JEE Mains 2020

7th Jan Shift 2 Paper – Mathematics

1. Let $A = [a_{ij}], B = [b_{ij}]$ are two 3×3 matrices such that $b_{ij} = \lambda^{i+j-2} a_{ij}$ & $|B| = 81$. Find $|A|$ if $\lambda = 3$.

A) $\frac{1}{9}$ B) 3 C) $\frac{1}{81}$ D) $\frac{1}{27}$

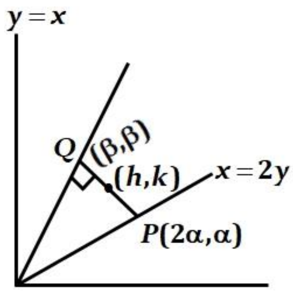
Ans. A

Sol. $|B| = \begin{vmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{vmatrix} = \begin{vmatrix} 3^0 a_{11} & 3^1 a_{12} & 3^2 a_{13} \\ 3^1 a_{21} & 3^2 a_{22} & 3^3 a_{23} \\ 3^2 a_{31} & 3^3 a_{32} & 3^4 a_{33} \end{vmatrix} \Rightarrow 81 = 3^3 \cdot 3 \cdot 3^2 |A| \Rightarrow 3^4 = 3^6 |A| \Rightarrow |A| = \frac{1}{9}$

2. From any point P on the line $x = 2y$ perpendicular is drawn on $y = x$. Let foot of perpendicular is Q. Find the locus of mid point of PQ.

A) $2x = 3y$ B) $5x = 7y$ C) $3x = 2y$ D) $7x = 5y$

Ans. B



Sol. Slope of $PQ = \frac{k-\alpha}{h-2\alpha} = -1$

$\Rightarrow k - \alpha = -h + 2\alpha$

$\Rightarrow \alpha = \frac{h+k}{3}$ (1)

Also $2h = 2\alpha + \beta$

$2k = \alpha + \beta$

$\Rightarrow 2h = \alpha + 2k$

$\Rightarrow \alpha = 2h - 2k$ (2)

from (1) & (2)

$\frac{h+k}{3} = 2(h-k)$

so locus is $6x - 6y = x + y \Rightarrow 5x = 7y$

3. Pair of tangents are drawn from origin to the circle $x^2 + y^2 - 8x - 4y + 16 = 0$ then square of length of chord of contact is

A) $\frac{64}{5}$ B) $\frac{24}{5}$ C) $\frac{8}{5}$ D) $\frac{8}{13}$

Ans. A

Sol. $L = \sqrt{S_1} = \sqrt{16} = 4$

$R = \sqrt{16 + 4 - 16} = 2$

Length of chord of contact $= \frac{2LR}{\sqrt{L^2+R^2}} = \frac{2\times4\times2}{\sqrt{16+4}} = \frac{16}{\sqrt{20}}$

Square of length of chord of contact $= \frac{64}{5}$

4. Contrapositive of if $A \subset B$ and $B \subset C$ then $C \subset D$

A) $C \not\subset D$ or $A \not\subset B$ or $B \not\subset C$ B) $C \subset D$ and $A \not\subset B$ or $B \not\subset C$
C) $C \subset D$ or $A \not\subset B$ and $B \not\subset C$ D) $C \subset D$ or $A \not\subset B$ or $B \not\subset C$

Ans. D

Sol. Let $P = A \subset B, Q = B \subset C, R = C \subset A$

Contrapositive of $(P \wedge Q) \to R$ is $\sim R \to \sim (P \wedge Q)$

$R \vee (\sim P \vee \sim Q)$

5. Let $y(x)$ is solution of differential equation $(y^2 - x)\frac{dy}{dx} = 1$ and $y(0) = 1$, then find the value of x where curve cuts the x-axis

A) $2 - e$ B) $2 + e$ C) 2 D) e

Ans. A

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

I.F. $= e^{\int I\cdot dy}=e^y$

$x\cdot e^y=\int y^2\cdot e^y\cdot dy$

$=y^2\cdot e^y-\int 2y\cdot e^y\cdot dy$

$\Rightarrow y^2e^y-2(y\cdot e^y-e^y)+c$

$x\cdot e^y=y^2e^y-2ye^y+2e^y+c$

$x=y^2-2y+2+c\cdot e^{-y}$

$x=0, y=1$

$0=1-2+2+\frac{c}{e}$

$c=-e$

$y=0, x=0-0+2+(-e)(e^{-0})$

$x=2-e$

6. Let θ_1 and θ_2 (where $\theta_1<\theta\_2$) are two solutions of $2\cot^2\theta-\frac{5}{\sin\theta}+4=0, \theta\in[0,2\pi)$ then $\int_{\theta_1}^{\theta_2}\cos^2 3\theta d\theta$ is equal to

A) $\frac{\pi}{3}$ B) $\frac{2\pi}{3}$ C) $\frac{\pi}{9}$ D) $\frac{\pi}{3}+\frac{1}{6}$

Ans. A

Sol. $2\cot^2\theta-\frac{5}{\sin\theta}+4=0$

$\frac{2\cos^2\theta}{\sin^2\theta}-\frac{5}{\sin\theta}+4=0$

$2\cos^2\theta-5\sin\theta+4\sin^2\theta=0, \sin\theta\neq 0$

$2\sin^2\theta-5\sin\theta+2=0$

$(2\sin\theta-1)(\sin\theta-2)=0$

$\sin\theta=\frac{1}{2}$

$\theta=\frac{\pi}{6},\frac{5\pi}{6}$

$$\therefore \int_{\pi/6}^{5\pi/6}\cos^2 3\theta\, d\theta=\int_{\pi/6}^{5\pi/6}\frac{1+\cos 6\theta}{2}d\theta$$

$$=\frac{1}{2}\left[\theta+\frac{\sin 6\theta}{6}\right]_{\pi/6}^{5\pi/6}=\frac{1}{2}\left[\frac{5\pi}{6}-\frac{\pi}{6}+\frac{1}{6}(0-0)\right]=\frac{1}{2}\cdot\frac{4\pi}{6}=\frac{\pi}{3}$$

7. Let $3+4+8+9+13+14+18+\ldots+40$ terms $=S$. If $S=(102)m$ then $m=$

A) 20 B) 25 C) 10 D) 5

Ans. A

Sol. $S=\underbrace{3+4}+\underbrace{8+9}+\underbrace{13+14}+\underbrace{18+19}\ldots 40$ terms

$S=7+17+27+37+47+\ldots 20$ terms

$S_{40}=\frac{20}{2}[2\times 7+(19)10]=10[14+190]=10[2040]=(102)(20)$

$\Rightarrow m=20$

8. If $({}^{36}C_{r+1})\times(k^2-3)={}^{35}C_r\ 6$, then number of ordered pairs (r,k) are (where $k\in I$).

A) 6 B) 2 C) 3 D) 4

Ans. D

Sol. $\frac{36}{r+1}\times\frac{35}{C_r}(k^2-3)=\frac{35}{C_r}$

$k^2-3=\frac{r+1}{6}\Rightarrow k^2=3+\frac{r+1}{6}$

r can be $5, 35$

for $r=5,\quad k=\pm 2$

$r=35,\quad k=\pm 3$

Hence number of order pair $=4$

9. Let $4\alpha\int_{-1}^{2}e^{-\alpha|x|}dx=5$ then $\alpha=$

A) $\ln 2$ B) $\ln\sqrt{2}$ C) $\ln\frac{3}{4}$ D) $\ln\frac{4}{3}$

Ans. A

Sol. $4\alpha\left\{\int_{-1}^{0} e^{\alpha x}\,dx + \int_{-1}^{0} e^{-\alpha x}\,dx\right\} = 5$

$\Rightarrow 4\alpha\left\{\left(\frac{e^{\alpha x}}{\alpha}\right)_{-1}^{0} + \frac{e^{-\alpha x}}{-\alpha}\Big|_{0}^{2}\right\} = 5$

$\Rightarrow 4\alpha\left\{\left(\frac{1-e^{-\alpha}}{\alpha}\right) - \left(\frac{e^{-2\alpha}-1}{\alpha}\right)\right\} = 5$

$\Rightarrow 4(2 - e^{-\alpha} - e^{-2\alpha}) = 5$ Put $e^{-\alpha} = t$

$\Rightarrow 4t^2 + 4t - 3 = 0$

$\Rightarrow (2t+3)(2t-1) = 0$

$\Rightarrow e^{-\alpha} = \frac{1}{2}$

$\Rightarrow \alpha = \ln 2$

10. Let $f(x)$ is a five degree polynomial which has critical points $x = \pm 1$ and $\lim_{x\to 0}\left(2 + \frac{f(x)}{x^3}\right) = 4$ then which one is incorrect.

A) $f(x)$ has minima at $x = 1$ & maxima at $x = -1$

B) $f(1) - 4f(-1) = 4$

C) $f(x)$ is maxima at $x = 1$ and minima $x = -1$

D) $f(x)$ is odd

Ans. A

Sol. $f(x) = ax^5 + bx^4 + cx^3$

$\lim_{x\to 0}\left(2 + \frac{ax^5 + bx^4 + cx^3}{x^3}\right) = 4 \Rightarrow 2 + c = 4 \Rightarrow c = 2$

$f'(x) = 5ax^4 + 4bx^3 + 6x^2$

$= x^2(5ax^2 + 4bx + 6)$

$f'(1) = 0$

$\Rightarrow 5x + 4b + 6 = 0$

$f'(-1) = 0$

$\Rightarrow 5a - 4b + 6 = 0$

$b = 0$

$a = -\frac{6}{5}$

$f(x) = \frac{-6}{5}x^5 + 2x^3$

$f'(x) = -6x^4 + 6x^2$

$= 6x^2(-x^2 + 1)$

$= -6x^2(x+1)(x-1)$

−1 + 1 −

1 − 1

Minima at $x = -1$

Maxima at $x = 1$

11. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $\lambda = \vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$ and $\vec{d} = \vec{a}\times\vec{b} + \vec{b}\times\vec{c} + \vec{c}\times\vec{a}$ then $(\lambda, \vec{d}) =$

A) $\left(\frac{3}{2}, 3\vec{a}\times\vec{b}\right)$

B) $\left(\frac{3}{2}, 3\vec{a}\times\vec{c}\right)$

C) $\left(-\frac{3}{2}, 3\vec{a}\times\vec{c}\right)$

D) $\left(-\frac{3}{2}, 3\vec{a}\times\vec{b}\right)$

Ans. D

Sol. $\left|\vec{a} + \vec{b} + \vec{c}\right|^2 = 0$

$3 + 2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) = 0$

$(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) = \frac{-3}{2}$

$\Rightarrow \lambda = \frac{-3}{2}$

$\vec{d} = \vec{a}\times\vec{b} + \vec{b}\times(-\vec{a} - \vec{b}) + (-\vec{a} - \vec{b})\times\vec{a}$

$= \vec{a}\times\vec{b} + \vec{a}\times\vec{b} + \vec{a}\times\vec{b}$

$\vec{a} = 3(\vec{a}\times\vec{b})$

12. Coefficient of x^7 in $(1+x)^{10} + x(1+x)^9 + x^2(1+x)^8 + \ldots + x^{10}$ is

A) 330

B) 210

C) 420

D) 260

Ans. A

Sol. $\frac{(1+x)^{10}\left[1-\left(\frac{x}{1+x}\right)^{11}\right]}{\left(1-\frac{x}{1+x}\right)}$

$$\frac{(1+x)^{10}[(1+x)^{11}-x^{11}]}{(1+x)^{11}\times\frac{1}{(1+x)}}$$

$= (1+x)^{11} - x^{11}$

Coefficient of x^7 is ${}^{11}C_7 = {}^{11}C_4 = 330$

13. Let α and β are the roots of $x^2 - x - 1 = 0$ such that $P_k = \alpha^k + \beta^k, k \geq 1$ then which one is incorrect?

A) $P_5 = P_2 \times P_3$

B) $P_1 + P_2 + P_3 + P_4 + P_5 = 26$

C) $P_3 = P_5 - P_4$

D) $P_4 = 11$

Ans. A

Sol. $\alpha^5 = 5\alpha + 3$

$\beta^5 = 5\beta + 3$

$P_5 = 5(\alpha+\beta) + 6$

$= 5(1) + 6$

$P_5 = 11$ and $P_5 = \alpha^2 + \beta^2 = \alpha + 1 + \beta + 1$

$P_2 = 3$ and $P_3 = \alpha^3 + \beta^3 = 2\alpha + 1 + 2\beta + 1 = 2(1) + 2 = 4$

$P_2 \times P_3 = 12$ and $P_5 = 11 \Rightarrow P_5 \neq P_2 \times P_3$

14. Let $f(x) = x^3 - 4x^2 + 8x + 11$, if LMVT is applicable on $f(x)$ in $[0,1]$, value of c is:

A) $\frac{4-\sqrt{7}}{3}$

B) $\frac{4-\sqrt{5}}{3}$

C) $\frac{4+\sqrt{7}}{3}$

D) $\frac{4+\sqrt{5}}{3}$

Ans. A

Sol. $f(x)$ is a polynomial function

$\therefore$ It is continuous and differentiable in $[0,1]$

Here $f(0) = 11, f(1) = 1 - 4 + 8 + 11 = 16$

$f'(x) = 3x^2 - 8x + 8$

$$\therefore f'(c) = \frac{f(1)-f(0)}{1-0} = \frac{16-11}{1} = 3c^2 - 8c + 8$$

$\Rightarrow 3c^2 - 8c + 3 = 0$

$$c = \frac{8 \pm 2\sqrt{7}}{6} = \frac{4 \pm \sqrt{7}}{3}$$

$$\therefore c = \frac{4-\sqrt{7}}{3} \in (0,1)$$

15. The area bounded by $4x^2 \leq y \leq 8x + 12$ is –

A) $\frac{127}{3}$

B) $\frac{128}{3}$

C) $\frac{124}{3}$

D) $\frac{125}{3}$

Ans. B

Sol. $4x^2 = y$

$y = 8x + 12$

$4x^2 = 8x + 12$

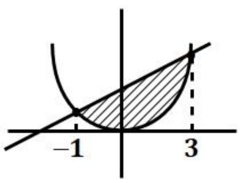
$x^2 - x - 3 = 0$

$x^2 - 2x - 3 = 0$

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

$(x+1)(x-3) = 0$

$x = -1$



$$A = \int_{-1}^{3} (8x + 12 - 4x^2)\, dx$$

$$A = \frac{8x^2}{2} + 12x - \frac{4x^3}{3}\Bigg|_{-1}^{3} = (4(9) + 36 - 36) - \left(4 - 12 + \frac{4}{3}\right) = 36 + 8 - \frac{4}{3}$$

$$= 44 - \frac{4}{3} = \frac{132-4}{3} = \frac{128}{3}$$

16. There are 5 machines. Probability of a machine being faulted is $\frac{1}{4}$. Probability of almost two machines is faulted, is $\left(\frac{3}{4}\right)^3 k$ then value of k is

A) $\frac{17}{2}$ B) 4 C) $\frac{17}{8}$ D) $\frac{17}{4}$

Ans. C

Sol. Required probability = when no. machine has fault + when only one machine has fault + when only two machines have fault.

$$= {}^5C_0\left(\frac{3}{4}\right)^5 + {}^5C_1\left(\frac{1}{4}\right)\left(\frac{3}{4}\right)^4 + {}^5C_2\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3$$

$$= \frac{243}{1024} + \frac{405}{1024} + \frac{270}{1024} = \frac{918}{1024} = \frac{459}{512} = \frac{27 \times 17}{64 \times 8}$$

$$= \left(\frac{3}{4}\right)^3 \times k = \left(\frac{3}{4}\right)^3 \times \frac{17}{8}$$

$$\therefore k = \frac{17}{8}$$

17. $3x + 4y = 12\sqrt{2}$ is the tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{9} = 1$ then the distance between foci of ellipse is –

A) $1\sqrt{5}$ B) $2\sqrt{3}$ C) $2\sqrt{7}$ D) 4

Ans. C

Sol. $3x + 4y = 12\sqrt{2}$

$\Rightarrow 4y = -3x + 12\sqrt{2}$

$\Rightarrow y = -\frac{3}{4}x + 3\sqrt{2}$

condition of tangency $c^2 = a^2m^2 + b^2$

$18 = a^2 \cdot \frac{9}{16} + 9$

$a^2 \cdot \frac{9}{16} = 9$

$a^2 = 16$

$1a = 4$

$e = \sqrt{1 - \frac{b^2}{a^2}} = \sqrt{1 - \frac{9}{16}} = \frac{\sqrt{7}}{4}$

$\therefore ae = \frac{\sqrt{7}}{4} \cdot 4 = \sqrt{7}$

$\therefore$ focus are $\left(\pm\sqrt{7}, 0\right)$

$\therefore$ distance between foci $= 2\sqrt{7}$

18. If $z = \left(\frac{3+i\sin\theta}{4-i\cos\theta}\right)$ is purely real and $\theta \in \left(\frac{\pi}{2}, \pi\right)$ then $\arg(\sin\theta + i\cos\theta)$ *is*

A) $-\tan^{-1}\frac{3}{4}$ B) $\pi - \tan^{-1}\frac{3}{4}$ C) $\pi - \tan^{-1}\frac{4}{3}$ D) $\tan^{-1}\frac{4}{3}$

Ans. C

Sol. $z = \frac{(3+i\sin\theta)}{(4-i\cos\theta)} \times \frac{(4+i\cos\theta)}{(4+i\cos\theta)}$

as z is purely real $\Rightarrow 3\cos\theta + 4\sin\theta = 0 \Rightarrow \tan\theta = -\frac{3}{4}$

$\arg(\sin\theta + i\cos\theta) = \pi + \tan^{-1}\left(\frac{\cos\theta}{\sin\theta}\right) = \pi + \tan^{-1}\left(-\frac{4}{3}\right) = \pi - \tan^{-1}\left(-\frac{4}{3}\right)$

19. $a_1, a_2, a_3 \ldots a_9$ are in GP where $a_1 < 0$,
$a_1 + a_2 = 4, a_3 + a_4 = 16$, if $\sum_{i=1}^{9} a_i = 4\lambda$, then λ is eqyal to

A) -513 B) $-\frac{511}{3}$ C) -171 D) 171

Ans. C

Sol. $a_1 + a_2 = 4 \Rightarrow a_1 + a_1 r = 4$ (i)

$a_3 + a_4 = 16 \Rightarrow a_1 r^2 + a_1 r^3 = 16$ (ii)

$\frac{1}{r^2} + \frac{1}{4} \Rightarrow r^2 = 4$

$r = \pm 2$

$r = 2, a_1(1+2) = 4 \Rightarrow a_1 = \frac{4}{3}$

$r = -2, a_1(1-2) = 4 \Rightarrow a_1 = -4$

$$\sum_{i=1}^{a} a_i = \frac{a_1(r^q - 1)}{r-1} = \frac{(-4)((-2)^9 - 1)}{-2-1} = \frac{4}{3}(-513) = 4\lambda$$

$\lambda = -171$

20. If $y\sqrt{1-x^2} = k - x\sqrt{1-y^2}$ and $y\left(\frac{1}{2}\right) = -\frac{1}{4}$. Then $\frac{dy}{dx}$ at $x = \frac{1}{2}$ is

A) $\frac{2}{\sqrt{5}}$ B) $-\frac{\sqrt{5}}{4}$ C) $-\frac{\sqrt{5}}{2}$ D) $\frac{\sqrt{5}}{2}$

Ans. C

Sol. $x = \frac{1}{2}, y = \frac{-1}{4} \Rightarrow xy = \frac{-1}{8}$

$$y \cdot \frac{1 \cdot (-2x)}{2\sqrt{-x^2}} + y' \cdot \sqrt{1-x^2} = \left\{1 \cdot \sqrt{1-y^2} + \frac{x \cdot (-2y)}{2\sqrt{1-y^2}} y'\right\}$$

$$-\frac{xy}{\sqrt{1-x^2}} + y'\sqrt{1-x^2} = -\sqrt{1-y^2} + \frac{xy \cdot y'}{\sqrt{1-y^2}}$$

$$y'\left(\sqrt{1-x^2} - \frac{xy}{\sqrt{1-y^2}}\right) = \frac{xy}{\sqrt{1-x^2}} - \sqrt{1-y^2}$$

$$y'\left(\frac{\sqrt{3}}{2} + \frac{1}{8 \cdot \frac{\sqrt{15}}{4}}\right) = \frac{-1}{8 \cdot \sqrt{\frac{3}{2}}} - \frac{\sqrt{15}}{4}$$

$$y'\left(\frac{\sqrt{45}+1}{2\sqrt{15}}\right) = -\frac{(1+\sqrt{45})}{4\sqrt{3}}$$

$$y' = -\frac{\sqrt{5}}{2}$$

21. Let $X = \{x : 1 \le x \le 50, x \in N\}$

$A = \{x : x \text{ is multiple of } 2\}$

$B = \{x : x \text{ is multiple of } 7\}$

Then find number of elements in the smallest subset of X which contain elements of both A and B

Ans. 29

Sol. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

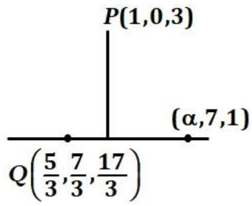
$= 25 + 7 - 3$

$= 29$

22. If $Q\left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$ is foot of perpendicular drawn from $P(1,0,3)$ on a line L and if line L is passing through $(\alpha, 7, 1)$, then value of α is

Ans. 4

Sol. Since PQ is perpendicular to L, therefore



$$\left(1-\frac{5}{3}\right)\left(\alpha - \frac{5}{3}\right) + \left(\frac{-7}{3}\right)\left(7 - \frac{7}{3}\right) + \left(3 - \frac{17}{3}\right)\left(1 - \frac{17}{3}\right) = 0$$

$$\Rightarrow \frac{-2\alpha}{3} + \frac{10}{9} - \frac{98}{9} + \frac{112}{9} = 0$$

$$\Rightarrow \frac{2\alpha}{3} = \frac{24}{9} \Rightarrow \alpha = 4$$

23. If $f(x)$ is defined in $x \in \left(-\frac{1}{3}, \frac{1}{3}\right)$

$f(x) = \begin{cases} \left(\frac{1}{x}\right)\log_e\left(\frac{1+3x}{1-2x}\right) & x \neq 0 \\ k & x = 0 \end{cases}$ Find k such that $f(x)$ is continuous

Ans. 5

Sol. $\lim_{x\to 0} f(x) \lim_{x\to 0}\left(\frac{1}{x}\ln\left(\frac{1+3x}{1-2x}\right)\right) = \lim_{x\to 0}\left(\frac{\ln(1+3x)}{x} - \frac{\ln(1-2x)}{x}\right)$

$$= \lim_{x\to 0}\left(\frac{3\ln(1+3x)}{3x} - \frac{2\ln(1-2x)}{-2x}\right) = 3 + 2 = 5$$

$\therefore f(x)$ will be continuous $f(0) = \lim_{x\to 0} f(x)$

24. If system of equation

$x+y+z=6$

$x+2y+3z=10$

$3x+2y+\lambda z=\mu$

Has more than two solutions. Find $(\mu-\lambda^2)$

Ans. 13

Sol. $x+y+z=6$ (1)

$x+2y+3z=10$ (2)

$3x+2y+\lambda z=\mu$ (3)

From (1) and (2)

If $z=0 \Rightarrow x+y=6$ and $x+2y=10$

$\Rightarrow y=4, x=2$

$(2,4,0)$

If $y=0 \Rightarrow x+z=6$ and $x+3z=10$

$\Rightarrow z=2$ and $x=4$

$(4,0,2)$

So $3x+2y+\lambda z=\mu$

Must pass through $(2,4,0)$ and $(4,0,2)$

So $6+8=\mu \Rightarrow \mu=14$

And $12+2\lambda=\mu$

$12+2\lambda=14 \Rightarrow \lambda=1$

So $\mu-\lambda^2=14-1$

$=13$

25. If mean and variance of $2,3,16,20,13,7,x,y$ are 10 and 25 respectively then find xy

Ans. 124

Sol. Mean $=\bar{x}=\frac{2+3+16+20+13+7+x+y}{8}=10 \Rightarrow x+y=19$ (1)

Variance $\sigma^2=\frac{\sum(x_i)^2}{8}-(\bar{x})^2=25$

$$\frac{4+9+256+400+169+49+x^2+y^2}{8}-100=25$$

$\Rightarrow x^2+y^2=113$ (2)

$(x+y)^2=(19)^2 \Rightarrow x^2+y^2+2xy=361 \Rightarrow xy=124$

(exact data is not retrieved so ans. can vary)