NIMCET-2016 SOLVED PAPER

Mathematics

1. The number of 5 people groups that can be selected from 9 people when two particular persons are not to be in the same group is **[2016]**

(a) 126 (b) 35 (c) 91 (d) 252

Ans. (c)

Sol. Total number of peoples $=9$

Number of ways in which 5 people groups can be selected from 9 people.

According to the question,

5 people are selected from 9-2 particulars people already in the same group

$\Rightarrow {}^9C_5 - {}^7C_3$

$$\Rightarrow \frac{9\times8\times7\times6}{4\times3\times2} - \frac{7\times6\times5}{3\times2} \Rightarrow \frac{9!}{5!4!} - \frac{7!}{3!4!}$$

$\Rightarrow 126 - 35 \Rightarrow 91$

2. The solution set of equation $\log_x 2 \log_{2x} 2 = \log_{4x} 2$ is **[2016]**

(a) $\left\{2^{-\sqrt{2}}, 2^{\sqrt{2}}\right\}$ (b) $\left\{\frac{1}{2}, 2\right\}$

(c) $\left\{\frac{1}{4}, 2^2\right\}$ (d) $\left\{\frac{1}{4}, 2\right\}$

Ans. (a)

Sol. By options,

here (b), (c) and (d) violates the conditions of logarithm because logarithm base become 1.

Hence, the correct answer is $\left\{2^{-\sqrt{2}}, 2^{\sqrt{2}}\right\}$.

3. If a twelve sides regular polygon is inscribed in a circle of radius 3 centimeters, then the length of each side of the polygon is **[2016]**

(a) 3 (b) $18-9\sqrt{3}$

(c) $18+9\sqrt{3}$ (d) $9\left(1-\sqrt{3}\right)$

Ans. (*)

Sol. Let the side of regular polygon is a.

Length of the each side of polygon is

$$a = 2R\sin\left(\frac{\pi}{n}\right)$$

$$= 2\times3\sin\left(\frac{180}{12}\right) = 6\sin\left(15^\circ\right)$$

$2\sqrt{2}$ $\sqrt{2}$

$$= \frac{3\sqrt{2}}{2}\left(\sqrt{3}-1\right)$$

$$= \frac{3\sqrt{6}-3\sqrt{2}}{2}$$

Noneoption is correct.

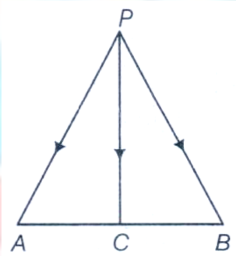
4. If C is the mid-point of AB and P is any point outside AB, then **[2016]**

(a) $PA+PB=2PC$ (b) $PA+PB=PC$

(c) $PA+PB+2PC=0$ (d) $PA+PB+PC=0$

Ans. (a)

Sol. Given, C is the mid-point of AB.



Applying triangle law of addition of vector. In ΔPAC and PBC, we get

$PA + AC = PC$

$PB + BC = PC$

and

On adding both equations,

$PA + AC + PB + BC = PC + PC$

$\Rightarrow PA + PB + AC + BC = 2PC$

$\Rightarrow PA + PB + AC - AC = 2PC$

$\Rightarrow (\because \text{C is the mid-point of AB})$

$\Rightarrow PA + PB = 2PC$

5. The average marks of boys in class is 52 and that of girls to 42 . The average marks of boys and girls combined is 50, then percentage of boys in the class is **[2016]**

(a) 80% (b) 60% (c) 40% (d) 20%

Ans. (a)

Sol. Given,

$\mathbf{x}_1 = 52, \mathbf{x}_2 = 42$ and $\mathbf{x} = 50$

Let n_1 and n_2 be the number of boys and girls respectively in the class.

$\because \quad \mathbf{x}=\frac{n_1\mathbf{x}_1+n_2\mathbf{x}_2}{n_1+n_2}$

$\Rightarrow \quad 50=\frac{52(n_1)+42n_2}{n_1+n_2}$

$\Rightarrow \quad 50(n_1+n_2)=52n_1+42n_2$

$\Rightarrow \quad 50n_1+50n_2=52n_1+42n_2$

$\Rightarrow \quad 8n_2=2n_1 \Rightarrow n_1=4n_2$

So, percentage of boys $=\frac{n_1}{n_1+n_2}\times 100$

$=\frac{4n_2}{4n_2+n_2}\times 100$

$=\frac{4n_2}{5n_2}\times 100$

$=\frac{4}{5}\times 100=80\%$

6. A box contains 2 blue caps, 4 red caps, 5 green caps and 1 yellow cap. If four caps are picked at random, then the probability that none of them is green, is **[2016]**

(a) $\frac{7}{99}$ (b) $\frac{7}{12}$ (c) $\frac{5}{99}$ (d) $\frac{5}{12}$

Ans. (a)

Sol. Total number of outcomes = selection of 4 caps from (2 blue +4 red +5 green +1 yellow) 12 caps.

$={}^{12}C_4$

Favourable number of outcomes $={}^{7}C_4$

$\therefore$ Required probability $=\frac{{}^{7}C_4}{{}^{12}C_4}$

$=\frac{\frac{7!}{4!3!}}{\frac{12!}{4!8!}}=\frac{7!}{3!}\times\frac{8!}{12!}$

$=\frac{8\times 7\times 6\times 5\times 4}{12\times 11\times 10\times 9\times 8}=\frac{7}{99}$

7. The line $3x+5y=k$ touches the ellipse $16x^2+25y^2=400$ if k is **[2016]**

(a) $\pm\sqrt{5}$ (b) $\pm\sqrt{15}$ (c) ± 25 (d) $\pm\sqrt{35}$

Ans. (c)

Sol. Given equation of line is $3x+5y=k...(i)$

comparing Eq. (i) with $lx+my+n=0$, we get

$I=3, m=5$ and $n=-k$

Equation of ellipse is

$16x^2+25y^2=400...(ii)$

On divide Eq. (ii) by 400, we get

$\frac{16x^2}{400}+\frac{25y^2}{400}=\frac{400}{400}$

$\Rightarrow \quad \frac{x^2}{25}+\frac{y^2}{16}=1$

By comparing with standard form of ellipse

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, we get $a=5, b=4$

$\because$ Condition of tangency

$n^2=a^2l^2+b^2m^2$

$(-k)^2=(5)^2(3)^2+(4)^2(5)^2$

$\Rightarrow k^2=225+400$

$\Rightarrow k^2=625$

$k=\pm 25$

8. If $X=\{4^n-3n-1, n\in N\}$ and $Y=\{9n-9, n\in N\}$, then $X\cup Y$ is equal to **[2016]**

(a) Y (b) X

(c) N (d) None of these

Ans. (a)

Sol. Given, $\mathrm{x}=\{4^{\mathrm{n}}-3\mathrm{n}-1, \mathrm{n}\in \mathrm{N}\}$and

$Y=\{9n-9, n\in N\}$

$\because 4^n-3n-1=(1+3)^n-3n-1$

$=\left({}^nC_0+{}^nC_1\times 3+{}^nC_2\times 3^2+\ldots+{}^nC_n3^n\right)-(3n+1)$

$\left[\because (1+x)^n=3^2\left({}^nC_0+{}^nC_3+\ldots{}^nC_n3^{n-2}\right)\right]$

$\therefore X$ contains same multiples of 9.

Here it is clear that Y contains all multiples of 9 including 0.

$\therefore X\cup Y$ equal to Y.

9. $\int\left\{\frac{(\log x-1)}{1+(\log x)^2}\right\}^2 dx$ is equal to **[2016]**

(a) $\frac{xe^x}{1+x^2}+C$ (b) $\frac{x}{(\log x)^2+1}+C$

(c) $\frac{\log x}{(\log x)^2+1}+C$ (d) $\frac{x}{x^2+1}+C$

Ans. (b)

Sol. Given, $I=\int\left\{\frac{(\log x-1)}{1+(\log x)^2}\right\}^2 dx$

Let $\log x=t$

$\Rightarrow x=e^t$

$\Rightarrow dx=e^t dt$

$l=\int e^t \frac{(t-1)^2}{\left(t^2+1\right)^2}dt$

$$\Rightarrow I=\int e^t \frac{t^2+1-2t}{(t^2+1)^2}dt$$

$$\Rightarrow I=\int e^t\left[\frac{1}{t^2+1}+\frac{(-2t)}{(t^2+1)^2}\right]dt$$

$$\Rightarrow I=\frac{e^t}{t^2+1}+C$$

$$\Rightarrow \left[\because \int e^x\left[f(x)+f'(x)\right]dx=e^x f(x)+C\right]$$

$$\Rightarrow I=\frac{x}{(\log x)^2+1}+C$$

10. The volume of the parallelopiped determined by $U=\hat{\mathbf{i}}+2\hat{\mathbf{j}}-\hat{\mathbf{k}}, V=-2\hat{\mathbf{i}}+3\hat{\mathbf{k}}$ and $W=7\hat{\mathbf{j}}-4\hat{\mathbf{k}}$ is **[2016]**

(a) 21 (b) 22 (c) 23 (d) 24

Ans. (c)

Sol. Given, $U=\hat{\mathbf{i}}+2\hat{\mathbf{j}}-\hat{\mathbf{k}}$

$V=-2\hat{\mathbf{i}}+3\hat{\mathbf{k}}$

and $w=7\hat{\mathbf{j}}-4\hat{\mathbf{k}}$

$\because$ Volume of parallelopiped $=U\cdot(V\times W)$

$$=\begin{vmatrix}1 & 2 & -1\\ -2 & 0 & 3\\ 0 & 7 & -4\end{vmatrix}$$

$=|1(-21)-2(8-0)-1(-14)|$

$=|-21-16+14|$

$=|14-37|$

$=|-23|$

$=23$ [since volume cannot be negative]

11. The vector perpendicular to the plane passing through $(1,-1,0),(-2,1,-1)$ and $(-1,1,2)$ is **[2016]**

(a) $6\hat{\mathbf{i}}+6\hat{\mathbf{k}}$ (b) $6\hat{\mathbf{i}}+7\hat{\mathbf{k}}$

(c) $7\hat{i}+6\hat{k}$ (d) $7\hat{\mathbf{i}}+8\hat{\mathbf{k}}$

Ans. (*)

Sol. Let the points are $A(1,-1,0),B(-2,1,-1)$ and $C(-1,1,2)$

$\therefore \mathbf{AB}=(-3,2,-1)$ and $\mathbf{AC}=(-2,2,2)$

The vector perpendicular to plane is $=AB\times AC$

So, $$\mathbf{AB}\times\mathbf{AC}=\begin{vmatrix}\hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}}\\ -3 & 2 & -1\\ -2 & 2 & 2\end{vmatrix}$$

$=\hat{\mathbf{i}}(4+2)-\hat{\mathbf{j}}(-6-2)+\hat{\mathbf{k}}(-6+4)]$

$=6\hat{\mathbf{i}}+8\hat{\mathbf{j}}-2\hat{\mathbf{k}}$

None option is correct.

12. The equation of a circle with diameters are $2x-3y+12=0$ and $x+4y-5=0$ and area of 154 sq units is **[2016]**

(a) $x^2+y^2-6x+4y-36=0$

(b) $x^2+y^2+6x-4y-36=0$

(c) $x^2+y^2-6x-4y+25=0$

(d) None of the above

Ans. (b)

Sol. Given, equation of circles are,

$2x-3y+12=0...(i)$

$x+4y-5=0...(ii)$

On solving Eq. (i) and Eq. (ii), we get $x=-3$ and $y=2$

Hence, coordinate of centre is $(-3,2)$.

Given, area of circle $=154$ sq units

$\Rightarrow \pi r^2=154$ [where r is radius of circle]

$\Rightarrow \frac{22}{7}\times r^2=154$

$\Rightarrow r^2=49$

$\Rightarrow r=7$

Here, centre is $(-3,2)$ and radius $=7$

Then, required of equation of circle is

$\{x-(-3)\}^2+(y-2)^2=(7)^2$

$\Rightarrow (x+3)^2+(y-2)^2=49$

$\Rightarrow x^2+9+6x+y^2+4-4y=49$

$\Rightarrow x^2+y^2+6x-4y+13-49=0$

$\Rightarrow x^2+y^2+6x-4y-36=0$

13. $\int\frac{x^2-1}{x^3\sqrt{2x^4-2x^2+1}}dx$ is equal to **[2016]**

(a) $\frac{\sqrt{2x^4-2x^2+1}}{x^2}+C$ (b) $\frac{\sqrt{2x^4-2x^2+1}}{x^3}+C$

(c) $\frac{\sqrt{2x^4-2x^2+1}}{x}+C$ (d) $\frac{\sqrt{2x^4-2x^2+1}}{2x^2}+C$

Ans. (d)

Sol. Here, $I=\int \frac{x^2-1}{x^3\sqrt{2x^4-2x^2+1}}dx$

[On dividing numerators and denominators by x^5]

$$l=\int \frac{\frac{x^2-1}{x^5}}{\frac{x^3\sqrt{2x^4-2x^2+1}}{x^5}}dx\,]$$

$$=\int \frac{\frac{1}{x^3}-\frac{1}{x^5}}{x^2\sqrt{2-\frac{2}{x^2}+\frac{1}{x^4}}}dx$$

$$=\int \frac{\frac{1}{x^3}-\frac{1}{x^5}}{\sqrt{2-\frac{2}{x^2}+\frac{1}{x^4}}}dx$$

Let $\left(2-\frac{2}{x^2}+\frac{1}{x^4}\right)=t$

$$\Rightarrow \left(\frac{4}{x^3}-\frac{4}{x^5}\right)dx=dt$$

$\therefore \quad l=\frac{1}{4}\int \frac{dt}{\sqrt{C}}$

$$=\frac{1}{4}\int t^{-1/2}dt$$

$=\frac{1}{4}\frac{t^{1/2}}{\frac{1}{2}}+C$ [Here C is integration constant]

$$=\frac{1}{4}\times 2t^{1/2}+C$$

$$=\frac{1}{2}t^{1/2}+C$$

On substituting the value of t, then

$$I=\frac{1}{2}\sqrt{2-\frac{2}{x^2}+\frac{1}{x^4}}+C$$

$$=\frac{1}{2}\sqrt{\frac{2x^4-2x^2+1}{x^4}}+C$$

$$=\frac{1}{2}\frac{\sqrt{2x^4-2x^2+1}}{x^2}+C$$

$$=\frac{\sqrt{2x^4-2x^2+1}}{2x^2}+C$$

14. If $\mathbf{a},\mathbf{b}$ and $\mathbf{a}+\mathbf{b}$ are vectors of magnitude α, then the magnitude of vector $\mathbf{a}-\mathbf{b}$ is **[2016]**

(a) $\sqrt{2}\alpha$ (b) $\sqrt{3}\alpha$ (c) 2α (d) 3α

Ans. (b)

Sol. Given, $|\mathbf{a}|=|\mathbf{b}|=|\mathbf{a}+\mathbf{b}|=\alpha$

$\because |\mathbf{a}+\mathbf{b}|^2=|\mathbf{a}|^2+|\mathbf{b}|^2+2\mathbf{a}\cdot\mathbf{b}$

$\Rightarrow \alpha^2=\alpha^2+\alpha^2+2\mathbf{a}\cdot\mathbf{b}$

$\Rightarrow \mathbf{a}\cdot\mathbf{b}=-\frac{\alpha^2}{2}\ldots(i)$

Then, $|\mathbf{a}-\mathbf{b}|^2=|\mathbf{a}|^2+|\mathbf{b}|^2-2\mathbf{a}\cdot\mathbf{b}$

$=\alpha^2+\alpha^2-2\cdot\frac{(-\alpha^2)}{2}$ [From Eq. (i)]

$=\alpha^2+\alpha^2+\alpha^2$

$|\mathbf{a}-\mathbf{b}|^2=3\alpha^2$

$\Rightarrow |\mathbf{a}-\mathbf{b}|=\sqrt{3\alpha^2}=\sqrt{3}\alpha$

15. Which of the following statements if FALSE ? **[2016]**

(a) $2\in A\cup B$ implies that if $2\notin A$, then $2\in B$

(b) $[2,3]\subseteq A$ implies that $2\subseteq A$ and $[2,3]\subseteq B$

(c) $A\cup B\supseteq[2,3]$ implies that $[2,3]\subseteq A$ and $[2,3]\subseteq B$

(d) $[2]\in A$ and $[3]\in A$ implies that $[2,3]\subseteq A$

Ans. (a)

Sol. (a)

16. If $2x^2+7xy+3y^2+8x+14y+\lambda=0$ represents pair of straight lines, the value of λ is **[2016]**

(a) 2 (b) 4 (c) 6 (d) 8

Ans. (d)

Sol. Given equation of pair of straight line is

$$2x^2+7\overline{xy}+3y^2+8x+14y+\lambda=0\ldots(i)$$

On comparing Eq. (i) by

$ax^2+2hxy+by^2+2gx+2fy+c=0$, we get

$$a=2,b=3,c=\lambda,h=\frac{7}{2},g=4 \text{ and } f=7$$

Eq. (i) will represents a pair of straight line, if

$abc+2fgh-af^2-bg^2-ch^2=0$

$$\Rightarrow 2\times3\times\lambda+2\times7\times4\times\frac{7}{2}-2\times7^2-3\times4^2-\lambda\times\left(\frac{7}{2}\right)^2=0$$

$$\Rightarrow 6\lambda+196-98-48-\lambda\times\frac{49}{4}=0$$

$$\Rightarrow \frac{24\lambda-49\lambda}{4}+50=0$$

$$\Rightarrow \frac{-25\lambda}{4}=-50$$

$$\Rightarrow -25\lambda=-200$$

$$\Rightarrow \lambda=8$$

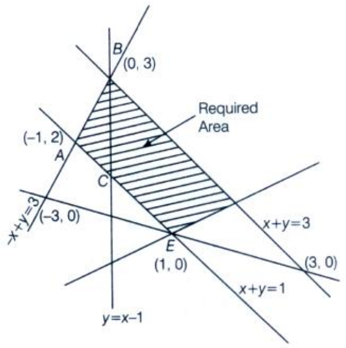
17. The area of the region bounded by the lines $y=|x-y|$ and $y=3-|x|$ is **[2016]**

(a) 3 sq units (b) 4 sq units
(c) 6 sq units (d) 2 sq units

Ans. (b)

Sol. $y=|x-1|=\begin{cases} x-1 : x \ge 1 \\ 1-x : x<1 \end{cases} \dots(i)$

and $y=3-|x|=\begin{cases} 3-x : x \ge 0 \\ 3-x : x<0 \end{cases} \dots(ii)$



Clearly, the two curves meet at $(-1,2)$ and $(2,1)$.

Required area

$=\int_{-1}^{0}(y_2-y_1)dx+\int_{0}^{1}(y^2-y_1)dx+\int_{1}^{2}(y_2-y_1)dx$

$=\int_{-1}^{\infty}[3+x-(1-x)]dx+\int_{0}^{1}[(3-x)-(1-x)]dx$

$+\int_{1}^{2}[(3-x)(x-1)dx$

$=4$

18. In a triangle $ABC, a=4, b=3, \angle BAC=60^\circ$, then the equation for which c is the root, is **[2016]**

(a) $c^2+3c+7=0$ (b) $c^2+3c-7=0$
(c) $c^2-3c+7=0$ (d) $c^2-3c-7=0$

Ans. (d)

Sol. Given that, $a=4, b=3$

and $\angle BAC=\angle A=60^\circ$

$\because \quad \cos A=\dfrac{b^2+c^2-a^2}{2bc}$

$\Rightarrow \quad \cos 60^\circ=\dfrac{3^2+c^2-4^2}{2\times 3\times c}$

$\Rightarrow \quad \dfrac{1}{2}=\dfrac{9+c^2-16}{6c}$

$\Rightarrow \quad c^2-7=3c$

$\Rightarrow \quad c^2-3c-7=0$

19. If $\cos\theta=\dfrac{5}{13}, \dfrac{3\pi}{2}<\theta<2\pi$, then $\tan 2\theta$ is **[2016]**

(a) $\dfrac{-120}{119}$ (b) $\dfrac{-120}{169}$ (c) $\dfrac{119}{116}$ (d) $\dfrac{120}{119}$

Ans. (d)

Sol. We have, $\cos\theta=\dfrac{5}{13}$

[where, $\dfrac{3\pi}{2}<\theta<2\pi$]

By trigonometric ratios,

$\tan\theta=-\dfrac{12}{5}$ [$\because \theta$ belongs to fourth quadrant]

$\because \tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\therefore \tan 2\theta=\dfrac{2\times\left(\dfrac{-12}{5}\right)}{1-\left(\dfrac{-12}{5}\right)^2}$

$=\dfrac{-\dfrac{24}{5}}{1-\dfrac{144}{25}}$

$=\dfrac{-\dfrac{24}{5}}{-\dfrac{119}{25}}$

$=-\dfrac{24}{5}\times\dfrac{25}{-119}$

$\Rightarrow \tan 2\theta=\dfrac{120}{119}$

20. An expression has 10 equally likely outcomes. Let A and B be two non-empty events of the experiment. If consists of 4 outcomes, the number of outcomes that B must have so that A and B are independent, is **[2016]**

(a) 2,4 , or 8 (b) 3, 6 or 9
(c) 4 or 8 (d) 5 or 10

Ans. (d)

Sol. Total number of possible outcomes $=10$

$\therefore P(A)=\dfrac{4}{10}=\dfrac{2}{5}$

Assume that B has n outcomes. Then,

$P(B)=\dfrac{n}{10},[0<n<10]$ Given that, A and B are independent events.

$\therefore P(A\cap B)=P(A)\cdot P(B)$

$\Rightarrow P(A\cap B)=\dfrac{2}{5}\times\dfrac{n}{10}$

$\Rightarrow P(A\cap B)=\dfrac{2n}{10}$

$\because \frac{2n}{5}$ is an integer which is lies between 0 and 10 and

$\frac{n}{5}$ is an integerswhich is lies between 0 and 5 .

$\therefore\ n=5,10$

21. Let $\mathbf{a},\mathbf{b}$ and $\mathbf{b}$ be three non-zero vectors, no two of which are collinear. If the vector $\mathbf{a}+2\mathbf{b}$ is collinear with $\mathbf{c}$ and $\mathbf{b}+3\mathbf{c}$ is collinear with $\mathbf{a}$, then $\mathbf{a}+2\mathbf{b}+6\mathbf{c}$ is equal to **[2016]**

(a) λa (b) $\lambda\mathbf{b}$ (c) $\lambda\mathbf{c}$ (d) 0

Ans. (d)

Sol. Given that $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ are non-zero vectors and $\mathbf{a}+2\mathbf{b}$ is collinear with $\mathbf{c}$ and $\mathbf{b}+3\mathbf{c}$ is collinear with $\mathbf{a}$.

$$\therefore a+2b=\lambda c...(i)$$

and $b+3c=\mu a...(ii)$

[for same λ,μ]

Put the value of $\mathbf{b}$ in Eq. (i) by Eq (ii), we get

$\mathbf{a}+2\left(\mu\mathbf{a}-3\mathbf{c}\right)=\lambda\mathbf{c}$

$\Rightarrow \mathbf{a}+2\mu\mathbf{a}-6\mathbf{c}=\lambda\mathbf{c}$

$\Rightarrow \mathbf{a}\left(1+2\mu\right)-\mathbf{c}\left(\lambda+6\right)=0$

[$\because \mathbf{a}$ and $\mathbf{c}$ are non-collinear]

$\Rightarrow 1+2\mu=0$ and $\lambda+6=0$

$\Rightarrow\ \lambda=-6$

and $\mu=-\frac{1}{2}$

$\because\quad \mathbf{a}+2\mathbf{b}=\lambda\mathbf{c}$

$\therefore\quad a+2b=-6c$

$\Rightarrow\quad \mathbf{a}+2\mathbf{b}+6\mathbf{c}=0$

22. The value of a, for which the sum of the squares of the roots of the equation $x^2-\left(a-2\right)x-\left(a+1\right)=0$, assumes the least value is **[2016]**

(a) 3 (b) 2 (c) 0 (d) 1

Ans. (d)

Sol. Given equation is

$x^2-\left(a-2\right)x-\left(a+1\right)=0$

Here, $a=1,b=-\left(a-2\right)$

and $c=-\left(a+1\right)$.

Let the roots of equation is α and β.

$\alpha+\beta=-\frac{b}{a}$

$=a-2$

$\alpha\beta=\frac{c}{a}$

$=-\left(a+1\right)$

$\Rightarrow\ \alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta$

$=(a-2)^2-2\left\{-\left(a+1\right)\right\}$

$\Rightarrow\ \alpha^2+\beta^2=(a-2)^2+2\left(a+1\right)$

$=a^2+4-4a+2a+2$

$=a^2-2a+1+5$

$\Rightarrow \alpha^2+\beta^2=(a-1)^2+5$

Clearly, $\alpha^2+\beta^2\geq 5$

So, the minimum value of $\alpha^2+\beta^2$ is 5 which it atains at $a=1$.

23. For any two events A and B, the probability that atleast one of them occur is 0.6 . If A and B occurs simultaneously with a probability 0.3 , then $P\left(A'\right)+P\left(B'\right)$ is **[2016]**

(a) 0.9 (b) 1.15 (c) 1.1 (d) 1.0

Ans. (c)

Sol. Given that,

$P\left(A\cup B\right)=0.6=\frac{3}{5}$

$P\left(A\cap B\right)=0.3=\frac{3}{10}$

Then, by probability law,

$P\left(A\cup B\right)=P\left(A\right)+P\left(B\right)-P\left(A\cap B\right)$

$\Rightarrow \frac{3}{5}=P\left(A\right)+P\left(B\right)-\frac{3}{10}$

$\Rightarrow P\left(A\right)+P\left(B\right)=\frac{3}{5}+\frac{3}{10}$

$=\frac{30+15}{50}=\frac{45}{50}$

$\Rightarrow P\left(A\right)+P\left(B\right)=\frac{9}{10}$

$\Rightarrow 1-P\left(\bar{A}\right)+1-P\left(\bar{B}\right)=\frac{9}{10}\left[\because P\left(A\right)+P\left(\bar{A}\right)=1\right]$

$\Rightarrow 2-P\left(\bar{A}\right)-P\left(\bar{B}\right)=\frac{9}{10}$

$\Rightarrow P\left(\bar{A}\right)+P\left(\bar{B}\right)=2-\frac{9}{10}=\frac{20-9}{10}$

$P\left(\bar{A}\right)+P\left(\bar{B}\right)=\frac{11}{10}=1.1$

24. Two finite sets A and B are having m and n elements. The total numbers subsets of the first set is 56 more than the total number of subsets of the second set. The value of m and n are **[2016]**

(a) 7,6 (b) 6,3 (c) 5,3 (d) 8,7

Ans. (b)

Sol. Let the total number of subset in set $A = 2^m$ and subset in set $B = 2^n$

According to the given condition,

$$2^m = 2^n + 56$$

$$\Rightarrow \quad 2^m - 2^n = 56$$

$$\Rightarrow 2^n\left(2^{m-n} - 1\right) = 8 \times 7$$

$$\Rightarrow 2^n\left(2^{m-n} - 1\right) = 2^3 \times \left(2^3 - 1\right)$$

On comparing both sides, we get

$n = 3$ and $m - n = 3$

$\Rightarrow m - 3 = 3$

$\Rightarrow m = 6$

So, $m = 6$ and $n = 3$

25. The probability that A speaks truth is $4/5$ while this probability for B is $3/4$. The probability that they contradict each other when asked to speak on a fact is **[2016]**

(a) $3/20$ (b) $1/5$ (c) $7/20$ (d) $4/5$

Ans. (c)

Sol. Given that,

$$P \text{ (Speak truth)} = P(A) = \frac{4}{5}$$

and

$$P(B) = \frac{3}{4}$$

$$\therefore P\left(\bar{A}\right) = \frac{1}{5}$$

and

$$P\left(\bar{B}\right) = \frac{1}{4}$$

$$\left[\because P(A) + P\left(\bar{A}\right) = 1\right]$$

Then, the probability when they contradict each other

$$= P(A) \cdot P\left(\bar{B}\right) + P(B) \cdot P\left(\bar{A}\right)$$

$$= \frac{4}{5} \times \frac{1}{4} + \frac{3}{4} \times \frac{1}{5}$$

$$= \frac{4}{20} + \frac{3}{20} = \frac{7}{20}$$

26. The sum of the expression **[2016]**

$\dfrac{1}{\sqrt{1}+\sqrt{2}} + \dfrac{1}{\sqrt{2}+\sqrt{3}} + \dfrac{1}{\sqrt{3}+\sqrt{4}} + \ldots. + \dfrac{1}{\sqrt{80}+\sqrt{81}}$ is

(a) 7 (b) 8 (c) 9 (d) 10

Ans. (b)

Sol. Let $S = \dfrac{1}{\sqrt{1}+\sqrt{2}} + \dfrac{1}{\sqrt{2}+\sqrt{3}} + \dfrac{1}{\sqrt{3}+\sqrt{4}} + \ldots + \dfrac{1}{\sqrt{80}+\sqrt{81}}$

Applying rationalisation rule in each term, we get

$$S = \frac{\sqrt{2}-\sqrt{1}}{2-1} + \frac{\sqrt{3}-\sqrt{2}}{3-2} + \ldots + \frac{\sqrt{81}-\sqrt{80}}{81-80}$$

$$= \sqrt{2} - 1 + \sqrt{3} - \sqrt{2} + \ldots + \sqrt{81} - \sqrt{80}$$

$$= 9 - 1 = 8$$

27. Consider the function f defined by

$f(x) = \begin{cases} x^2 - 1, & x < 3 \\ 2ax, & x \geq 3 \end{cases}$ for all real number x. If f is continuous at $x = 3$, then value a is **[2016]**

(a) 8 (b) $\dfrac{3}{4}$ (c) $\dfrac{1}{8}$ (d) $\dfrac{4}{3}$

Ans. (d)

Sol. Given that, $f(x) = \begin{cases} x^2 - 1, & x < 3 \\ 2ax, & x \geq 3 \end{cases}$

Since, $f(x)$ is continuous at $x = 3$, then

$$f(3) = \lim_{h\to 0} f(3+h) = \lim_{h\to 0} f(3-h)$$

$$\Rightarrow \lim_{h\to 0} 2a(3+h) = \lim_{h\to 0}\left[(3-h)^2 - 1\right]$$

$$\Rightarrow \lim_{h\to 0}(6a + 2ah) = \lim_{h\to 0}\left[9 + h^2 - 6h - 1\right]$$

$$\Rightarrow \lim_{h\to 0}(6a + 2ah) = \lim_{h\to 0}\left[8 + h^2 - 6h\right]$$

$$\Rightarrow \quad 6a = 8$$

$$\Rightarrow a = \frac{8}{6} = \frac{4}{3}$$

28. Three houses are available in a locality. Three persons apply for the houses. Each applies for one house without consulting others. The probability that all the three apply for the same house is **[2016]**

(a) $\dfrac{8}{9}$ (b) $\dfrac{7}{9}$ (c) $\dfrac{2}{9}$ (d) $\dfrac{1}{9}$

Ans. (d)

Sol. Since, each person can apply for any house. Therefore, total number of ways in which three person can apply for three houses

$$= 3 \times 3 \times 3$$

$$= 27 \text{ ways}$$

As given that three person can apply for house 1 or house 2 or house 3 among three house.

So, three person can apply for the same house in 3 ways.

$\therefore$ Favourable number of ways $= 3$

Hence, required probability

$$= \frac{\text{Favourable number of ways}}{\text{Total number of ways}}$$

$$= \frac{3}{27} = \frac{1}{9}$$

29. Five horses are in a race. Mr. A selects two of the horses at random and bets on them. The probability that Mr. A selected the winning horse is **[2016]**

(a) $\frac{3}{5}$ (b) $\frac{1}{5}$ (c) $\frac{2}{5}$ (d) $\frac{4}{5}$

Ans. (c)

Sol. Required probability

$=1-P$ (none of the selected houses is a winning house)

$$=1-\left(\frac{4}{5}\times\frac{3}{4}\right)$$

$$=1-\frac{3}{5}=\frac{2}{5}$$

30. If $3^x=4^{x-1}$, then x is equal to **[2016]**

(a) $\frac{2-\log_3 2}{2\log_3 2-1}$ (b) $\frac{2}{2\log_3 2-1}$

(c) $\frac{2-\log_3 2}{2\log_3 2+1}$ (d) $\frac{2\log_3 2}{2\log_3 3-1}$

Ans. (d)

Sol. Given,

$3^x=4^{x-1}$

On taking log both sides, we get

$\log\left(3^x\right)=\log 4^{(x-1)}$

$x\log 3=(x-1)\log 4\left[\because \log m^n=n\log m\right]$

$\Rightarrow x\log 3=x\log 4-\log 4$

$\Rightarrow x\log 3-\log 4=-\log 4$

$\Rightarrow x(\log 3-\log 4)=-\log 4$

$\Rightarrow x(\log 4-\log 3)=-\log 4$

$$\Rightarrow x=\frac{\log 4}{\log 4-\log 3}$$

$$=\frac{\log 2^2}{\log 2^2-\log 3}$$

$$=\frac{2\log 2}{2\log 2-\log 3}$$

$$=\frac{\frac{2\log 2}{\log 3}}{\frac{2\log 2-\log 3}{\log 3}}$$

[On dividing numerator and denominator by $\log 3$]

$$\Rightarrow x=\frac{2\log_3 2}{2\log_3 2-1}$$

31. The matrix A has x rows and $(x+5)$ columns and the matrix D has y rows and $(11-y)$ columns. If both the matrices AB and BA exist, then the value of x and y are **[2016]**

(a) 8,3 (b) 3,5 (c) 3,8 (d) 8,5

Ans. (c)

Sol. We have, $[A]_{x\times(x+5)}$

[where $x=$ number at rows and $x+5=$ number of column] and

$[B]_{y\times(11-y)}$

[where $y=$ number of rows and $11-y=$ number of columns] According to the matric rule AB exist if

$\Rightarrow$ Number of column of $A=$ number of raw of B

$\Rightarrow x+5=y...(i)$

and BA exist if

$\Rightarrow$ Number of column of $B=$ Number of raw of A

$\Rightarrow 11-y=x...(ii)$

By solving Eq. (i) and Eq. (ii), we get

$x=3$ and $y=8$

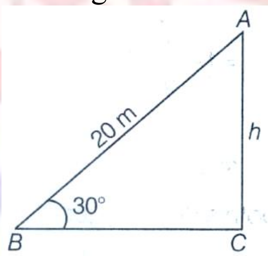
32. A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground. Find the height of the pole, if the angle made by the rope with the ground level is 30°. **[2016]**

(a) 10 m (b) 20 m (c) 30 m (d) 40 m

Ans. (a)

Sol. Let the length of rope $(AB)=20$ m

and length of vertical pole $=hm$



In $\triangle ABC$, by sine rule, we get

$$\sin 30^\circ=\frac{AC}{AB}$$

$$\Rightarrow\frac{1}{2}=\frac{h}{20}$$

$\Rightarrow 2h=20$

$$\Rightarrow h=\frac{20}{2}$$

$=10$ m

33. There are n equally speed points $1,2,\ldots\ldots,n$ marked on the circumference of a circle. If the point 15 is directly opposite of the point 49 , then the total number of points is **[2016]**

(a) 50 (b) 68 (c) 66 (d) 70

Ans. (c)

Sol. There are given n equally spaced points $1,2,\ldots\ldots,n$

Given 15 is directly opposite to the point 49.

$\therefore$ other point will be $49-15=34$

But two points must be exclude.

So, there are 32 points which apposite

Then, total number of points are

$$=32\times 2+2$$

$$=64+2=66$$

34. Let $S=\{1,2,\ldots\ldots,n\}$. The number of possible pairs of form (A,B) with $A\subseteq B$ for subsets A,B of S is **[2016]**

(a) 2^n (b) 3^n

(c) nl (d) $\sum_{k=a}^{n}\binom{n}{k}\binom{n}{n-k}$

Ans. (*)

Sol. Given, $S=\{1,2,\ldots,n\}$

First chose a k element subset B of S. This can be done in $\binom{n}{k}$ ways.

Given the subset B, A has 2^k-1 options (since the numbers of proper subset of a k - element let is 2^k-1)

Hence, the total number of pairs of sets (A,B) such that $A\subseteq B$ is given by

$$\sum_{k=0}^{n}(2^k-1)\binom{n}{k}=\sum_{k=0}^{n}\binom{n}{k}2^k-\sum_{k=0}^{n}\binom{n}{k}$$

$$=3^n-2^n$$

None option is correct.

35. Sum of the roots of the equations **[2016]**

$4^x-3\left(2^{x+3}\right)+128=0$ is

(a) 5 (b) 6 (c) 7 (d) 8

Ans. (c)

Sol. Given equation is

$$4^x-3\left(2^{x+3}\right)+128=0\ldots(i)$$

Put $2^x=y$ in Eq. (i), we get

$$\Rightarrow \left(2^x\right)^2-3\left(2^x\cdot 2^3\right)+128=0$$

$$\Rightarrow y^2-3(8y)+128=0$$

$$\Rightarrow y^2-24y+128=0$$

$$\Rightarrow y^2-16y-8y+128=0$$

$$\Rightarrow y(y-16)-8(y-16)=0$$

$$\Rightarrow (y-16)(y-8)=0$$

$$\Rightarrow y=16,8$$

$$\Rightarrow 2^x=16 \text{ or} 2^x=8$$

$$\Rightarrow 2^x=2^4 \text{ or} 2^x=2^3$$

$$\Rightarrow x=4,3$$

$\therefore$ Sum of the root $=4+3=7$

36. If the sum of the slopes of the lines given by $x^2-2cxy-7y^2=0$ is four times their product, then the value of c is **[2016]**

(a) 1 (b) -1 (c) -2 (d) 2

Ans. (d)

Sol. Given equation of lines is

$$x^2-2cxy-7y^2=0\ldots.(i)$$

Let the m_1 and m_2 be the slopes of Eq. (i), then

$$m_1+m_2=-\frac{2c}{7}$$

and $$m_1m_2=-\frac{1}{7}$$

According to given condition,

$$\Rightarrow \quad m_1+m_2=4m_1m_2$$

$$\Rightarrow \quad \frac{-2c}{7}=4\left(-\frac{1}{7}\right)$$

$$\Rightarrow \quad -\frac{2c}{7}=-\frac{4}{7}$$

$$\Rightarrow \quad 2c=4$$

$$\Rightarrow \quad c=2$$

37. The system of equations **[2016]**

$$x+y+2z=a$$

$$x+z=b$$

$$2x+y+3z=c$$

has a solution if

(a) $B=C$ (b) $c=a+b$

(c) $c=a+2b$ (d) $a=b=c$

Ans. (b)

Sol. Given system of equations is

$$x+y+2z=a$$

$$x+z=b$$

$$2x+y+3z=c$$

Applying matrix method, we get augmented matrix in the following form

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

$$=\begin{bmatrix}1 & 1 & 2 & : \\ 0 & 1 & 1 & : \\ 0 & 1 & 1 & : \\ & & & 2a-b\end{bmatrix}$$

[applying $R_2 \to R_1 - R_2$ and $R_3 \to 2R_1 - R_3$]

$$= \begin{bmatrix} 1 & 1 & 2 & :c \\ 0 & 1 & 1 & : \\ 0 & 0 & 0 & a-b \\ & & & a+b-c \end{bmatrix}$$

[applying $R_3 \to R_3 - R_2$]

If solution exist, then

$\Rightarrow \quad a+b-c=0$

$\Rightarrow \quad a+b=c$

38. Let $f(x)=x^2-bx+c, b$ is an odd positive integer. If $f(x)=0$ has two prime number as roots and $b+c=35$, then the global minimum value of $f(x)$ is **[2016]**

(a) $\frac{-183}{4}$ (b) $\frac{173}{16}$

(c) $\frac{-81}{4}$ (d) $\frac{17}{2}$

Ans. (c)

Sol. We have, $f(x)=x^2-bx+c$ and $b+c=35$

According to the condition $b+c=35$,

Let assume that 2 and 11 be the prime root of above equation, then $(x-2)(x-11)=0$

$\Rightarrow \quad x^2-2x-11x+22=0$

$\Rightarrow \quad x^2-13x+22=0$

Which satisfies the condition $b+c=35$.

On comparing both equations, we get

$b=13$ and $c=22$

Global minimum $f'(x)=0$

$\Rightarrow 2x-13=0 \Rightarrow x=\frac{13}{2}$

$\therefore f''\left(\frac{13}{2}\right)>0$

So, $f\left(\frac{13}{2}\right)=\left(\frac{13}{2}\right)^2-13\times\frac{13}{2}+22$

$=\frac{169}{4}-\frac{169}{2}+22=-\frac{81}{4}$

39. The vertex of the parabola whose focus is $(-1,1)$ and directrix is $4x+3y-24=0$ is **[2016]**

(a) $\left(0,\frac{3}{2}\right)$ (b) $\left(0,\frac{5}{2}\right)$

(c) $\left(1,\frac{3}{2}\right)$ (d) $\left(1,\frac{5}{2}\right)$

Ans. (d)

Sol. Given focus is $(-1,1)$ and equation of directrix is $4x+3y-24=0$

The equation of axis which perpendicular to directrix is

$3x-4y+c=0$

Point $(-1,1)$ lies on above equation,

$3(-1)-4(1)+c=0$

$\Rightarrow \quad -3-4+c=0$

$\Rightarrow \quad c-7=0$

$\Rightarrow \quad c=7$

Then, equation of axis is $3x-4y+7=0$

Since, vertex lie on given axis.

Therefore, only option (d) satisfy the above equation.

Hence, vertex will be $\left(1,\frac{5}{2}\right)$.

40. The number of points in $(-\infty,\infty)$, for which $x^2-x\sin x-\cos x=0$ is **[2016]**

(a) 6 (b) 4 (c) 2 (d) 0

Ans. (d)

Sol. We have, $x^2-x\sin x-\cos x=0$

for any positive root in $(-\infty,\infty)$,

$f'(x)=2x-\sin x-x\cos x+\sin x=0$

$\Rightarrow \quad 2x-x\cos x=0$

$\Rightarrow \quad x(2-\cos x)=0$

$\cos x=2$

[which is not possible]

Hence, number of root will be zero.

41. There are 4 books on fairy tales, 5 novels and 3 plays. In how many ways can they be arranged in the order, books on fairy tales, novels and then plays so that the books of the same category are put together? **[2016]**

(a) 17280 (b) 103680

(c) 51840 (d) 360

Ans. (a)

Sol. Books on fairy tales can be arranged in 4! ways novels can be arranged in 5 ! ways.

Books on plays can be arranged in 3 ! ways.

Number of arrangement in which fairy tales books are arranged first, then novels and after that books on plays

$=4!\times5!\times3!$

$=24\times120\times6=17280$

42. Suppose a population A has 100 observations $101,102,\ldots\ldots,200$ and another population B has 100 observation $151, 152, \ldots\ldots, 250$. If V_A and V_B represent variance of the two population respectively, then $\frac{V_A}{V_B}$ is **[2016]**

(a) $\frac{9}{4}$ (b) $\frac{4}{9}$ (c) 1 (d) $\frac{2}{3}$

Ans. (c)

Sol. Given that,

A has 100 observations from 101, 102, 200 and B has 100 observations from 151, 152, 250.

Here, It is given that each of the two population has 100 observations which are 100 consecutive integers. So, sum of the squares of deviations from their respective mean are same.

So, $V_A = V_B$

$\therefore \quad \frac{V_A}{V_B} = 1$

43. If $\mathbf{a}, \mathbf{b}$ are vectors such that $|\mathbf{a}+\mathbf{b}| = \sqrt{29}$ and $\mathbf{a}\times\left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right) = \left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right)\times\mathbf{b}$, then a possible value of $(\mathbf{a}+\mathbf{b})\cdot\left(-7\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3\hat{\mathbf{k}}\right)$ is **[2016]**

(a) 0 (b) 3 (c) 4 (d) 8

Ans. (c)

Sol. Given $|\mathbf{a}+\mathbf{b}| = \sqrt{29}$

and $\mathbf{a}\times\left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right) = \left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right)\times\mathbf{b}$

$\Rightarrow a\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right) = -b\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right)$

$\Rightarrow (a+b)\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right) = 0$

$\Rightarrow a+b = \lambda\left(2\hat{i}+3\hat{j}+4\hat{k}\right)$

$\Rightarrow |a+b| = |\lambda|\sqrt{4+9+16}$

$\Rightarrow \sqrt{29} = |\lambda|\sqrt{29}$

$\Rightarrow |\lambda| = 1$

$\Rightarrow \lambda = \pm 1$

$\therefore \; a+b = \pm\left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right)$

Hence, $(\mathbf{a}+\mathbf{b})\cdot\left(-7\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3\hat{\mathbf{k}}\right)$

$\Rightarrow \left(2\hat{\mathbf{i}}+3\hat{\mathbf{j}}+4\hat{\mathbf{k}}\right)\cdot\left(-7\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3\hat{\mathbf{k}}\right)$

$\Rightarrow -14+6+12 = 4$

44. Let $x_1, x_2, \ldots\ldots, x_n$ be n observation such that $\sum x_i^2 = 400$ and $\sum x = 80$. Then a possible value of n among the following is **[2016]**

(a) 10 (b) 15 (c) 20 (d) 8

Ans. (c)

Sol. Given, $\Sigma x_i^2 = 400$ and $\Sigma x_i = 80$

Applying variance rule,

$$\frac{\Sigma x_i^2}{n} \geq \frac{(\Sigma x_i)^2}{n^2}$$

$$\Rightarrow \frac{400}{n} \geq \frac{80\times 80}{n^2}$$

$$\Rightarrow n \geq \frac{6400}{400}$$

$$\Rightarrow n \geq 16$$

So, possible value of n can be 20 .

45. Area of the greatest rectangle that can be inscribed in the ellipse is **[2016]**

(a) $\sqrt{ab}$ (b) $2ab$ (c) ab (d) $\frac{a}{b}$

Ans. (b)

Sol. The vertices of any rectangle inscribed in an ellipse is given by

$(\pm a\cos\theta, \pm b\sin\theta)$

The area of the rectangle is given by

$A(\theta) = 4ab\cos\theta\sin\theta$

$= 2ab\sin 2\theta$

So, the area is maximum when $\sin(2\theta) = 1$

Hence, the maximum area is when $2\theta = \frac{\pi}{2}$.

i.e. $\theta = \frac{\pi}{4}$ the maximum area is $A = 2ab$

46. Two common tangents to the circle $x^2+y^2 = 2a^2$ and parabola $y^2 = 8ax$ are **[2016]**

(a) $x = \pm(y+2a)$ (b) $y = \pm(x+2a)$

(c) $x = \pm(y+a)$ (d) $y = \pm(x+a)$

Ans. (b)

Sol. Equation of tangent to parabola $y^2 = 8ax$ is

$y = mx + \frac{2a}{m}$.

This tangent is also touches the circle $x^2+y^2 = 2a^2$.

$\therefore$ Length of perpendicular = Radius

$$\Rightarrow \frac{2a}{m} = \sqrt{2}a$$

$$\Rightarrow \frac{4a^2}{\sqrt{m^2+1}} = 2a^2$$

$$\Rightarrow m^2\left(m^2+1\right)$$

$$\Rightarrow m^2\left(m^2+1\right) = 2$$

$$\Rightarrow \left(m^2-1\right)\left(m^2+2\right) = 0$$

$$\Rightarrow m^2 = 1$$

$$\therefore m = \pm 1$$

Hence, equation of common tangent is $y = \pm\left(x+2a\right)$

47. If $a_1, a_2, \ldots\ldots, a_n$ are in AP and $a_1 = 0$, then the value **[2016]**

$\left(\frac{a_3}{a_2}+\frac{a_4}{a_3}+\ldots,+\frac{a_n}{a_{n-1}}\right) - a_2\left(\frac{1}{a_2}+\frac{1}{a_3}+\ldots\ldots+\frac{1}{a_{n-2}}\right)$ is equal to

(a) $\left(n-2\right)+\frac{1}{\left(n-2\right)}$ (b) $\frac{1}{n-2}$

(c) $n-2$ (d) $n-\frac{1}{n-2}$

Ans. (a)

Sol. Given $a_1, a_2, \ldots\ldots, a_n$ are in AP and $a_1 = 0$

$$\therefore a_2 = d, a_3 = 2d$$

$$\because \left(\frac{a_3}{a_2}+\frac{a_4}{a_3}+\ldots+\frac{a_n}{a_{n-1}}\right) - a_2\left(\frac{1}{a_2}+\frac{1}{a_3}+\ldots+\frac{1}{a_{n-2}}\right)$$

$$\therefore \left(\frac{2d}{d}+\frac{3d}{2d}+\frac{4}{3}+\ldots\frac{\left(n-1\right)d}{\left(n-1\right)d}\right) - d\left(\frac{1}{d}+\frac{1}{2d}+\ldots+\frac{1}{\left(n-3\right)d}\right)$$

$$= \left[1+1+1+\frac{1}{2}+1+\frac{1}{3}+\ldots+1+\frac{1}{n-2}\right] - \left[1+\frac{1}{2}+\frac{1}{3}+\ldots+\frac{1}{\mathrm{n}-3}\right]$$

$$= \left[1+\frac{1}{2}+\frac{1}{3}+\ldots+\frac{1}{n-3}+\frac{1}{n-2}+n-2\right] - \left[1+\frac{1}{2}+\frac{1}{3}+\ldots+\frac{1}{n-3}\right]$$

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

48. The value of $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ$ is **[2016]**

(a) 0 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{2}$ (d) 1

Ans. (a)

Sol. Given,

$$\cos 20^\circ + \cos 100^\circ + \cos 140^\circ$$

$$\Rightarrow \left(\cos 20^\circ + \cos 100^\circ\right) + \cos 140^\circ$$

$$\Rightarrow 2\cos\left(\frac{20^\circ+100^\circ}{2}\right)\cos\left(\frac{20^\circ-100^\circ}{2}\right) + \cos 140^\circ$$

$$\left[\because \cos C + \cos D = 2\cos\frac{C+D}{2}\cos\frac{C-D}{2}\right]$$

$$= 2\cos 60^\circ \cos\left(-40^\circ\right) + \cos 140^\circ$$

$$= 2\cos 60^\circ \cos 40^\circ + \cos 140^\circ \quad \left[\because \cos\left(-\theta\right) = \cos\theta\right]$$

$$= 2\times\frac{1}{2}\cos 40^\circ + \cos 140^\circ$$

$$= 2\cos\left(\frac{140^\circ+40^\circ}{2}\right)\cos\left(\frac{140^\circ-40^\circ}{2}\right)$$

$$= 2\cos 90^\circ \cdot \cos 50^\circ \quad \left[\because \cos 90^\circ = 0\right]$$

$$\Rightarrow 0$$

49. The permutations of (a, b, c, d, e, f, g) are listed in lexicographic order. Which of the following permutations are just before and just after the permutation bacdefg? **[2016]**

(a) agfedbc and bacdfge
(b) agfedcb and badcefg
(c) agfebcd and bacedgf
(d) agfedcb and bacdegf

Ans. (d)

Sol. From the option, of all the given options (a), (b), (c) are different from given orders of word.

50. The foci the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. The the value of b^2 is **[2016]**

(a) 5 (b) 7 (c) 9 (d) 1

Ans. (b)

Sol. Given equation of ellipse is

$$\frac{x^2}{16}+\frac{y^2}{b^2}=1 \ldots(i)$$

and equation of hyperbola

$$\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$$

$$\Rightarrow \frac{x^2}{\frac{144}{25}}-\frac{y^2}{\frac{81}{25}}=1 \ldots\text{(ii)}$$

By comparing Eq. (ii) with $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, we get

$$a^2 = \frac{144}{25}$$

$$b^2 = \frac{81}{25}$$

So, foci of the ellipse are ($\pm\sqrt{16-b^2}, 0$) and hyperbola are

$$\left(\pm\sqrt{\left(\frac{12}{5}\right)^2 + \left(\frac{9}{5}\right)^2}, 0\right)$$

If they coincide, then

$$16 - b^2 = \frac{144}{25} + \frac{81}{25}$$

$$\Rightarrow \quad 16 - b^2 = \frac{225}{25}$$

$$\Rightarrow \quad 16 - b^2 = 9$$

$$\Rightarrow \quad b^2 = 16 - 9 = 7$$

Analytical Ability and Logical Reasoning

Directions (Q. Nos. 51-52) Are based on the following A boy is asked to put in a basket one mango when ordered 'One', one orange when ordered 'Two'. One apple when ordered 'Three' and is asked to take out from the basket one mango and an orange when ordered 'Four'. A sequence of order is given as 12332142314223314113234

51. How many total fruits will be in the basket at the end of the above order sequence? **[2016]**

(a) 9 (b) 8 (c) 11 (d) 10

Ans. (c)

Sol. Total number of fruits in the basket

$$= 19 \times 1 - 4 \times 2$$

$$= 19 - 8 = 11$$

52. How many total oranges were in the basket at the end of the above sequence? **[2016]**

(a) 1 (b) 4 (c) 3 (d) 2

Ans. (d)

Sol. Total number of two's $=$ total number of orang $= 6$

Total number of four $= 4$

$\therefore$ Total number of oranges in the basket

$$= 6 - 4 = 2$$

Directions (Q. Nos. 53 to 56) Are based on the following: Eight friends J, K, L, M, N, O, P and Q live on eight different floors of a building but not necessarily in same order. The lower most floor of the building is numbered one, the above that numbered two and soon until the lop most floor is numbered eight.

- J lives on floor numbered six.
- Only one person lives between J and L.
- O lives on the floor immediately below L.
- Only one person lives between O and P .
- O lives above P.
- K lives on an even numbered floor but not on the floor numbered two.
- Two persons live between K and Q .
- Q does not live on the lower most floor

N lives on one of the floor above Q.J lives on floor numbered six.

- Only one person lives between J and L.
- O lives on the floor immediately below L.
- Only one person lives between O and P .
- O lives above P.
- K lives on an even numbered floor but not on the floor numbered two.
- Two persons live between K and Q .
- Q does not live on the lower most floor

N lives on one of the floor above Q.

53. If P and L Interchange their places, who will live between P and M ? **[2016]**

(a) O (b) L (c) J (d) No one

Ans. (a)

Sol. After interchanging the places, O lives between P and M .

Solutions (Q. Nos. 53-56) From the given information the order will be as

8	K
7	N
6	J
5	Q
4	L
3	O
2	M
1	P

54. Which of the following is true about M? **[2016]**

(a) K lives immediately above M

(b) Only two people live between M and Q

(c) M lives on an odd numbered floor

(d) M lives on the lower most floor

Ans. (b)

Sol. Only two people live between M and Q.

55. Who amongst the following lives on the floor number eight? **[2016]**

(a) P (b) O

(c) K (d) Cannot be determined

Ans. (c)

Sol. K lives on floor number 8.

56. Three of the following four are alike in a certain way based on the given arrangement and thus form a group. Which of the following does not belong to the group? **[2016]**
(a) PL (b) MQ (c) LN (d) OM
Ans. (d)
Sol. Only O and M are adjacent to each other.

Directions (Q. Nos. 57 to 59) Are based on the folloiwng A team must be selected from the ten probable players A, B, C, D, E, F, G, H, I and J. Of these, A, C, E and J are forwards, B, G and H are point guards and D, F and I are defender.

- The team must have at least one forward, one point guard and one defender.
- If the team includes J, it must also include F.
- The team must include E or B , but not both.
- If the team includes G , it must also include F .
- The team must include exactly one among C, G and I.
- C and F cannot be members of the same team.
- D and H cannot be members of the same team.
- The team must include both A and D or neither of them.

There is no restriction on the number of members in the team.

57. What would be the size of the largest possible team? **[2016]**
(a) 7 (b) 6 (c) 5 (d) 4
Ans. (a)
Sol. The largest possible team shall be of 6 .
F, J, A, D, G and B/E.

Solutions (Q. Nos. 57-59)
Forwards - A, C, E and J
Point Guard - B, G and H
Defenders - D, F and I

58. Which of the following cannot be included in a team of size 6 ? **[2016]**
(a) A (b) H (c) J (d) E
Ans. (b)
Sol. H cannot be included in 6 member team as if H is included then A and D will not be in the team.

59. What could be the maximum size of the team that includes G ? **[2016]**
(a) 4 (b) 5
(c) 6 (d) More than 6
Ans. (c)
Sol. G will be a member of 6 member team.

60. A family has several children. Each boy in this family has as many sisters as brothers, but each girls has twice as many brothers as sister. How many brothers and sister are there? **[2016]**
(a) 1 and 2 (b) 3 and 4
(c) 6 and 3 (d) 4 and 3
Ans. (d)
Sol. Through option we can check the possibilities. With option (d), we have

$B-B-B-B$

$S-S-S$

So, each boy has 3 sisters and 3 brothers and each girl has 2 sisters and 4 brothers.

61. In a certain code language '134' means 'good and tasty', '478' means 'see good picture' and '729' means 'picture are faint'. Which of the following numerical symbols stands for see? **[2016]**
(a) 2 (b) 7 (c) 8 (d) 1
Ans. (c)
Sol.

As, good $=4$
Picture $=7$
So, see $=8$

62. If the English word 'EXAMINATION' is coded as 56149512965, then word 'GOVERNMENT' can be coded as **[2016]**
(a) 7655955552 (b) 7645954452
(c) 7645954552 (d) 7644956552
Ans. (c)
Sol. As, $\mathrm{E} \rightarrow 05 \rightarrow 0+5=5$
$X \rightarrow 24 \rightarrow 2+4=6$
$A \rightarrow 01 \rightarrow 0+1=1$
$M \rightarrow 13 \rightarrow 1+3=4$
$1 \rightarrow 09 \rightarrow 0+9=9$
$\mathrm{N} \rightarrow 14 \rightarrow 1+4=5$
$\mathrm{A} \rightarrow 01 \rightarrow 0+1=1$
$\mathrm{T} \rightarrow 20 \rightarrow 2+0=2$
$1 \rightarrow 09 \rightarrow 0+9=9$
$\mathrm{O} \rightarrow 15 \rightarrow 1+5=6$
$N \rightarrow 14 \rightarrow 1+4=5$
Similarly, $\mathrm{G} \rightarrow= 07 \rightarrow 0+7=7$
$\mathrm{O} \rightarrow 15 \rightarrow 1+5=6$
$\mathrm{V} \rightarrow 22 \rightarrow 2+2=4$
$\mathrm{E} \rightarrow 05 \rightarrow 0+5=5$
$R \rightarrow 18 \rightarrow 1+8=9$
$N \rightarrow 14 \rightarrow 1+4=5$
$M \rightarrow 13 \rightarrow 1+3=4$
$\mathrm{E} \rightarrow= 05 \rightarrow 0+5=5$
$N \rightarrow 14 \rightarrow 1+4=5$

$T \rightarrow 20 \rightarrow 2+0=2$

GOVERNMENT - 7645954552

63. Fact 1 : Most stuffed toys are stuffed with beans.
Fact 2 : There are stuffed bears and stuffed tigers.
Fact 3 : Some chairs are stuffed with beans.
If the above statement are fact. Which of the following statements, must also be fact? **[2016]**
1. Only children's chairs are stuffed with beans.
2. All stuffed tigers are stuffed with beans.
Stuffed monkeys are not stuffed with beans.
(a) 1 is a fact
(b) Only 2 is fact
(c) Both 2 and 3 are facts
(d) None of the statements 1,2,3 are true
Ans. (d)
Sol. None of the given statements match the facts.

64. If all the 6 's are replaced by 9 's then the algebraic sum of all the numbers from 1 to 100 (both inclusive) varies by **[2016]**
(a) 333 (b) 300
(c) 279 (d) 330
Ans. (d)
Sol. There are 19 numbers which has 6 as a digit when unit digit 6 is replaced by 9 , then sum of numbers will be increase by $=3\times10=30$
From 60 to 69 there are 10 numbers which have ten's digit 6.
Here, the increase will be $30\times10=300$
$\therefore$ Total increase $=30+300=330$

65. 405 sweets were distributed equally among a group of children such that the number of sweet received by each child is one fifth of the number of children. The number of children in the group is **[2016]**
(a) 45 (b) 9 (c) 21 (d) 15
Ans. (a)
Sol. Let the number of children be x.

$$\therefore \quad x\times\frac{x}{5}=405$$
$$\Rightarrow x^2=5\times405=2025$$
$$\Rightarrow x=\sqrt{2025}=45$$

66. The number of common terms in the two sequence $17, 21, 25, \ldots\ldots, 817$ and $16, 21, 26,$ _____ 851 is **[2016]**
(a) 28 (b) 39 (c) 40 (d) 87
Ans. (c)
Sol. Number of terms in
1st series $817=17+(m-1)4$
$\Rightarrow m=201$
2nd series, $851=16+(n-1)5$
$\Rightarrow n=168$
Now, $17+(m-1)4=16+(n-1)5$
$\Rightarrow 4m+2=5n$
For, $m=2, n=2$
$m=7, n=6$
$m=12, n=10$
$m=17, n=14$
It also form a series.
$\therefore$ Number of common terms,
$$197=2+(P-1)5$$
$$\Rightarrow \quad P=40$$

67. Unscramble the letter in the following words and find the odd one. **[2016]**
(a) ONGEAR (b) NOONI
(c) ALPEP (d) AUVAG
Ans. (b)
Sol.

(a) ONGEAR	ORANGE
(b) NOONI	ONION
(c) ALPEP	APPLE
(d) AUVAG	GUAVA

Onion is the only thing that is taken out of the soil.

68. A bus starts from its depot filled to seating capacity. It stops at a point A where $1/6$ th the of passengers alight and 10 board the bus. At point B, $1/5$ th of the passengers alight and boards the bus. At point C which is the last stop, all the 55 passengers alight. The capacity of the bus is **[2016]**
(a) 96 (b) 99 (c) 66 (d) 90
Ans. (c)
Sol. At C , number of passenger $=55$
$\therefore$ Total number of passenger at $B=\frac{5}{4}\times(55-3)$
$$=\frac{5}{4}\times52=65$$
$\therefore$ Total number of passengers at
$$A \quad =\frac{6}{5}\times(65-10)$$
$$=\frac{6}{5}\times55=66$$

69. Kha-kha is an obscure island which is inhabited by two types of people; the 'Yes' type and the 'No' type. Native of types 'Yes' ask only questions the right answer in which is 'Yes' while those of type 'No' ask only questions the right answer to which is 'No'. For example the 'Yes' type will ask questions like "Is 2 plus 2 equal to 4 ?" While the "No" type will ask question like "Is 2 plus 2 equal to 5 ?". The following question is based on your visit to the island Kha-kha. Kevin and

Kumar are brothers from the island. Kumar asks you, Isatleast one of us is of type 'No'? You can conclude that **[2016]**

(a) Kevin is 'No', Kumar is 'Yes'.
(b) Both are 'Yes'.
(c) Kevin is 'Yes', Kumar is 'No'.
(d) Both are 'No'.

Ans. (a)

Sol. If the answer of question is 'No', then none belongs to No-zone. This implies both are Yes. Which is a contradiction.
If Kumar is 'Yes' the answer to the questions is 'Yes' that implies that Kevin is from No.

70. Raman was born on March 5, 1970. Lakshman was born 25 days before Raman. The year when they took birth. the Republic Day fell on Monday. What is the day of birth of Lakshman. **[2016]**

(a) Sunday (b) Monday
(c) Wednesday (d) Saturday

Ans. (a)

Sol. Raman's $\text{DOB} = 5\text{th March, } 1970$
$\therefore$ Lakshman's $\text{DOB} = 8\text{th Feb } 1970$
Repulic Day, i.e. 26 Jan = Monday
$\therefore$ 8th Feb = Sunday.

71. P, Q, R and S are four logical statements such that if P is true, then Q is true; if Q is true, then R is true; and if S is true, then at least one of Q and R is false. The it follows that **[2016]**

(a) if S is false, then both Q and R true
(b) if at least one of Q and R is true, then S is false
(c) if P is true, then S is false
(d) if Q is true, then S is true

Ans. (c)

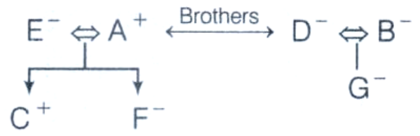
Sol. If P is true, then Q is true.
If Q is true, then R is true.
So, if P is true, then Q and R are both true.
and if Q and R are true, then S is false.

72. A, B, C, D, E, F and G are members of a family consisting of four adults, three children, three males and four female. Out of the children F and G are girls. A and D are brothers and A is doctor, E is an engineer married to one of the brothers and has two children. B is married to D and G is their child. Who is C ? **[2016]**

(a) E's daughter (b) A's son
(c) G's brother (d) F's father

Ans. (b)

Sol.



So, C is son of A and E .

73. A clock is set right at 5 am the clock losses 16 minutes in 24 hours. What will be the correct time when the clock indicates 10 pm on the 3rd day? **[2016]**

(a) 11 pm (b) 10:45pm
(c) 11:15pm (d) 12 pm

Ans. (b)

Sol. Total hours from 5 am to 10 pm of 3rd day $= 65$ h
The clock looses 16 min in 24 h .
i.e. 23 h 44 min of the clock $= 24$ h of the correct clock

So, 65 h of clock $= \dfrac{24 \times 15 \times 65}{356}$ of the correct clock
$= 65.73$ h
$= 65$ h44 min

So, correct time = 10:45pm (approx)

74. The day after the day after tomorrow is four days after Monday. What day is it today? **[2016]**

(a) Monday (b) Tuesday
(c) Wednesday (d) Thursday

Ans. (b)

Sol. 4 days after Monday is Friday
So, today is Tuesday.

Directions (Q. Nos. 75 to 77)

- There are six houses P, Q, R, S, T and U , three on either side of a road.
- The houses are of different colours - red, blue, green, orange, yellow and white.
- All the houses are of different heights.
- T, the tallest house is exactly opposite to the red coloured house.
- The shortest house is exactly opposite to the green coloured house.
- U, the orange coloured house is located between P and S.
- R, the yellow coloured house is exactly opposite to P.
- Q, the green coloured house is exactly opposite to U. P, the white coloured house is taller than R, but shorter than S and Q .

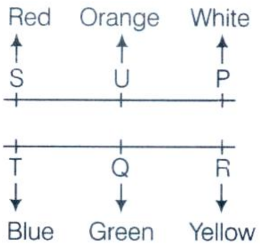
75. Which is the second largest house? **[2016]**

(a) Q (b) R
(c) S (d) Cannot be determined

Ans. (d)

Sol. 2nd highest cannot be determined.

Solutions. (Q. Nos. 75-77) From the given information the arrangement will be as follows.



Order of height $T > S/Q > P > R > U$

76. Which of the second shortest houses? **[2016]**
(a) P (b) R
(c) S (d) Cannot be determined
Ans. (b)
Sol. 2nd shortest house is R.

77. What is the colour of the tallest house? **[2016]**
(a) Red (b) Blue
(c) Green (d) Yellow
Ans. (b)
Sol. The tallest house is T which is Blue.

78. How many pairs of letters are there in the word NECESSARY which have as many letters between them in the word as there are between them in the alphabet and in the same order. **[2016]**
(a) One (b) Two
(c) Three (d) Four
Ans. (a)
Sol.

There is only one such pair NS.

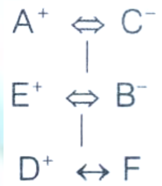
79. What is missing number is the series,
$4, 7, 11, 18, 29, 47$, ..., 123, 199 ? **[2016]**
(a) 76 (b) 77 (c) 86 (d) 87
Ans. (a)
Sol. The series is as follows
4
7
$7+4=11$
$11+7=18$
$11+18=29$
$18+29=47$
$29+47=76$
$47+76=123$
$76+123=199$
$\therefore$ Missing term $=76$

Directions (Q. Nos. 80 to 82)

- A, B, C, D, E and F are six members in a family in which there are two married couples.
- D is brother of F.
- Both D and F are lighter than B .
- B is mother of D and lighter than E.
- C a lady, is neither heaviest nor lightest in the family.
- E is lighter than C .

The grandfather in the family is the heaviest.

80. Which of the following is a pair of married couples. **[2016]**
(a) AB (b) BC (c) AD (d) BE
Ans. (d)
Sol. BE is a couple
Solutions (Q. Nos. 80-82) From the given information,



According to weight $A > C > E > B > D, F$

81. Who among the following will be in the second place, if all the members in the family are arranged in a descending order of their weights? **[2016]**
(a) C (b) A
(c) D (d) Data inadequate
Ans. (a)
Sol. C will be at 2 nd place.

82. How is C related to D ? **[2016]**
(a) Grandmother (b) Cousin
(c) Sister (d) Mother
Ans. (a)
Sol. C is grandmother of D.

Directions (Q. Nos. 83 to 85) are based on the following:

- Eleven students, A, B, C, D, E, F, G, H, I, J and K are sitting in the first row of the class facing the teacher.
- D who is to the immediate left of F is second to the right of C .
- A is second to the right of E , who is at one of the ends.
- J is the immediate neighbor of A and B and third to the left of G.

H is to the immediate left of D and third to the right of I.

83. Who is sitting in the middle of the row? **[2016]**
(a) B (b) C (c) G (d) I
Ans. (d)
Sol. I is sitting in the middle of the row.

Solutions (Q. Nos. 83-85) From the given information the arrangement will be as

84. If E and D, C and B, A and H and K and F interchange their position, which of the following pairs of students are sitting at the ends? **[2016]**

(a) D and E (b) E and F
(c) D and K (d) K and F

Ans. (c)

Sol. D and K will be at end points.

85. Which of the following groups of friends is sitting to the right of G ? **[2016]**

(a) CHDE (b) CHDF
(c) IBJA (d) None of the above

Ans. (b)

Sol. CHDF are sitting to the right of G.

Directions (Q. Nos. 86 to 89) are based on the following:

- A group of six friends are sitting around a hexagonal table, each one at one corner of the hexagon.
- Ram is sitting opposite to Ramesh.
- Jyoti is sitting next to Seema.
- Neeta is sitting opposite to Seema but not next to Ram.

Amrit has a person sitting between Ramesh and himself.

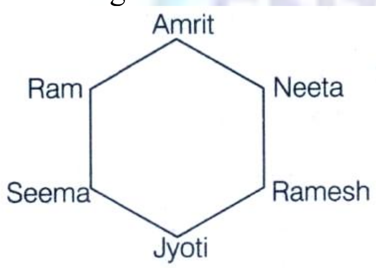
86. If Seema and Jyoti mutually interchange their positions, then who will be sitting opposite to Neeta? **[2016]**

(a) Jyoti (b) Ram
(c) Seema (d) Ramesh

Ans. (a)

Sol. After interchanging their position Jyoti will be opposite to Neeta.

Solutions (Q.Nos. 86-89) From the given information the arrangement is as follows.



87. If Neeta sits to the right of Amrit, then who is sitting to the left of Amrit? **[2016]**

(a) Ramesh (b) Neeta
(c) Jyoti (d) Ram

Ans. (d)

Sol. Ram is sitting left to Amrit.

88. Who is sitting between Amrit and Ramesh ? **[2016]**

(a) Neeta (b) Jyoti
(c) Seema (d) Ram

Ans. (a)

Sol. Neeta is sitting between Amrit and Ramesh.

89. Who is sitting opposite to Jyoti ? **[2016]**

(a) Ramesh (b) Neeta
(c) Amrit (d) Seema

Ans. (c)

Sol. Amrit is sitting opposite to Jyoti.

90. A Group of 630 children are seated in n rows for a group photo session. Each row contains three less children than the row in front of it. Which one of the following number of rows is not possible? **[2016]**

(a) 3 (b) 4 (c) 5 (d) 6

Ans. (d)

Sol. We can check it through option.

General English

Directions (Q. Nos. 91 to 94) are based on the following.

White cement is the basic raw material for producing cement tiles and cement paint which are used extensively in building construction. The main consumers of white cement are, therefore, cement title and cement paint manufacturing units. These consumers, mostly in the small scale sector, are today facing a major crisis because of a significant increase in the price of white cement during a short period. The present annual licensed production capacity of white and grey cement in a country is approximately 3.5 lakh tones. The average demand is 2-2.5 lakh tones. This means that there is idle capacity to the tone of one lakh tones or more, The price is, therefore, not a phenomenon arising out of inadequate production capacity but evidently because of artificial scarcity created by the manufactures in their self-interest.

The main reason for the continuing spurt in cement price is its decontrol. As it is, there is stiff competition in the cement paint and tile manufacturing business. Any further price revision at this stage is bound to have a severe adverse impact on the market conditions. The Government should take adequate steps to ensure that suitable controls are brought in. Else it should allow import of cement.

91. Which of the following words has the opposite meaning as the word "basic" as used in the passage?

[2016]

(a) Vital (b) Unimportant
(c) Acidic (d) Last

Ans. (b)

Sol. In the passage, "basic" has the context of being important. So, its opposite word will be "unimportant'.

92. Why is the price of cement going up ? **[2016]**

(a) Because the Government is controlling quota
(b) Because of export of white cement
(c) Because of the large usage of white cement
(d) None of the above

Ans. (d)

Sol. The reason for the cement prices going-up is not given in any of the statements.

93. What is the crisis faced by the cement tile manufactures as described in the passage? **[2016]**

(a) White cement prices are very high
(b) White cement is not of good quality
(c) White cement usage is high
(d) White cement is priced very low

Ans. (a)

Sol. The crisis faced by the cement tile manufactures is the very high prices of white cement.

94. Which of the following words has the same meaning as the word 'artificial' as used in the passage? **[2016]**

(a) Deliberate
(b) Prolonged
(c) Practical
(d) Unnatural

Ans. (a)

Sol. 'Artificial' generally gives the sense of 'man-made' but in the passage it is used to denote the sense of 'deliberate'.

95. Choose the words that accurately signifies a person who makes money by starting or running business. **[2016]**

(a) Antreprenour (b) Andrapreneur
(c) Entraprenour (d) Entrepreneur

Ans. (d)

Sol. A person who makes money by starting or running business-entrepreneur.

96. Which of the following is correct phrase to describe a group of insects? **[2016]**

(a) A flock of insects (b) A swarm of insects
(c) A school of insects (d) A shoal of insects

Ans. (b)

Sol. Group of insects is denoted by the phrase-swarm of flies.

97. Which of the following has closest meaning to the word 'REPUTATION'? **[2016]**

(a) Character (b) Respect
(c) Fame (d) Honour

Ans. (c)

Sol. 'Reputation' and 'fame' are the similar words.

98. Which of the following words means 'Theatrical'? **[2016]**

(a) Thrilling (b) Histrionic
(c) Delicate (d) Delicious

Ans. (b)

Sol. 'Theatrical' and 'dramatic' are similar from the options, 'histrionic' gives the same sense.

99. Identify the word which is different from the rest of the words **[2016]**

(a) Indisputable (b) Uncertain
(c) Dubious (d) Doubtful

Ans. (a)

Sol. Uncertain, dubious and doubtful have the same meaning. Only "indisputable" is different from the group.

100. Select the pair that best expresses a relationship similar to the expressed in SCALE: TONE **[2016]**

(a) Physician : Medicine
(b) Wave : Amplitude
(c) Spectrum : Colour
(d) Rainbow: Shower

Ans. (c)

Sol. Scale: Tone gives the sense of "skin" and its colour" with the same theme the only spectrum : colour is similar.

101. Choose the answer which best expresses the meaning of the idiom/phrase "to burn a hole in the pocket". **[2016]**

(a) Steal from someone's pocket
(b) To destroy other's belongings
(c) To be very miserly
(d) Money that Is spent quickly

Ans. (d)

Sol. Idiom "to burn a hole in the pocket means" money that is spent quickly.

102. Choose the correct alternative to fill the blank. My window look .... the garden. **[2016]**

(a) upon (b) out on
(c) in (d) at

Ans. (b)

Sol. Phrasal verb "look out on" means "intended in a certain direction. Hence" out on" will be the correct choice.

If x is the number of children in 1st row.
then in 2nd row $= (x-3)$ children
in 3rd row $= (x-6)$ children
....
....
6th row $= (x-15)$ children

$\therefore \quad x+x-3+x-6+x-9+x-12+x-15=630$

$\Rightarrow \quad 6x-45=630$

$\Rightarrow \quad 6x=675$

$\Rightarrow \quad n=\dfrac{675}{6}=112.5$

So, 6 row is not possible as number of children cannot be in fraction.

103. Fill in the blank with suitable article.
.... darkest cloud has a silver lining **[2016]**

(a) An (b) A
(c) The (d) From

Ans. (c)
Sol. The adjective "dark" has been used in the superlative degree. So, article "the" is suitable usage.

104. Fill In the blank with appropriate adjective.
The steak is completely .... it is cold and tough.
[2016]

(a) edible (b) erratic
(c) unswerving (d) thedible

Ans. (a)
Sol. "steak" means "a piece of meat". So, the item is "edible". Hence, (a) is the suitable usage.

105. Fill In the blank with a suitable preposition.
We have been looking for a new flat _____ ages.
[2016]

(a) since (b) for
(c) during (d) in

Ans. (b)
Sol. The correct phrase will be "for ages as it denotes a period of time.

106. Fill in the blank With appropriate verb
Where is he? He should .... home hours ago.
[2016]

(a) be (b) have been
(c) had been (d) were

Ans. (b)
Sol. "Should" will be followed by either. "be" or "have been. But "be is not appropriate as "hour" is not preceded by "at". Hence "have been" is the suitable usage.

107. Fill in the blank With appropriate question tag
You shouldn't be here on a holiday, ...
[2016]

(a) shouldn't you (b) should you not
(c) wouldn't you (d) should you

Ans. (d)
Sol. As the statement is negative the tag must be positive. The auxiliary verb is 'should'. So, the tag will be 'should you'.

108. Change the following sentence into passive sentence. They studied Mathematics last year.
[2016]

(a) Mathematics was studied by them last year
(b) Mathematics were studied by them last year
(c) Mathematics has been studied by them last year
(d) Mathematics studied them last year.

Ans. (a)
Sol. Mathematics was studied by them last year.
Structure: obj + was/were + V_3 + by + sub. (obj. case) + complement.

109. The meaning of the word "EGRESS" is **[2016]**

(a) Entrance (b) Exit
(c) Double (d) Program

Ans. (b)
Sol. 'Egress' means 'exit'.

110. Choose the answer which best expresses the meaning of the Idiom/phrase "Elbow room" **[2016]**

(a) Opportunity for freedom of action
(b) Special room for the guest
(c) To give enough space to move or work in
(d) To add a new room to the house

Ans. (a), (c)
Sol. Idiom 'elbow room' has two senses.
First : opportunity for freedom of action.
Second : to give enough space to move or work in.
Hence, both the options are correct.

Computer Awareness

111. Consider a hard disk with 16 recording surfaces $(0-15)$ having 16384 cylinders ($0-16383$) and each cylinder contains 64 sectors ($0-63$). Data storage capacity in each sector is 512 bytes. Data are organised cylinder-wise and the addressing format is < cylinder no., surface no., sector no.>. A file of size 42797 KB is stored in the disk and the starting disk location of the file is $<1200, 9, 40>$. What is the cylinder number of the last sector of the file, if it is stored in a continuous manner? **[2016]**

(a) 1284 (b) 1282 (c) 1286 (d) 1288

Ans. (a)

Sol. 42797 KB will take 85512 sectors ($42797^{*}1024$ bytes $/512$ bytes).

Since, there are 64 sectors per surface $85512/64 = 1337.406$ sectors are required, so we take 1338 sectors. These sectors are distributed among 16 surfaces, so $1338/16 = 83.58$ cylinders will be required. So, the final answer will be $84 + 1200 = 1284$.

One more fact to be noted is that the file occupies 83.58 cylinders, but the 0.58 cannot be accommodated in the first one (the files storage starts from < 1200, 9, 40 >).

Hence, the file will be extended to 194 ($85594 - 85400$) more bytes of cylinder 1284.

112. Consider the following minterm expression for F.

$F(P,Q,R,S) = \Sigma 0,2,5,7,8,10,13,15$

The minterms $2,7,8$ and 13 are 'do not care' terms. The minimal sum-of-product form for F is **[2016]**

(a) $Q\bar{S} + \bar{Q}S$

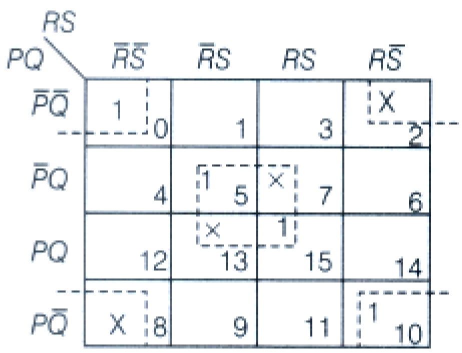
(b) $QS + \bar{Q}\bar{S}$

(c) $\bar{Q}\bar{R}\bar{S} + \bar{Q}R\bar{S} + Q\bar{R}S + QRS$

(d) $\bar{P}\bar{Q}\bar{S} + \bar{P}QS + PQS + P\bar{Q}\bar{S}$

Ans. (b)

Sol. K-map for $F(P,Q,R,S) = \Sigma(0,2,5,7,8,10,13,15)$ where, $2,7,8,13$ are do not care terms.



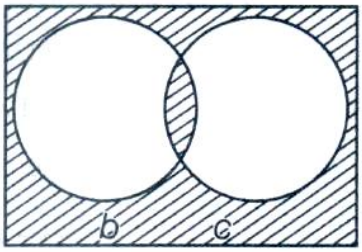
There are 2 quads:

Quad $1(m_0 + m_2 + m_8 + m_{10}) = \bar{Q}\bar{S}$

Quad $2(m_5 + m_7 + m_{13} + m_{15}) =$ QS

Hence, minimal SOP form $= QS + \bar{Q}\bar{S}$

113. The Bollean expression represented by the following Venn diagram is **[2016]**



(a) $aXORb$ (b) $a'b + ab'$

(c) $ab + a'b'$ (d) $(a + b')(a' + b)$

Ans. (c)

Sol. The given Venn diagram represent XNOR expression.

Hence, a XNOR $b = ab + a'b'$

114. The range of n-bit signed magnitude representation is **[2016]**

(a) 0 to $2^n - 1$

(b) $-(2^{n-1} - 1)$ to $(2^{n-1} - 1)$

(c) $-(2^n - 1)$ to $(2^{n-1} - 1)$

(d) 0 to $2^{n-1} - 1$

Ans. (b)

Sol. The range of values for n-bit signed magnitude representation is $-(2^{n-1} - 1)$ to $(2^{n-1} - 1)$.

115. A hard disk has a rotational speed of 6000 rpm. Its average latency time is **[2016]**

(a) 5×10^{-3} sec (b) 0.05 sec

(c) 1 sec (d) 0.5 sec

Ans. (a)

Sol. We know that,

Average latency $= \dfrac{\text{Max latency}}{2}$

where, Max latency $= \dfrac{1}{\text{rev / time}} = \dfrac{1}{\frac{6000}{60}}$ s

$= \dfrac{60}{6000} s = \dfrac{1}{100} s$

$= 10^{-2} s$

So, the average latency $= \dfrac{10^{-2}}{2}$

$= 0.5 \times 10^{-2}$

$= 5 \times 10^{-3}$ s

116. The 2's complement representation of the number $(-100)_{10}$ in an 8-bit computer is **[2016]**

(a) 10011011 (b) 01100100

(c) 11100100 (d) 10011100

Ans. (d)

Sol. 8 bit representation of 100 $\rightarrow$ 01100100

Complement $\rightarrow 10011011$

add1 $\rightarrow 00000001$

$-100 \rightarrow 10011100$

Hence, 2's complement representation is 10011100.

117. The number of terms in the product of sum canonical form of $\left|(x_1+x_2)(x_3x_4)\right|$ is **[2016]**

(a) 7 (b) 8 (c) 9 (d) 10

Ans. (*)

Sol. None option is correct.

118. Find the odd one out: **[2016]**

(a) HTTP (b) FCFS

(c) HTML (d) TCP/IP

Ans. (b)

Sol. (b)

119. Consider the equation $(43)_x = (y3)_8$ where x and y are unknown. The number of possible solutions are **[2016]**

(a) 4 (b) 6 (c) 5 (d) 7

Ans. (c)

Sol. Given, $(43)_x = (y3)_8$

By converting to decimal system

$$4x^1 + 3x^0 = y \cdot 8^1 + 3.8^0$$

$$4x + 3 = 8y + 3$$

$$4x = 8y$$

$$x = 2y$$

x is the base of number system $x > 4$

y is number in the number system with base 8 , so $y < 8$.

x	y
6	3
8	4
10	5
12	6
14	7

Number of possible solutions $= 5$

120. Subtract $(1010)_2$ from $(1101)_2$ using first complement **[2016]**

(a) $(1100)_2$ (b) $(0101)_2$

(c) $(1001)_2$ (d) $(0011)_2$

Ans. (d)

Sol. $(1101)_2 - (1010)_2$

1's complement of 1010 is 0101.

Minued -1101

-0101

1's complement of subtrahend - 0101

Carry over 10010

1

0011

The required difference is 0011.