Solutions

1. (d) Given, $\frac{14587}{1250} = \frac{14587}{5^4 \times 2} = \frac{14587 \times 2^3}{5^4 \times 2^4}$

$\therefore$ Power of $m = n = 4$

Hence, it will terminate after 4 decimal places.

2. (d) Let number of girls be x and number of boys be y.
According to the question,

$x + y = 100$ … (i)

and $50x + 25y = 3000$ … (ii)

From Eq. (i), $x = 100 - y$

From Eq. (ii),

$50(100 - y) + 25y = 3000$

$\Rightarrow$ $2(100 - y) + y = 120$ [dividing both sides by 25]

$\Rightarrow$ $200 - 2y + y = 120$

$\Rightarrow$ $200 - y = 120$

$\Rightarrow$ $200 - 120 = y$

$\Rightarrow$ $y = 80$ and $x = 20$

$\therefore$ Number of boys is 80.

3. (c) Let the terms of AP be $a, a + d, a + 2d, a + 3d, a + 4d, a + 5d$

where, $a = 4$ …(i)

and $a + 5d = 49$ …(ii)

On subtracting Eq. (i) from Eq. (ii), we get

$5d = 45$

$\Rightarrow$ $d = 9$

We have, the 4 inserted term equal to $a + d, a + 2d, a + 3d, a + 4d$ i.e. 13, 22, 31, 40. Here, 40 is the biggest number.

4. (a) $\because$ Number of oatmeal cookies = 30

and number of chocolate chip cookies = 42

Maximum number of cookies, which can be put in the container = HCF of (30, 42) = 6

Now, number of containers required to pack the cookies

$= \frac{30 + 42}{6} = \frac{72}{6} = 12$

5. (b) We have, $\sqrt{\frac{1 + \sin\theta}{1 - \sin\theta}}$

Rationalising, we get $\sqrt{\frac{(1 + \sin\theta)(1 + \sin\theta)}{(1 - \sin\theta)(1 - \sin\theta)}} = \sqrt{\frac{(1 + \sin\theta)^2}{1 - \sin^2\theta}}$

$= \frac{1 + \sin\theta}{\cos\theta}$ [$\because 1 - \sin^2\theta = \cos^2\theta$]

$= \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta} = \sec\theta + \tan\theta$

6. (a) Since, tyre A has a diameter 14 + 2(5.1) or 24.2 inch. $\therefore$

Circumference $= 2 \times \pi \times \frac{24.2}{2} = 76.06$ inch

and tyre B has a diameter = 15 + 2(5.25)

= 25.5 inch

$\therefore$ Circumference = 80.14 inch

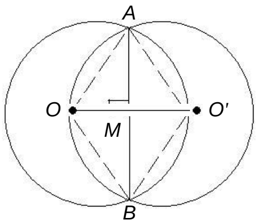
Given, travelled distance = 200 ft

= 2400 inch

$\therefore$ Number of revolutions of tyre $A = \frac{2400}{76.06} = 31.5 = 32$

and number of revolutions of tyre $B = \frac{2400}{80.14} = 29.9 = 30$

7. (b)



We have, radii of both the circles are equal.

$\Rightarrow$ $AO' = AO = x$ cm

In $\Delta AO'M$,

$(O'A)^2 = (O'M)^2 + AM^2$

$\Rightarrow$ $x^2 = \left(\frac{x}{2}\right)^2 + AM^2$

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

$\Rightarrow$ $AB = 2 \times AM$

$= 2 \times \frac{\sqrt{3}x}{2}$

$= \sqrt{3}x$

[since, the line joining the centres bisects the common chord]

Now, radius $= x$

$\Rightarrow$ Diameter $= 2x$

$\therefore$ Required ratio $= \sqrt{3}x : 2x = \sqrt{3} : 2$

8. (c) Given, list of numbers = 4, 4, 8, 11, 13

Here, $n = 5$

Now, average $= \frac{4 + 4 + 8 + 11 + 13}{5} = \frac{40}{5} = 8$

$\therefore$ Median $= \left(\frac{n + 1}{2}\right)$th term

$= \left(\frac{5 + 1}{2}\right)$th term

= 3 rd term = 8

and mode = 4 [since, 4 is repeated maximum 2 times]

Now, according to the question,

New list of numbers = 2, 4, 4, 8, 11, 13

Here, $n = 6$ [even]

Now, average $= \frac{2 + 4 + 4 + 8 + 11 + 13}{6} = \frac{42}{6} = 7$

$\therefore$ Median $= \left[\frac{\left(\frac{n}{2}\right)\text{th term} + \left(\frac{n}{2} + 1\right)\text{th term}}{2}\right]$

$= \left[\frac{\left(\frac{6}{2}\right)\text{th term} + \left(\frac{6}{2} + 1\right)\text{th term}}{2}\right]$

$= \left(\frac{3\text{rd term} + 4\text{th term}}{2}\right) = \left(\frac{4 + 8}{2}\right)$

$= \frac{12}{2} = 6$

and mode = 4 [since, 4 is repeated maximum 2 times]

Hence, the mode will not change.

9. (b)

$$\begin{array}{r} x^2 + (3-\pi)x + \frac{1}{\pi} - 3\pi + \pi^2 \\ x+\pi \overline{\big) x^3 + 3x^2 + \frac{x}{\pi} + 1} \\ x^3 + \pi x^2 \\ - \quad - \\ \hline (3-\pi)x^2 + \frac{x}{\pi} + 1 \\ (3-\pi)x^2 + (3-\pi)\pi x \\ \hline + \left(\frac{1}{\pi} - 3\pi + \pi^2\right)x + 1 \\ + \left(\frac{1}{\pi} - 3\pi + \pi^2\right)x + \pi\left(\frac{1}{\pi} - 3\pi + \pi^2\right) \\ - \qquad\qquad - \\ \hline + (3\pi^2 - \pi^3) \end{array}$$

$\therefore$ Remainder $= -\pi^3 + 3\pi^2$

10. (b) Given, $(p^2 + r^2)x^2 - 2r(p+q)x + r^2 + q^2 = 0$

For equal roots, $D = 0$

i.e. $b^2 - 4ac = 0$

$\Rightarrow [2r(p+q)]^2 - 4(p^2 + r^2)(r^2 + q^2) = 0$

$\Rightarrow 4r^2(p+q)^2 - 4(p^2r^2 + p^2q^2 + r^4 + r^2q^2) = 0$

$\Rightarrow 4r^2(p^2 + q^2 + 2pq) - 4(p^2r^2 + p^2q^2 + r^4 + r^2q^2) = 0$

$\Rightarrow r^2(p^2 + q^2 + 2pq) - (p^2r^2 + p^2q^2 + r^4 + r^2q^2) = 0$

$\Rightarrow r^2p^2 + r^2q^2 + 2pr^2q - p^2r^2 - p^2q^2 - r^4 - r^2q^2 = 0$

$\Rightarrow r^4 + p^2q^2 - 2pqr^2 = 0$

$\Rightarrow (r^2 - pq)^2 = 0$

$\Rightarrow r^2 = pq$

11. (a) Given points are $A(2, k)$, $B(5, 6)$ and $C(6, 7)$. Since, the points are collinear.

$\therefore$ Area of $\Delta ABC = 0$

$\Rightarrow \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] = 0$

$\Rightarrow [(6-7) + 5(7-k) + 6(k-6)] = 0$

$\Rightarrow 2 \times (-1) + 35 - 5k + 6k - 36 = 0$

$\Rightarrow k + 35 - 36 - 2 = 0$

$\Rightarrow k = 3$

12. (b) $\because$ Number of letters $= 8$

and number of vowels $= 3$

$\therefore$ P (selecting a vowel) $= \frac{3}{8}$

13. (d) Given, $\sqrt{\frac{4 + 2\sqrt{3}}{7 + 4\sqrt{3}}} = \sqrt{\frac{1 + 3 + 2\sqrt{3}}{4 + 3 + 4\sqrt{3}}}$

$= \sqrt{\frac{(\sqrt{3} + 1)^2}{(\sqrt{3} + 2)^2}} = \frac{\sqrt{3} + 1}{\sqrt{3} + 2}$

14. (b) Given, $f(x) = 3x^2 + 13x + 4$

Let α and β be zeroes of the given polynomial.

Then, sum of zeroes, $\alpha + \beta = \frac{-13}{3} = a + b$

and product of zeroes, $\alpha\beta = \frac{4}{3} = ab$

$\therefore \frac{a}{b} + \frac{b}{a} = \frac{a^2 + b^2}{ab} = \frac{(a+b)^2 - 2ab}{ab} = \frac{\left(\frac{-13}{3}\right)^2 - 2 \times \frac{4}{3}}{\frac{4}{3}}$

$= \frac{\frac{169}{9} - \frac{8}{3}}{\frac{4}{3}} = \frac{169 - 24}{12} = \frac{145}{12}$

15. (d) Since, the possible outcomes are (2, 1), (2, 6), (2, 8), (4, 1), (4, 6), (4, 8), (9, 1), (9, 6)and (9, 8).

$\therefore$ Number of possible outcomes $= 9$

Number of favourable outcomes $= 5$

$\therefore$ Required probability $= 5/9$

16. (a) Let original price be ₹ x.

According to the question,

$\frac{300}{x} - \frac{300}{x + 45} = 15$

$\Rightarrow 300(x + 45 - x) = 15(x^2 + 45x)$

$\Rightarrow 20(45) = x^2 + 45x$

$\Rightarrow x^2 + 45x - 900 = 0$

$\Rightarrow x^2 + 60x - 15x - 900 = 0$

$\Rightarrow x(x + 60) - 15(x + 60) = 0$

$\Rightarrow (x - 15)(x + 60) = 0$

$\Rightarrow x = 15, -60$

$\Rightarrow$ Price = ₹ 15 [neglecting - ve sign]

$\therefore$ New quantity of the commodity bought

$= \frac{300}{15 + 45} = \frac{300}{60} = 5$ kg

17. (c) Given, $a + 3d = 620$ …(i)

and $a + 8d = 720$ …(ii)

From Eqs. (i) and (ii), we get

$5d = 100$

$\Rightarrow d = 20$

and $a = 620 - 60 = 560$

$\therefore S_{10} = \frac{10}{2}[2a + (10 - 1)d] = \frac{10}{2}[2 \times 560 + 9 \times 20]$ $\left[\because S_n = \frac{n}{2}\{2a + (n-1)d\}\right]$

$= 10[560 + 90]$

$= 10 \times 650 = 6500$

18. (c) Given, coordinates are $A(5, 6)$, $B(1, 5)$, $C(2, 1)$ and $D(6, 2)$.

Firstly, we show the distance, $AB = BC = CA = DA$

and diagonal, $AC = BD$

Now, $AB = \sqrt{(5-1)^2 + (6-5)^2} = \sqrt{4^2 + 1^2} = \sqrt{17}$

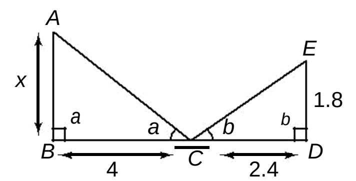
Similarly, $BC = CA = DA = \sqrt{17}$

Again, $AC = \sqrt{(5-2)^2 + (6-1)^2} = \sqrt{34}$

and $BD = \sqrt{(1-6)^2 + (5-2)^2} = \sqrt{34}$

Hence, the geometrical figure represents square.

19. (b) We know that,



$\angle \alpha = \angle \beta$ [image is joined]

$\angle a = \angle b$ [each 90°]

So, $\Delta ABC \sim \Delta EDC$ [by AA similarity]

$\therefore \frac{x}{4} = \frac{1.8}{2.4}$

$\Rightarrow x = 3$ m

20. (d) All are correctly matched.

PRACTICE SET 1

21. (b) Radius of pool = 12 ft

Width of cover = 24 inch = 2 ft

$\therefore$ Outer radius = (12 + 2) ft = 14 ft

Now, length of rope = Circumference of outer circle

$$= 2 \times \frac{22}{7} \times 14 = 88 \text{ ft}$$

22. (c) Given, $3ax - 3by + a + 6b = 0$ and $3bx + 3ay + b - 6a = 0$

By cross-multiplication method,

$$\frac{x}{-3b \quad a+6b} = \frac{y}{a+6b \quad 3a} = \frac{1}{3a \quad -3b}$$

$$3ab - 6a \quad b - 6a \quad 3b \quad 3b \quad 3a$$

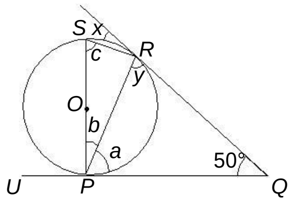
$$\Rightarrow \frac{x}{-3b(b-6a) - 3a(a+6b)} = \frac{y}{3b(a+6b) - 3a(b-6a)} = \frac{1}{9a^2 + 9b^2}$$

$$\Rightarrow \frac{x}{-3b^2 + 18ab - 3a^2 - 18ab} = \frac{y}{3ab + 18b^2 - 3ab + 18a^2} = \frac{1}{9a^2 + 9b^2}$$

$$\Rightarrow x = \frac{-3(a^2+b^2)}{9(a^2+b^2)}, \quad y = \frac{18(a^2+b^2)}{9(a^2+b^2)}$$

$$\Rightarrow x = \frac{-1}{3}, \; y = 2$$

23. (d) In the given figure, QP and QR are tangents.



$\therefore QP = QR$ [tangent from a same point are equal]

$\therefore \angle QRP = \angle QPR$

i.e. $\angle y = \angle a$ … (i)

Now, in ΔQPR,

$\angle a + \angle y + \angle RQP = 180°$ [angle sum property]

$\Rightarrow 2\angle a + 50° = 180°$

$\Rightarrow 2\angle a = 130° \Rightarrow a = 65°$

Now, $OP \perp PQ$ [radius is perpendicular to tangent]

$\therefore \angle b + \angle a = 90°$

$\Rightarrow \angle b = 90° - 65° = 25°$

Also, $\angle c = \angle a$

[angle made by chord in alternate segment]

$= 65°$

24. (d) Number of married employees = 70

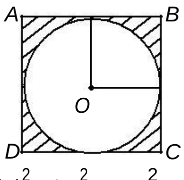
Number of married, who are supervisors = 20% of 70

$$= \frac{1}{5} \times 70 = 14$$

$\therefore P$ (employee is married and a supervisor) $= \frac{14}{140} = 0.1$

25. (c) Required area = Area of shaded portion

= Area of square $ABCD$ − Area of circle with centre O



$= (2a)^2 - \pi(a)^2 = 4a^2 - \pi a^2 = a^2(4 - \pi)$ sq units

26. (a) $\because$ Angle subtended by each side at the centre = 36°

$$\therefore n = \frac{\text{Central angle}}{\text{Angle subtended by each side}} = \frac{360°}{36°} = 10$$

27. (c) The expression $(pr + q)^{(p-q)}$ will have the maximum value, if the power is maximum which gives $p = 4$ and $q = 2$ such that

$$p - q = 4 - 2 = 2$$

For maximum value, $r = 4$

$\therefore \quad pr + q = 4 \times 4 + 2 = 18$

Now, $(18)^2 = 324$

28. (a) Given, $\frac{1}{2(3x+2y)} + \frac{12}{5(2x-3y)} = \frac{34}{10}$

Let $\frac{1}{3x+2y} = u$ and $\frac{1}{2x-3y} = v$

$\therefore \quad \frac{1}{2}u + \frac{12}{5}v = \frac{34}{10}$ …(i)

and $\frac{5}{6}u + \frac{25}{12}v = \frac{15}{4}$ …(ii)

From Eq. (i),

$5u + 24v = 34$ …(iii)

and $10u + 25v = 45$ …(iv)

From Eqs. (iii) and (iv), we get

$$10u + 48v = 68$$
$$10u + 25v = 45$$
$$- \quad - \quad -$$
$$23v = 23$$

$\Rightarrow \quad v = 1$

$\therefore \quad u = 2$

Now, $3x + 2y = \frac{1}{u} = \frac{1}{2}$

and $2x - 3y = \frac{1}{v} = 1$ …(v)

By using elimination method,

$$6x + 4y = 1$$
$$6x - 9y = 3$$
$$- \quad + \quad -$$
$$13y = -2$$

$\Rightarrow \quad y = \frac{-2}{13}$

From Eq. (v), $2x - 3 \times \frac{-2}{13} = 1$

$\Rightarrow \quad 2x = 1 - \frac{6}{13} \Rightarrow 2x = \frac{7}{13}$

$\therefore \quad x = \frac{7}{26}$

29. (d) Given, $2p - q = 38$ …(i)

and $p(q + 4) = 400$ …(ii)

From Eq. (i), $2p = 38 + q$

$\Rightarrow \quad p = 19 + \frac{q}{2}$

From Eq. (ii),

$$\left(\frac{1}{2}q + 19\right)(q + 4) = 400$$

$\Rightarrow \quad \frac{1}{2}q^2 + 2q + 19q + 76 = 400$

$\Rightarrow \quad q^2 + 42q + 152 = 800$

$\Rightarrow \quad q^2 + 42q = 648$

$\Rightarrow \quad q^2 + 42q + 441 = 648 + 441$

[adding both sides 441]

$\Rightarrow \quad (q + 21)^2 = 1089$

$\Rightarrow \quad q + 21 = \pm 33$

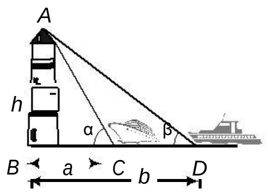
$\Rightarrow \quad q = -21 \pm 33$

$\Rightarrow \quad q = 12, -54$

$\therefore$ Commodity sold = 12 units

$\Rightarrow \quad$ Price, $p = \frac{400}{16} =$ ` 25

30. (a) Let height of the lighthouse be h.



In ΔABC, $\quad \tan \alpha = \frac{h}{a} \Rightarrow a = \frac{h}{\tan \alpha}$

In ΔABD, $\quad \tan \beta = \frac{h}{b} \Rightarrow b = \frac{h}{\tan \beta}$

Now, $\quad b - a = -\frac{h}{\tan \alpha} + \frac{h}{\tan \beta} = -h \cot \alpha + h \cot \beta$

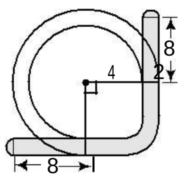
$$= h\left(-\frac{\cos \alpha}{\sin \alpha} + \frac{\cos \beta}{\sin \beta}\right) = h\left(\frac{\cos \alpha \sin \beta + \sin \alpha \cos \beta}{\sin \alpha \sin \beta}\right)$$

$$= \frac{h(\cos \beta \sin \alpha - \cos \alpha \sin \beta)}{\sin \alpha \sin \beta}$$

31. (a) Area of boomerang

= 2 (Area of semi-circle) + 2 (Area of rectangle)

+ Area of portion of ring



Area of semicircle $= \frac{1}{2} \times \pi \times 1^2$

Area of rectangle $= 8 \times 2$

Area of portion of ring = Area of inner quadrant

– Area of outer quadrant

$\because$ Outer radius = 4 + 2 = 6 and inner radius = 4

$$= \frac{1}{4} \times \pi \times 6^2 - \frac{1}{4} \times 4^2 \times \pi = (9\pi - 4\pi) = 5\pi$$

$\therefore$ Area of boomerang $= 2\left(\frac{\pi}{2}\right) + 2(16) + 5\pi$

$= (6\pi + 32)$ sq units

32. (b) We know that, $\Sigma p_i = 1$

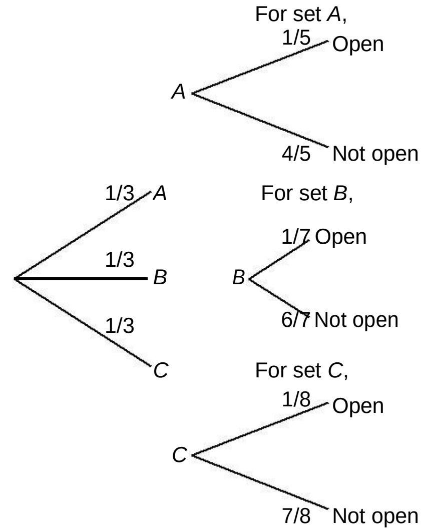
$\therefore \quad 0.25 + 0.20 + z + 0.15 + 0.05 = 1$

$\Rightarrow \quad z = 0.35$

$\Rightarrow \quad \frac{x}{100} = 0.35$

$\therefore \quad x = 35$

33. (c)



$\therefore$ Required probability $= \frac{1}{3} \times \frac{7}{8} = \frac{7}{24}$

34. (d) $\frac{8x^3 - y^3 + z^3 + 6xy}{a^3 - 8b^3 + 27c^3 + 18abc} \div \frac{a^2 + 4b^2 + 9c^2 + 2ab + 6bc - 3ac}{4x^2 + y^2 + z^2 + 2xy + yz - 2xz}$

$$= \frac{(2x - y + z)(4x^2 + y^2 + z^2 + 2xy + yz - 2xz)}{(a - 2b + 3c)(a^2 + 4b^2 + 9c^2 + 2ab + 6bc - 3ac)} \div \frac{a^2 + 4b^2 + 9c^2 + 2ab + 6bc - 3ac}{4x^2 + y^2 + z^2 + 2xy + yz - 2xz}$$

$$= \frac{2x - y + z}{a - 2b + 3c}$$

35. (a) Let the initial savings be a.

Given, $\quad S_{20} = 1050000$

and $\quad S_{40} = 4100000$

Now, $\quad S_{20} = \frac{20}{2}[2a + 19d]$

$\Rightarrow \quad S_{20} = 20a + 190d$

Similarly, $\quad S_{40} = 40a + 780d$

$\Rightarrow \quad 20a + 190d = 1050000 \quad$ …(i)

and $\quad 40a + 780d = 4100000 \quad$ …(ii)

On solving Eqs. (i) and (ii), we get

$40a + 380d = 2100000$

$\underline{-\,40a +_{-} 780d = _{-}4100000}$

$\Rightarrow \quad -400d = -2000000$

$\Rightarrow \quad d = 5000$

From Eq. (i), we get

$20a + 950000 = 1050000$

$\Rightarrow \quad 20a = 100000$

$\therefore \quad a = 5000$

Hence, the initial savings is ` 5000.