# KOTHARI INTERNATIONAL SCHOOL, NOIDA
## ANNUAL EXAMINATION, SESSION: 2025-26
## GRADE: 11 SUBJECT: APPLIED MATHEMATICS (241)
## MARKING SCHEME

1. (c) $\frac{4}{11}$

Explanation:

Total number of alphabets in the word 'PROBABILITY = 11

Number of vowels = 4

$\therefore$ Required probability $= \frac{4}{11}$

2. (a) the square root of the coefficient of determination

Explanation:

The coefficient of Determination is the square of the Coefficient of Correlation. R square or coeff. of determination shows percentage variation in y which is explained by all the x variables together.

3. (a) 1961

Explanation:

The income tax act was passed in the year 1961.

4.

(c) $\frac{-4}{5}$

Explanation:

$$3^{5x} = \frac{1}{81}$$
$$3^{5x} = \frac{1}{3^4}$$
$$3^{5x} = 3^{-4}$$

Now base is same, so power same

$$\therefore 5x = -4$$
$$x = \frac{-4}{5}$$

5. (b) $\{0,5,12,13\}$

Explanation:

Given, $R = \{(x,y): x, y \in \mathbf{W}, x^2 + y^2 = 169\}$

$$\therefore R = \{(0,13), (5,12), (12,5), (13,0)\}$$

$\therefore$ domain of $R = \{0,5,12,13\}$

6. (b) $\log_2 16 = 4$

Explanation:

$2^4 = 16$ in logarithmic form.

As we know that

if $a^y = x$

then $\log_a x = y$

$\therefore \log_2 16 = 4$

7. (b) $\frac{1}{2}$

Explanation:

Here, $P(B) = \frac{3}{5}, P\left(\frac{A}{B}\right) = \frac{1}{2}$ and $P(A \cup B) = \frac{4}{5}$

$$\because P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)}$$
$$\Rightarrow \frac{1}{2} = \frac{P(A \cap B)}{\frac{3}{5}}$$
$$\Rightarrow P(A \cap B) = \frac{3}{5} \times \frac{1}{2} = \frac{3}{10} \text{ and } P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$\Rightarrow \frac{4}{5} = P(A) + \frac{3}{5} - \frac{3}{10}$$
$$\therefore P(A) = \frac{4}{5} - \frac{3}{5} + \frac{3}{10} = \frac{8-6+3}{10} = \frac{1}{2}$$

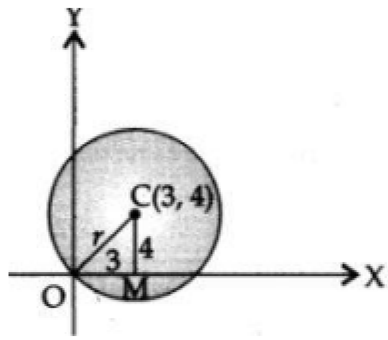
8. (c) $x^2 + y^2 - 6x - 8y = 0$

Explanation:

If the origin be on the circumference of the circle and coordinates of the centre C be (3,4), then from the adjoining figure, it is clear that

$$OC^2 = OM^2 + CM^2$$

i.e., $r^2 = 3^2 + 4^2 = 9 + 16 = 25$




Thus, the equation of required circle with centre (3,4) and radius 25 is given by

$$(x-3)^2 + (y-4)^2 = 25$$
$$\Rightarrow (x^2 - 6x + 9) + (y^2 - 8y + 16) = 25$$
$$\Rightarrow x^2 + y^2 - 6x - 8y = 0$$

9. (b) Fear

Explanation:

On the basis of the four options given above it looks as if all the four can be filled in the place of blank space. But we have t select one that is most appropriate and indispensable. We have experienced in our life that danger always leads fear. All the other options are remote but fear is most proximate option.

10. (a) $\frac{1}{n}\sum_{i=1}^{n} |x_i - \bar{x}|$

Explanation:

Mean Deviation, MD $= \frac{1}{n}\sum_{i=1}^{n} |x_i - \bar{x}|$

where, $\bar{x}$ is mean n is number of observations

11.

(c) 4

Explanation: $\log 50 = \log 2 + \frac{x}{2}\log 5$

$$\log 50 = \log 2 + \log 5^{\frac{x}{2}}$$

$$\log 50 = \log\left(2 \times 5^{\frac{x}{2}}\right)$$

$$\therefore 50 = 2 \times 5^{\frac{x}{2}}$$

$$2 \times 5^{\frac{x}{2}} = 50$$

$$5^{\frac{x}{2}} = 25$$

$$5^{\frac{x}{2}} = 5^2$$

$$\therefore \frac{x}{2} = 2$$

$$x = 4$$

12. (c) only iii

Explanation:

present value of annuity

13. (a) ₹ 2160

Explanation:

₹ 2160

14. (c) 0

Explanation:

Given $\mathrm{P(A) = 0.2, P(B) = 0.4, P(A \cup B) = 0.6}$, then

$$\mathrm{P(A \cap B) = P(A) + P(B) - P(A \cup B)}$$

$$= 0.2 + 0.4 - 0.6 = 0$$

$$\mathrm{P(A \mid B)} = \frac{P(A \cap B)}{P(B)} = 0$$

15. (d) A and B are mutually exclusive

Explanation:

hey cannot be mutually exclusive because

$$\mathrm{P(A \cap B) = P(A) \cdot P(B) = \neq = 0}(\because \text{ A and B are independent}$$

16. (a) Effective rate > Nominal rate

Explanation:

If interest is compounded more than once a year the effective interest rate for a year exceeds the per annum nominal interest rate i.e., effective rate > nominal rate

17. (b) ${}^{(m+n+k)}C_3 - {}^{m}C_3 - {}^{n}C_3 - {}^{k}C_3$

Explanation:

Here, total number of points are $(m+n+k)$ which must give ${}^{(m+n+k)}C_3$ number of triangles but $m$ points on line $l_1$ taking 3 points at a time gives ${}^{m}C_3$ combinations which produce no triangle.

Similarly, ${}^{n}C_3$ and ${}^{k}C_3$ number of triangles cannot be formed.

Therefore, the required number of triangles is

$$(m+n+k)C_3 - {}^{m}C_3 - {}^{n}C_3 - {}^{k}C_3.$$

18. (b) 63

Explanation:

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

$\therefore$ Total relations $= 2^6 = 64$

Total non-empty relations $= 64 - 1 = 63$

19. (a) Both A and R are true and R is the correct explanation of A .

Explanation:

Given variance $(\mu_2) = 7$

We know that for mesokurtic curve, $\beta_2 = 3$.

$\therefore$ R is true.

Now, $\beta_2 = \frac{\mu_4}{\mu_2^2}$

$$\Rightarrow 3 = \frac{\mu_4}{7^2} \Rightarrow \mu_4 = 3 \times 49 = 147$$

$\therefore$ A is true and R is the correct explanation of A .

20. (a) Both A and R are true and R is the correct explanation of A .

Explanation:

Let a and b be two positive numbers, then

$A = \frac{a+b}{2}$ and $G^2 = ab$

$\Rightarrow a + b = 2A$ and $ab = G^2$.

Now, the quadratic equation whose roots are $a$ and $b$ is

$$x^2 - (a+b)x + ab = 0$$
$$\Rightarrow x^2 - 2Ax + G^2 = 0.$$

So, roots of the above quadratic equation are

$$x = \frac{-(-2A) \pm \sqrt{(-2A)^2 - 4 \times 1 \times G^2}}{2 \times 1}$$

$\Rightarrow x = A \pm \sqrt{A^2 - G^2}$

$\therefore$ R is true.

Now, given $A = 20, G = 16$.

So, numbers are $20 \pm \sqrt{(20)^2 - 16^2} = 20 \pm \sqrt{400 - 256} = 20 \pm 12 = 32$ and $8$ .

$\therefore$ A is true and R is the correct explanation of A .

21. Work done by A in 10 days $= \frac{1}{80} \times 10 = \frac{1}{8}$

Remaining work $= \left(1 - \frac{1}{8}\right) = \frac{7}{8}$

Now, $\frac{7}{8}$ work is done by $B$ in 42 days

Whole work will be done by B in $\left(42 \times \frac{8}{7}\right) = 48$ days

$\therefore$ A's 1 day's work $= \frac{1}{80}$ and B's 1 days' work $= \frac{1}{48}$

$\therefore$ (A + B) 's 1 days' work $= \frac{1}{80} + \frac{1}{48} = \frac{8}{240} = \frac{1}{30}$

Hence, both will finish the work in 30 days.

22.
$$\begin{array}{r} BA \\ \times B3 \\ 57A \end{array}$$

$A \times 3 = A$

$\Rightarrow A = 5[\because 3 \times 5 = 15]$

$$\begin{array}{r} B5 \\ \times B3 \\ \hline (3B+1)5 \\ B^2(5B)\times \\ \hline 575 \end{array}$$

$$\Rightarrow 3B + 1 + 5B = 7 \ldots (1)$$

if $B = 2$ i.e.

$3 \times 2 + 1 + 5 \times 2 = 17$

$$\Rightarrow B = 2$$

$$\begin{array}{r} 25 \\ \times 23 \\ 75 \\ 50\times \\ \hline 575 \end{array}$$

$$A = 5, B = 2$$

$$2$$

$$\begin{array}{r} AB \\ \times 5 \\ CAB \end{array}$$

$$5 \times B = B$$

$$\Rightarrow B = 5[\because 5 \times 5 = 25]$$

$$\text{Now, } 5 \times A + 2 = A$$

$$\Rightarrow A = 7[\because 5 \times 7 + 2 = 37]$$

Thus

$$\begin{array}{r} 75 \\ \times 5 \\ 375 \end{array}$$

$$A = 7, B = 5, C = 3$$

$$A = 3$$

23. Weighted mean $= \frac{\sum_{i=1}^{n} x_i w_i}{\sum_{i=1}^{n} w_i} = \frac{25\times88+30\times71+10\times97+35\times90}{100}$

$$= \frac{8450}{100} = 84.5$$

∴ student obtained 84.5%

24. diff. $\frac{1}{x}$ w.r.t. x

$y = \frac{1}{x}$

$\frac{dy}{dx} = \frac{d}{dx}x^{-1}$

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

$= -x^{-2}$

$= -\frac{1}{x^2}$

OR

Let $y = \log\left(\frac{\sqrt{x+1}+\sqrt{x-1}}{\sqrt{x+1}-\sqrt{x-1}}\right) = \log\left(\frac{\sqrt{x+1}+\sqrt{x-1}}{\sqrt{x+1}-\sqrt{x-1}} \times \frac{\sqrt{x+1}+\sqrt{x-1}}{\sqrt{x+1}+\sqrt{x-1}}\right)$

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

$= \log\left(x+\sqrt{x^2-1}\right)$, differentiating w.r.t. x , we get

$\frac{dy}{dx} = \frac{1}{x+\sqrt{x^2-1}} \cdot \left[1+\frac{1}{2}(x^2-1)^{\frac{-1}{2}} \cdot 2x\right]$

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

25. Step I: Divide the number by 2 to get the quotient. Keep the whole part for the next step and set the remainder aside.

Step II: Divide the whole part of the quotient from step I by 2. Again, keep the whole part for the next step and set the remainder aside.

Step III: Repeat step 2 until the whole part is 0.

The given decimal number is 13

| | | |
|---|---|---|
| 2 | 13 | |
| 2 | 6 | 1 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| 2 | 0 | 1 |

Put the remainder together in reverse order.

So the required binary number is 1101 .

26. Given: $\frac{x+y}{2} = 13 \Rightarrow x + y = 26$

and $\sqrt{x}y = 12 \Rightarrow xy = 144$

(4) Mathpix Snipping

From (i) and (ii)

$$\begin{aligned} & x(26-x) = 144 \Rightarrow 26x - x^2 = 144 \\ & \Rightarrow x^2 - 26x + 144 = 0 \\ & \Rightarrow (x-18)(x-8) = 0 \\ & \Rightarrow x - 18 = 0 \text{ or } x - 8 = 0 \\ & \Rightarrow x = 18 \text{ or } 8 \end{aligned}$$

∴ Numbers are 18, 8 or 8, 18.

OR

Let three numbers in G.P. be $\frac{a}{r}$, a, ar

∴ Their product $= \frac{a}{r} \cdot a \cdot ar = 216$ (given)

$$\Rightarrow a^3 = 216 = (6)^3 \Rightarrow a = 6$$

Also sum of their products in pairs = 156 (given)

$$\begin{aligned} & \Rightarrow \frac{a}{r} \cdot a + a \cdot ar + ar \cdot \frac{a}{r} = 156 \\ & \Rightarrow a^2\left(\frac{1}{r} + r + 1\right) = 156 \\ & \Rightarrow 6^2 \cdot \frac{1 + r^2 + r}{r} = 156 \\ & \Rightarrow 3 \cdot \frac{r^2 + r + 1}{r} = 13 \\ & \Rightarrow 3r^2 + 3r + 3 = 13r \\ & \Rightarrow 3r^2 - 10r + 3 = 0 \\ & \Rightarrow (r-3)\left(r - \frac{1}{3}\right) = 0 \Rightarrow r = 3, \frac{1}{3} \end{aligned}$$

When $r = 3$, numbers are $2, 6, 18$ and when $r = \frac{1}{3}$, numbers are $18, 6, 2$

27. $\begin{array}{r} 2\,AB \\ +AB\,1 \\ \hline B18 \end{array}$

We have to find the value of A and B .

$\because$ B + 1 we get 8 , i.e., a number whose unit digit is 8 .

For this, B must be 7 .

So the question has been decoded as

$$\begin{array}{r} 2\,A7 \\ +A71 \\ \hline 718 \end{array}$$

$\because$ A + 7 we get 1 , i.e., a number whose unit digit is 1 .

For this, A must be 4 , as $4 + 7 = 11$.

So the question has been decoded as,

$$\begin{array}{r} 1 \\ 247 \\ +471 \\ \hline 718 \end{array}$$

Hence $A = 4$ and $B = 7$.

28. For domain: $1 - x^2 \neq 0 x \neq \pm 1$

$$\therefore \text{ Domain } = R - \{-1,1\}$$

For range: $y = \frac{1}{1-x^2} \Rightarrow y - yx^2 = 1 \Rightarrow yx^2 = y - 1$

$$x = \pm\sqrt{\frac{y-1}{y}}$$

$$\frac{y-1}{y} > 0, y \neq 0 \Rightarrow y^2 - y > 0$$

$$\Rightarrow \left(y - \frac{1}{2}\right)^2 > \left(\frac{1}{2}\right)^2 \Rightarrow y - \frac{1}{2} > \frac{1}{2} \text{ or } y - \frac{1}{2} < -\frac{1}{2}$$

$$\Rightarrow y > 1 \text{ or } y < 0$$

Range $= (-\infty, 0) \cup (1, \infty)$

29. Given simple interest for 3 years = ₹1200

∴ Simple interest for one year = $\frac{1}{3}$ of ₹ 1200 = ₹400

S.I. $= \frac{P \times R \times T}{100} \Rightarrow$ ₹400 $= \frac{P \times 5 \times 1}{100}$

$\Rightarrow$ P = ₹$\frac{400 \times 100}{5 \times 1}$ = ₹8000

Amount after one year = ₹8000 + ₹400 = ₹8400

Principal for the second year = ₹8400

Interest for the second year = ₹$\frac{8400 \times 5 \times 1}{100}$ = ₹420

Amount after 2 years = ₹8400 + ₹420 = ₹8820

Interest for the third year = ₹$\frac{8820 \times 5 \times 1}{100}$ = ₹441

Amount due after 3 years = ₹8820 + ₹441 = ₹9261

Compound interest for 3 years = ₹9261 − ₹8000 = ₹1261

30. Volumetric Charge for consumption upto 20kl = ₹20 × 5.27 = ₹105.4

Volumetric Charge for consumption between 20 − 30kl = ₹10 × 26.36 = ₹263.6

Volumetric Charge for consumption between 30 − 40kl = ₹10 × 43.93 = ₹439.3

Total volumetric Charge for consumption of 40kl = ₹(105.4 + 263.6 + 439.3) = ₹808.3

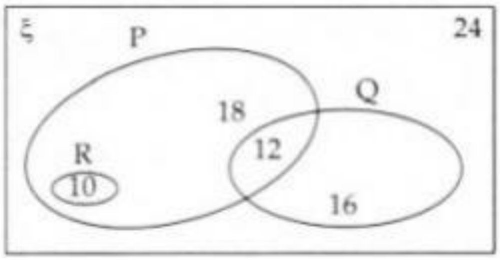
Service Charge = ₹292.82

Sewage Charges = 60% of Volumetric Charges

= 808.3 × 60% = ₹484.98

Amount of water bill for the given month = ₹(808.3 + 292.82 + 484.98) = ₹1586.1
Thus, amount of domestic water bill is ₹ 1586

31. i. The number of elements in different regions are shown in the adjoining figure.




ii. From the Venn diagram, we get

$$n(P \cup Q) = 10 + 18 + 12 + 16 = 56$$
$$n(Q \cup R) = 16 + 12 + 10 = 38$$
$$\Rightarrow n((Q \cup R)') = 80 - 38 = 42$$

Section D

32. $(n + 2)! = 60(n - 1)!$

$$\Rightarrow (n+2)(n+1)n(n-1)! = 60(n-1)!$$
$$\Rightarrow (n+2)(n+1)n = 5 \times 4 \times 3$$
$$\Rightarrow n = 3$$

OR

Out of six periods 5 subjects can be arranged in ${}^6P_5$ ways and for remaining period any subject can be taken. Total arrangements =

$${}^6P_5 \times {}^5P_1 = 720 \times 5 = 3600$$

33. We have, $\lim_{x\to 0} \frac{(\sin 3x + \sin 5x)}{(\sin 6x - \sin 4x)} = \lim_{x\to 0} \frac{\left(2\times\sin\frac{3x+5x}{2}\times\cos\frac{3x-5x}{2}\right)}{\left(2\times\cos\frac{6x+4x}{2}\sin\frac{6x-4x}{2}\right)}$

$$= \lim_{x\to 0} \frac{\sin 4x \cos x}{\cos 5x \sin x}$$

$$= \lim_{x\to 0} \frac{\sin 4x}{\cos 5x \times \frac{\sin x}{\cos x}} \times \frac{4x}{4x}$$

$$= 4 \times \lim_{x\to 0} \frac{\sin 4x}{4x} \times \frac{1}{\cos 5x} \times \frac{x}{\tan x}\left[\because \lim_{x\to 0}\frac{\sin\theta}{\theta} = 1 \text{ and } \lim_{x\to 0}\frac{\theta}{\tan\theta} = 1\right] = 4$$

$$\therefore \lim_{x\to 0} \frac{(\sin 3x + \sin 5x)}{(\sin 6x - \sin 4x)} = 4$$

34. Here, the variables are

4,8,12,16,20,24,28,32,36,40.

Here, N = 10,

So, Mean, $\bar{x} = \frac{4+8+\cdots+40}{10}$

$= \frac{4(1+2+\cdots 10)}{10}$

$= \frac{4}{10} \cdot \frac{10(10+1)}{2}$

$= 2 \times 11$

$= 22$

| $x_i$ | $X_{i-\bar{x}}$ | $(x_i - \bar{x})^2$ |
|---|---|---|
| 4 | -18 | 324 |
| 8 | -14 | 196 |
| 12 | -10 | 100 |
| 16 | -6 | 36 |
| 20 | -2 | 4 |
| 24 | 2 | 4 |
| 28 | 6 | 36 |
| 32 | 10 | 100 |
| 36 | 14 | 196 |
| 40 | 18 | 324 |
| Total | $\sum(x_i - \bar{x}) = \mathbf{0}$ | $\sum(x_i - \bar{x})^2 = 1320$ |

We have n = 10, $\sum(x_i - \bar{x})^2 = 1320$

$$\therefore \text{ Variance, } \sigma^2 = \frac{1}{n}\sum (x_i - \bar{x})^2 = \frac{1}{10} \times 1{,}320 = 132$$

and $\sigma = \sqrt{132} = 11.49$

∴ Mean = 22, Variance = 132 (Approx.) and Standard deviation = 11.49 (Approx.).

OR

We make the table from the given data.

| Class | Mid value ( $x_i$ ) | $f_i$ | $u_i = \frac{x_i - 25}{10}$ | $f_i u_i$ | $\lvert x_i - \bar{x}\rvert$ | $f_i \lvert x_i - \bar{x}\rvert$ |
|---|---|---|---|---|---|---|
| 0-10 | 5 | 5 | -2 | -10 | 22 | 110 |
| 10-20 | 15 | 8 | -1 | -8 | 12 | 96 |
| 20-30 | 25 | 15 | 0 | 0 | 2 | 30 |
| 30-40 | 35 | 16 | 1 | 16 | 8 | 128 |
| 40-50 | 45 | 6 | 2 | 12 | 18 | 108 |
| Total | | $\sum f_i = 50$ | | $\sum f_i u_i = 10$ | | $\sum f_i \lvert x_i - \bar{x}\rvert 472$ |

Here, $\sum f_i = 50$, a $= 25$, $\sum f_i u_i = 10$, h $= 10$ and $\sum f_i |x_i - \bar{x}| = 472$

$$\therefore \text{ Mean, } \bar{x} = 25 + \frac{\sum f_i u_i}{\sum f_i} \times h$$

$$= 25 + \frac{10}{50} \times 10 = 27 \left[\because \bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h\right]$$

$$\therefore \text{ Mean deviation from mean } = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{472}{50} = 9.44$$

35. Electricity consumed = 1264 unit (Kwh)

| Unit Range | Unit (KWh) | Rate (₹/Kwh) | Charge (₹) |
|---|---|---|---|
| 0-50 | 50 | 4.05 | 202.5 |
| 51-100 | 50 | 4.95 | 247.5 |
| 101-300 | 200 | 6.30 | 1260.0 |
| 300-1264 | 964 | 6.50 | 6266.0 |
| Total Electricity Charges (₹) | 1264 | | 7976.0 |

Fixed Charges (₹ 250/KW) $= 250 \times 5 = 1250$
Energy duty (₹ 63/ Unit) $= 0.63 \times 1264 = 796.32$
$\therefore$ Electricity bill = ₹7976.0 + ₹1250.0 + ₹796.32 = ₹10022.32

36. i. Midpoint of (2,1) and (4,13) is given by (3,7).

ii. Slope $= \frac{12-0}{1-(-2)} = \frac{12}{3} = 4$

iii. Equation of BC: $= (y-0) = 4(x+2)$

$= y - 2 = 4x$

OR

Equation of BC is $y - 2 - 4x = 0$. Putting coordinates of A(3,7) in this equation, we get: 7-2-12 ≠ 0, therefore we ca that point A will not lie on the line BC .

37. i. Mean $= 40, n = 100$, sum $= 100 \times 40 = 4000$

ii. Corrected sum $= 4000 - 50 + 40 = 3990$

iii. $\sigma^2 = \frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2$

$$\Rightarrow (5.1)^2 = \frac{\Sigma x^2}{100} - (40)^2$$
$$\Rightarrow (26.01 + 1600)100 = \Sigma x^2$$

OR

Corrected $\Sigma x^2 = 162601 - (50)^2 + (40)^2$

$= 162601 - 2500 + 1600 = 161701$

Corrected $\sigma^2 = \frac{161701}{100} - (39.9)^2$

$= 1617.01 - 1592.01 = 25$

38. i. The probability of a randomly chosen seed to germinate is 0.49 .

ii. $\frac{65}{100}$

iii. $\frac{16}{51}$