4$

44.

**Ans. (3)**

In the first complex ligand is $O_2^{2-}$ which is oxidised into $O_2^{1-}$ .

hence O – O bond length decreases.

45.

**Ans . (4)**

$$P_{Total} = P_{HNO_3} + P_{NO_2} + P_{H_2O} + P_{O_2}$$

$$\because P_{NO_2} = 4P_{O_2} \quad \& \quad P_{H_2O} = 2P_{O_2}$$

$$\therefore \quad P_{Total} = P_{HNO_3} + 7P_{O_2}$$

$$\Rightarrow 30 - 2 = P_{O_2} \times 7 \Rightarrow P_{O_2} = 4$$

$$K_P = \frac{\left(P_{NO_2}\right)^4 . P_{H_2O} . P_{O_2}}{P^4{}_{HNO_3}}$$

$$= \frac{(4\times4)^4 \times (2\times4)^2 \times 4}{2^4} = 2^{20}$$

$$K_P = K_C (RT)^{\Delta ng} = K_C \times (0.08\times400)^3$$

$$K_C = \frac{2^{20}}{(32)^3} = 32$$

46 4 For H first excited state requires Energy change

$= 13.6 \times Z^2 \left[\frac{1}{1^2} - \frac{1}{2^2}\right] eV = \frac{3}{4} \times 13.6 eV$

For $He^+$ ion energy change after absorbing energy

relased by H-atom = $13.6 \times Z^2 \left[\frac{1}{2^2} - \frac{1}{n^2}\right] eV$

$= 13.6 \times 4 \left(\frac{1}{4} - \frac{1}{n^2}\right) = 13.6 \times \frac{3}{4}$

$= 1 - \frac{4}{n^2} = \frac{3}{4}$

$\frac{1}{4} = \frac{4}{n^2} \qquad \therefore n = 4$

47. 4 Due to isotopic effect
2, 3, 4, 5 option are correct

48. 5 Difference in mass of compound
$= 390 - 180 = 210$
wt. of $CH_3CO$ – group is = 43
Therefore no. of $-NH_2$ group = $\frac{210}{43} = 4.88 = 5$.

49. 6 Six type of tripeptide molecules are formed.

50. 2 (b) $\frac{r_{He}}{r_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} = \sqrt{\frac{16}{4}} = 2$

# [MATHEMATICS]

51.

**Ans. (1)**

$f'(x) = e^{-x}(x-2)(x-4) < 0$

52.

**Ans. (4)**

$$2\int \frac{(\cos x + \sec x)\sin x}{(\cos^6 x + 6\cos^2 x + 4)}dx = -2\int \frac{(t^2+1)}{t^7+6t^3+4t}dt$$

Putting cosx = t

$$= -2\int \frac{\frac{1}{t^5}+\frac{1}{t^7}}{1+\frac{6}{t^4}+\frac{4}{t^6}}dt = \frac{1}{12}\ln\left(1+\frac{6}{t^4}+\frac{4}{t^6}\right)+c,\ t = \cos x$$

53.

**Ans. (3)**

$$\int_{-6}^{6}\max\left(\left|2-|x|\right|, 4-|x|, 3\right)dx$$

$$= 2\left[\int_0^1 (4-|x|)dx + \int_1^5 3dx + \int_5^6 |2-|x||\,dx\right] = 38$$

54.

**Ans. (3)**

$$BB^T = \begin{bmatrix}\frac{\sqrt3}{2} & \frac{1}{2}\\ -\frac{1}{2} & \frac{\sqrt3}{2}\end{bmatrix}\begin{bmatrix}\frac{\sqrt3}{2} & -\frac{1}{2}\\ \frac{1}{2} & \frac{\sqrt3}{2}\end{bmatrix} = \begin{bmatrix}\frac{3}{4}+\frac{1}{4} & -\frac{\sqrt3}{4}+\frac{\sqrt3}{4}\\ -\frac{\sqrt3}{4}+\frac{\sqrt3}{4} & \frac{1}{4}+\frac{3}{4}\end{bmatrix} = \begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$$

55.

**Ans. (3)**

$$I = \int_\alpha^\beta \frac{e^{f\left(\frac{a(x-\alpha)(x-\beta)}{x-\alpha}\right)}}{e^{f\left(\frac{a(x-\alpha)(x-\beta)}{x-\alpha}\right)} + e^{f\left(\frac{a(x-\alpha)(x-\beta)}{x-\beta}\right)}}dx$$

$$= \int_\alpha^\beta \frac{e^{f(a(x-\beta))}}{e^{f(a(x-\beta))}+e^{f(a(x-\alpha))}}dx \qquad ....(1)$$

$$= \int_\alpha^\beta \frac{e^{f(a(\alpha+\beta-x-\beta))}}{e^{f(a(\alpha+\beta-x-\beta))}+e^{f(a(\alpha+\beta-x-\alpha))}}dx$$

$$I = \int_\alpha^\beta \frac{e^{f(a(x-\alpha))}}{e^{f(a(x-\alpha))}+e^{f(a(x-\beta))}}dx \qquad ....(2)$$

$$2I = \int_\alpha^\beta dx \Rightarrow I = \frac{|\alpha-\beta|}{2} = \frac{\sqrt{b^2-4ac}}{2|a|}$$

56.

**Ans. (4)**

$$I = xf(x)\Big|_0^2 - \int_0^2 f(x)dx = 0 - \frac{3}{4} = -\frac{3}{4}$$

57.

**Ans. (4)**

$$(1+\omega)^n = {}^nC_0 + {}^nC_1\omega + {}^nC_2\omega^2 + .... + {}^nC_n\omega^n$$

$$(1+1)^n = {}^nC_0 + {}^nC_1 + {}^nC_2 + .... + {}^nC_n$$

$$(1+\omega)^n + (1+1)^n = 2C_0 + C_1(1+\omega) + C_2(1+\omega^2) + C_3(1+\omega^3) + C_4(1+\omega)$$

$$+C_5(1+\omega^2) + C_6(1+\omega^3) + ...C_n(1+\omega^n)$$

$$2(C_0+C_3+C_6+...)+(C_1+C_4+C_7+...)(1+\omega)+(C_2+C_5+C_8+...)(1+\omega^2) = -\omega^{2n}+2^n$$

$$\Rightarrow (2^n - 1)(\because n \text{ in a multiple of } 3,\ w^n = 1)$$

58.

**Ans. (2)**

Let

$$I = f\left(\frac12\right) - f\left(\frac13\right) = \int_0^{\pi/4} \log_e\left(\frac{1+\frac12\tan z}{1+\frac13\tan z}\right) dz = \int_0^{\pi/4} \log_e\left(\frac32\cdot\frac{2+\tan z}{3+\tan z}\right) dz$$

Replacing $z$ by $\frac{\pi}{4} - z$, we get

$$I = \int_0^{\pi/4} \log_e\left(\frac34\cdot\frac{3+\tan z}{2+\tan z}\right) dz$$

$$\Rightarrow 2I = \int_0^{\pi/4} \log_e\left(\frac98\right)dz = \frac{\pi}{4}\log_e\left(\frac98\right)$$

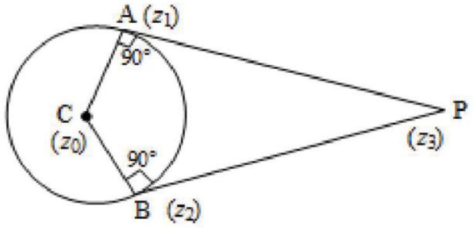
$$\Rightarrow I = \frac{\pi}{8}\log_e\left(\frac98\right)$$

59.

**Ans. (3)**

Let $z_1, z_2$ are represented by A, B whereas $z_0$ is represented by C.

Let P represent $z_3$




$$\frac{z_3 - z_1}{z_0 - z_1} = \frac{PA}{AC} e^{\frac{i\pi}{2}} ; \frac{z_0 - z_2}{z_3 - z_2} = \frac{BC}{PB} e^{\frac{i\pi}{2}}$$

$$\frac{z_3 - z_1}{z_0 - z_1} . \frac{z_0 - z_2}{z_3 - z_2} = \frac{PA}{radius} . \frac{radius}{PB} e^{i\pi} = -1 \quad (\because PA = PB)$$

60.

**Ans. (3)**

Letters of the word STATISTICS are

AIICSSSTTT (10 letters)

Letter of the word ASSISTNAT are AAINSSSTT (9 letters)

Common letters are A, I, S and T

Probability of choosing A is $\frac{1}{10} \times \frac{2}{9} = \frac{2}{90}$

Probability of choosing I is $\frac{2}{10} \times \frac{1}{9} = \frac{2}{90}$

Probability of choosing S is $\frac{3}{10} \times \frac{3}{9} = \frac{9}{90}$

Probability of choosing T is $\frac{3}{10} \times \frac{2}{9} = \frac{6}{90}$

$\therefore$ Probability of required event =

$$\frac{2}{90} + \frac{2}{90} + \frac{9}{90} + \frac{6}{90} = \frac{19}{90}$$

61.

**Ans. (4)**

General equation of tangent to the curve

$y^2 = 8x$ is $y = mx + \frac{2}{m}$

Now on solving it with xy = –1, put discriminant = 0

$$x\left(mx + \frac{2}{m}\right) = -1 \quad \Rightarrow \quad m = 1$$

62.

**Ans. (1)**

$$(HHH),(RR),\underbrace{(II),(PP),AYU}_{x} = {}^{12}C_7 . \frac{|7}{|2 . |2} . 1 \quad = (198)7!$$

63.

**Ans. (3)**

$$\frac{\left(\frac{x - y + 1}{\sqrt{2}}\right)^2}{10} + \frac{\left(\frac{x + y - 3}{\sqrt{2}}\right)^2}{5/2} = 1$$

Here $a^2 = 10$ and $b^2 = 5/2$ and centre is (1, 2)

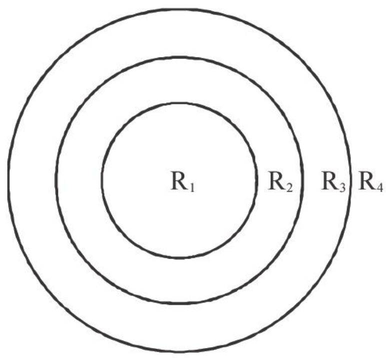
$\because$ Locus of feet of perpendicular lie on auxiliary circle of ellipse

$\therefore$ Equation of circle is $(x - 1)^2 + (y - 2)^2 = 10$

$$x^2 + y^2 - 2x - 4y - 5 = 0$$

64.

**Ans. (2)**



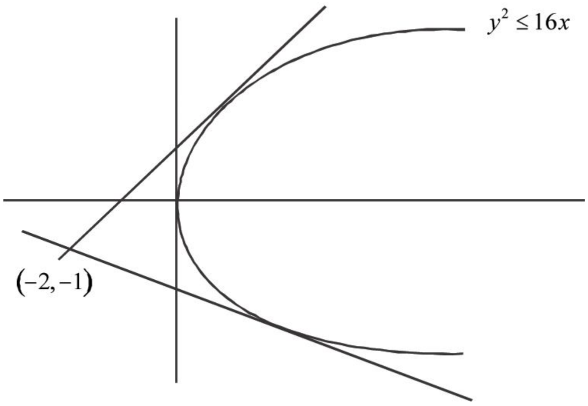

$$Area = \pi\left[\left(2^2 - 1^2\right) + \left(4^2 - 3^2\right) + ....\left(100^2 - 99^2\right)\right]$$

$$= \pi[3 + 7 + 11 + ........ + 199]$$

$$= 5050\pi$$

65.

**Ans. (4)**




S be the set of points inside the parabola.

and $\frac{y+1}{x+2}$ is $\frac{y-(-1)}{x-(-2)}$

which is slope of line joining (x, y) and (–2, –1)

$\therefore$ points (x, y) should the taken on parabola and then make tangents .

now eq$^n$ of tangent in slope form

$$y = mx + \frac{a}{m}$$

$$y = mx + \frac{4}{m}$$

$$-1 = -2m + \frac{4}{m}$$

$$-m = -2m^2 + 4$$

$$2m^2 - m - 4 = 0$$

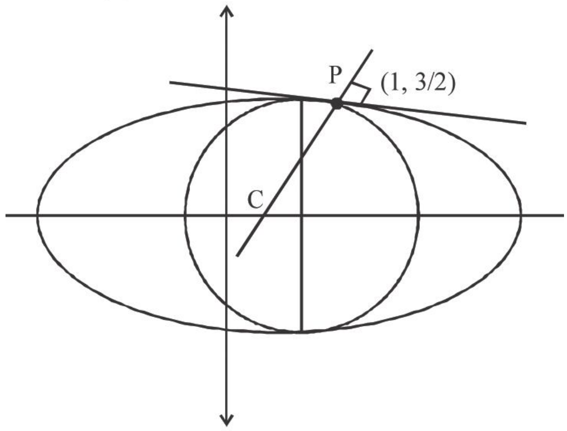
$$m = \frac{1 \pm \sqrt{1+32}}{4}$$

$$m = \frac{1-\sqrt{33}}{4} \qquad M = \frac{1+\sqrt{33}}{4}$$

$$\Rightarrow m + M = \frac{1}{2}$$

66.

**Ans. (1)**




By symmetry centre of circle lies on X-axis

$\therefore$ Normal at P is $\frac{4x}{1} - \frac{3y}{3/2} = 1$

$$\Rightarrow c \equiv \left(1/4, 0\right)$$

$\therefore$ radius $= \sqrt{\left(1-1/4\right)^2 + \left(3/2\right)^2} = \frac{3\sqrt{5}}{4}$

$\therefore$ equation of circle is

$$\left(x - 1/4\right)^2 + y^2 = \left(\frac{3\sqrt{5}}{4}\right)^2$$

$$\Rightarrow x^2 - \frac{x}{2} + y^2 + \frac{1}{16} - \frac{45}{16} = 0$$

$$x^2 - \frac{x}{2} + y^2 - \frac{44}{16} = 0$$

$$\therefore x - \text{int ercept} = 2\sqrt{g^2 - c}$$

$$= 2\sqrt{\frac{1}{16} + \frac{44}{16}} \quad = \frac{2}{4}\sqrt{45}$$

$$= \frac{1}{2}3\sqrt{5} \qquad = \frac{3\sqrt{5}}{2}$$

y - intercept $= 2\sqrt{f^2 - c}$

$$= 2\sqrt{\frac{44}{16}} \qquad = \frac{2\times 2}{4}\sqrt{11}$$

$$= \sqrt{11}$$

$$\therefore \text{product} = \frac{3\sqrt{5}}{2} \times \sqrt{11} = \frac{3\sqrt{55}}{2}$$

67.

**Ans. (3)**

No of (rectangles + squares)

$$= {}^9C_2 \times {}^9C_2 = 1296$$

and no. of squares

$$= {}^8C_1 \times {}^8C_1 + {}^7C_1 \times {}^7C_1 + \ldots\ldots\ldots {}^1C_1 \times {}^1C_1$$

$$= 1^2 + 2^2 + 3^2 + \ldots\ldots + 8^2$$

$$= 204$$

$\therefore$ No of pure rectangles = 1296 – 204

= 1092

$$\therefore \text{ ratio } = \frac{1092}{204} = \frac{91}{17}$$

68.

**Ans. (2)**

A.M $\geq$ G.M

$$\Rightarrow \frac{1+x+x^2+\ldots\ldots+x^{100}}{101} \geq \left(1.x.x^2 \ldots\ldots\ldots\ldots x^{100}\right)^{\frac{1}{101}}$$

$$\Rightarrow \frac{1+x+x^2+\ldots\ldots\ldots\ldots+x^{100}}{101} \geq x^{\frac{100\times 101}{2}\times\frac{1}{101}}$$

$$\Rightarrow \frac{1+x+x^2+\ldots\ldots x^{100}}{101} \geq x^{50}$$

$$\Rightarrow \frac{1}{101} \geq \frac{x^{50}}{1+x+x^2+\ldots\ldots\ldots+x^{100}}$$

$$\therefore \text{ Greatest value } = \frac{1}{101}$$

69.

**Ans. (1)**

Expression = $x^2 + 2y^2 + 4x = 9 + y^2 + 4x$

$= 9 + 9\sin^2 q + 4(3 \cos q) = 9 + 9(1 - \cos^2 q) + 12\cos q$

$= 18 - 3[3\cos^2 q - 4\cos q]$

$$= 18 - 3 \times 3\left[\cos^2\theta - \frac{4}{3}\cos\theta\right]$$

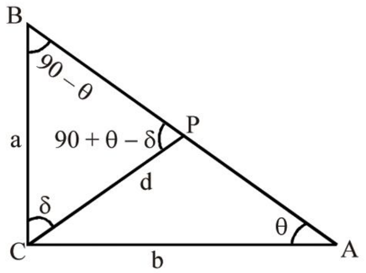
$$= 18 - 9\left[\left(\cos\theta - \frac{2}{3}\right)^2 - \frac{4}{9}\right]$$

$$= 18 + 4 - 9\left(\cos\theta - \frac{2}{3}\right)^2 = 22 - 9\left(\cos\theta - \frac{2}{3}\right)^2$$

Clearly maximum value = 22

70.

**Ans. (3)**




We have $\dfrac{a}{\sin(90°+\theta-\delta)} = \dfrac{d}{\cos\theta}$ (By sine rule in $\Delta$ BCP)

$\Rightarrow \dfrac{a}{d} = \dfrac{\cos(\theta-\delta)}{\cos\theta} = \dfrac{\cos\theta\cos\delta+\sin\theta\sin\delta}{\cos\theta}$

$\Rightarrow \dfrac{a}{d} = \cos\delta + \tan\theta\sin\delta$ ....(1)

or $\dfrac{1}{d} = \dfrac{\cos\delta}{a} + \dfrac{\sin\delta}{a}\tan\theta$

But $\tan\theta = \dfrac{a}{b}$

$\Rightarrow \dfrac{1}{d} = \dfrac{\cos\delta}{a} + \dfrac{\sin\delta}{a}\left(\dfrac{a}{b}\right)$..... Hence $\dfrac{1}{d}$

$= \dfrac{\cos\delta}{a} + \dfrac{\sin\delta}{b}$

71. Let $P(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + a_3x^{n-3} + .... + a_n$

$P(2x) = a_0 2^n x^n + a_1 2^{n-1} x^{n-1} + .... + a_n$

$P(x) + P(2x) = 5x^2 - 18$

$\Rightarrow \left(a_0 + a_0 2^n\right)x^n + ... + 2a_n = 5x^2 - 18$

$\therefore n = 2$

$\left(a_0 + 4a_0\right)x^2 + 2a_2 = 5x^2 - 18$

$5a_0 = 5$ and $a_2 = -9$

$\therefore$ P(x) = $x^2$ - 9

$\lim\limits_{x\to3}\dfrac{x^2-9}{x-3} = \lim\limits_{x\to3}\left(x+3\right) = 6$

72.

$px^2 + qx + r = 0$

$rx^2 + qx + p = 0$

$\therefore x = -1$

$\therefore p - q + r = 0$

73.

$\lfloor 1 + \lfloor 2 + ............. + \lfloor n = 9 + 24P \quad [n \ge 4]$

74.

Eccentricity of the hyperbola $x^2 - y^2\sec^2\theta = 5$ is

$e_1 = \sqrt{\dfrac{1+\sec^2\theta}{\sec^2\theta}} = \sqrt{1+\cos^2\theta}$

Eccentricity of the ellipse $x^2\sec^2\theta + y^2 = 25$ is

$e_2 = \sqrt{\dfrac{\sec^2\theta - 1}{\sec^2\theta}} = |\sin\theta|$ Given $e_1 = \sqrt{3}e_2$

$\Rightarrow 1 + \cos^2\theta = 3\sin^2\theta \Rightarrow \cos\theta = \pm\dfrac{1}{\sqrt{2}}$

$\therefore$ Least positive value of $\theta$ is $\dfrac{\pi}{4}$ $\therefore P = 4 \Rightarrow 2P = 8$

75.

As x, y $\in$ R and xy > 0, so x and y will be of same sign.

All the quantities $\dfrac{2x}{y^3}, \dfrac{x^3y}{3}, \dfrac{4y^2}{9x^4}$ are positive.

A.M. $\ge$ G.M.

$\Rightarrow \dfrac{2x}{y^3} + \dfrac{x^3y}{3} + \dfrac{4y^2}{9x^4} \ge 3\left(\left(\dfrac{2x}{y^3}\right)\left(\dfrac{x^3y}{3}\right)\left(\dfrac{4y^2}{9x^4}\right)\right)^{\frac{1}{3}}$

$= 3 \times \dfrac{2}{3} = 2$