QUESTION PAPER CODE 30/5/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. a.b = 1000 — 1

2. $k(2)^2 + 2(2) - 3 = 0$ — $\frac{1}{2}$

$k = -\frac{1}{4}$ — $\frac{1}{2}$

OR

For real and equal roots

$k^2 - 4 \times 3 \times 3 = 0$ — $\frac{1}{2}$

$k = \pm 6$ — $\frac{1}{2}$

3. $15 + (n - 1)(-3) = 0$ — $\frac{1}{2}$

$n = 6$ — $\frac{1}{2}$

4. $\sin 30^\circ + \cos y = 1$

$\cos y = \frac{1}{2}$ — $\frac{1}{2}$

$\Rightarrow \; y = 60^\circ$ — $\frac{1}{2}$

OR

$\cos 48^\circ - \sin 42^\circ$

$= \cos 48^\circ - \cos (90^\circ - 42^\circ)$ — $\frac{1}{2}$

$= 0$ — $\frac{1}{2}$

5. 5 : 11 — 1

6. $6 - 3a = 5$ — $\frac{1}{2}$

$a = \frac{1}{3}$ — $\frac{1}{2}$

SECTION B

7. $a_1 = S_1 = 2(1)^2 + 1 = 3$ $\frac{1}{2}$

$a_2 = S_2 - S_1 = 10 - 3 = 7$ $\frac{1}{2}$

AP 3, 7 ..., $\Rightarrow d = 4$

$a_n = 3 + (n - 1)4 = (4n - 1)$ 1

OR

$a_{17} = a_{10} + 7$ $\frac{1}{2}$

$a + 16d = a + 9d + 7$ $\frac{1}{2}$

$d = 1$ 1

8. $\frac{2a-2}{2} = 1$

$\Rightarrow a = 2$ 1

$\frac{4+3b}{2} = 2a + 1$

$\Rightarrow b = 2$ 1

9. (i) P (getting A) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

(ii) P (getting B) = $\frac{2}{6}$ or $\frac{1}{3}$ 1

10. $612 = 2^2 \times 3^2 \times 17$ $\frac{1}{2}$

$1314 = 2 \times 3^2 \times 73$ $\frac{1}{2}$

HCF (612, 1314) = $2 \times 3^2 = 18$ 1

OR

Let a be any +ve integer

and $b = 6$

$\Rightarrow$ a = 6m + r $0 \le r < 6$, for any +ve integer m 1

Possible forms of 'a' are

6m, 6m + 1, 6m + 2, 6m + 3, 6m + 4, 6m + 5 $\frac{1}{2}$

Out of which 6m, 6m + 2 and 6m + 4 are even.

Hence, any +ve odd integer can be 6m + 1, 6m + 3 or 6m + 5 $\frac{1}{2}$

11. Total cards = 46 $\frac{1}{2}$

(i) P [Prime number less than 10(5, 7)] = $\frac{2}{46}$ or $\frac{1}{23}$ $\frac{1}{2}$

(ii) P [A number which is perfect square (9, 16, 25, 36, 49)] = $\frac{5}{46}$ 1

12. For infinitely many solutions

$$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$$ 1

2k + 4 = 3k − 3;   9k = 7k + 14

k = 7   k = 7

Hence k = 7 1

SECTION C

13. Let $\sqrt{5}$ be rational.

$\therefore \sqrt{5} = \frac{a}{b}$, $b \neq 0$. a, b are positive integers, HCF (a, b) = 1 $\frac{1}{2}$

On squaring,

$$5 = \frac{a^2}{b^2}$$

$$b^2 = \frac{a^2}{5}$$

$\Rightarrow$ 5 divides a^2

$\Rightarrow$ 5 divides a also.

a = 5m, for some +ve integer m. 1

$$b^2 = \frac{25m^2}{5}$$

$$b^2 = 5m^2$$

$\Rightarrow$ 5 divides b^2

$\Rightarrow$ 5 divides b also

$\Rightarrow$ 5 divides a and b both. 1

Which is the contradiction to the fact that HCF (a, b) = 1

Hence our assumption is wrong. $\frac{1}{2}$

$\sqrt{5}$ is irrational.

14. Given $\sqrt{2}$ and $-\sqrt{2}$ are zeroes of given polynomial.

$\therefore$ $(x-\sqrt{2})$ and $(x+\sqrt{2})$ are two factors i.e. $x^2 - 2$ is a factor $\frac{1}{2}$

$$x^2 - 2 \,\big)\, x^4 + x^3 - 14x^2 - 2x + 24 \,\big(\, x^2 + x - 12$$

$$\begin{array}{l} x^4 \quad -2x^2 \\ - \quad\quad + \\ \hline x^3 - 12x^2 - 2x + 24 \\ x^3 \quad\quad\quad -2x \\ - \quad\quad\quad\quad + \\ \hline -12x^2 + 24 \\ -12x^2 + 24 \\ + \quad\quad - \\ \hline 0 \\ \hline \end{array}$$

$1\frac{1}{2}$

$x^2 + x - 12 = x^2 + 4x - 3x - 12$

$= (x + 4)(x - 3)$ $\frac{1}{2}$

$\therefore$ –4, 3 are the zeroes.

Hence, all zeroes are –4, 3, $\sqrt{2}, -\sqrt{2}$ $\frac{1}{2}$

15. $\frac{AP}{AB} = \frac{1}{3} \Rightarrow \frac{AP}{PB} = \frac{1}{2}$ 1

Coordinates of P are $\left(\frac{5+4}{3}, \frac{-8+2}{3}\right) = (3, -2)$ 1

Now, P lies on $2x - y + k = 0$

$\therefore \quad 2(3) - (-2) + k = 0$

$\Rightarrow \quad k = -8$ 1

OR

Three points are collinear ⇒ area of Δ formed by these points is zero. 1

$\therefore \ \frac{1}{2}[2(-1-3) + p(3-1) - (1+1)] = 0$ 1

$-8 + 2p - 2 = 0$

$p = 5$ 1

16. LHS $= \frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta}$

$= \frac{\frac{\sin\theta}{\cos\theta}}{1 - \frac{\sin\theta}{\cos\theta}} - \frac{\frac{\cos\theta}{\sin\theta}}{1 - \frac{\cos\theta}{\sin\theta}}$ 1

$= \frac{\sin\theta}{\cos\theta - \sin\theta} + \frac{\cos\theta}{\cos\theta - \sin\theta}$ $1\frac{1}{2}$

$= \frac{\sin\theta + \cos\theta}{\cos\theta - \sin\theta} = \text{RHS}$ $\frac{1}{2}$

OR

$\sin\theta = (\sqrt{2}-1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = (\sqrt{2}-1)(\sqrt{2}+1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = \cos\theta$

$\Rightarrow \sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

Alternate method

$\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

On squaring

$\cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta = 2\cos^2\theta$ 1

$\sin^2\theta + 2\cos\theta\sin\theta = \cos^2\theta$

$2\cos\theta\sin\theta = \cos^2\theta - \sin^2\theta$ 1

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\cos\theta + \sin\theta)$

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\sqrt{2}\cos\theta)$

$\sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

17. Let the fixed charges per student = ₹ x

Cost of food per day per student = ₹ y

$x + 25y = 4500$ 1

$x + 30y = 5200$ 1

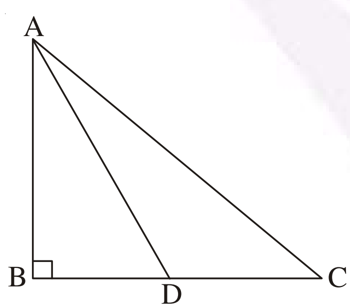
On solving $5y = 700$

$\therefore\ y = 140$

$x = 1000$ 1

$\therefore$ Fixed charges = ₹ 1000 & cost of food per day ₹ 140

18. Correct Figure $\frac{1}{2}$



ΔABC is right angled at B

$\therefore\ AC^2 = AB^2 + BC^2$

$AC^2 = AB^2 + (2CD)^2$

$AC^2 - 4CD^2 = AB^2$ ...(1) 1

ΔABD is right angled at B,

$\therefore\ AD^2 - BD^2 = AB^2$ ...(2) $\frac{1}{2}$

By (1) & (2) $AC^2 - 4CD^2 = AD^2 - BD^2$ $\frac{1}{2}$

$AC^2 = AD^2 - CD^2 + 4CD^2 = AD^2 + 3CD^2$ $(\because\ BD = CD)$ $\frac{1}{2}$

OR

$AB = AC \Rightarrow \angle C = \angle B$ ...(1) 1

In ΔABD & ΔECF,

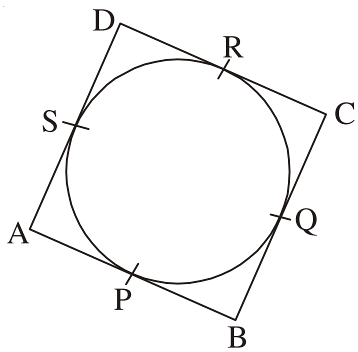
$\angle ADB = \angle EFC$ (each 90°)

$\angle ABD = \angle ECF$ (by (1)) 1

By AA similarity

$\Delta ABD \sim \Delta ECF$ 1

19. Correct Figure $\frac{1}{2}$



Let parallelogram ABCD circumscribes a circle

$\left.\begin{array}{l} AP = AS \\ PB = BQ \\ DR = DS \\ CR = CQ \end{array}\right\}$ tangents from an external point to a circle. 1

$AP + PB + DR + RC = AS + BQ + DS + CQ$

$AB + DC = AD + BC$ 1

$AB + AB = AD + AD$ (opp. sides equal)

$2AB = 2AD$

$\Rightarrow AB = AD$ $\frac{1}{2}$

$\Rightarrow$ ABCD is a rhombus.

20. Area of shaded region $= \frac{80°}{360°}\pi(7)^2 + \frac{40°}{360°}\pi(7)^2 + \frac{60°}{360°}\pi(7)^2$ $1\frac{1}{2}$

$= \frac{22}{7} \times 7 \times 7 \left[\frac{180°}{360°}\right]$ 1

$= 77 \text{ cm}^2$ $\frac{1}{2}$

21. Modal class: 50 – 60 $\frac{1}{2}$

mode $= 50 + \left(\frac{90-58}{180-58-83}\right) \times 10$ $1\frac{1}{2}$

$= 50 + \frac{32}{39} \times 10$

$= 58.2$ 1

$\therefore$ Modal age = 58.2 years.

22. Apparent capacity $= \pi r^2 h$

$= 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10$ 1

$= 196.25 \text{ cm}^3$ $\frac{1}{2}$

Actual capacity $= 196.25 - \frac{2}{3} \times 3.14 \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$ 1

$= 196.25 - 32.71$

$= 163.54 \text{ cm}^3$ $\frac{1}{2}$

OR

$\pi(18)^2 \times 32 = \frac{1}{3} \pi r^2 \times 24$ 1

$r^2 = (18)^2 \times 4$

$r = 36$ cm 1

$l^2 = (36)^2 + (24)^2$

$l^2 = 1872$

$l = 43.2$ cm 1

SECTION D

23. Let speed of train be x km/h

$\frac{360}{x} - \frac{360}{x+5} = 1$ 2

$360\left[\frac{x+5-x}{x(x+5)}\right] = 1$

$x^2 + 5x - 1800 = 0$ $\frac{1}{2}$

$(x + 45)(x - 40) = 0$ $\frac{1}{2}$

$x = -45, \quad x = 40$ 1

(Rejected)

Hence, speed of train = 40 km/h

OR

$$\frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}$$ 1

$$\frac{x-a-b-x}{x(a+b+x)} = \frac{b+a}{ab}$$

$-ab = x^2 + (a + b)x$

$x^2 + (a + b)x + ab = 0$ $1\frac{1}{2}$

$(x + a)(x + b) = 0$ 1

$x = -a,\ x = -b$ $\frac{1}{2}$

24. $\frac{p}{2}(2a + (p-1)d = q$

$2a + (p-1)d = \frac{2q}{p}$ ...(1) 1

$\frac{q}{2}[(2a + (q-1)d] = p$

$2a + (q-1)d = \frac{2p}{q}$ ...(2) $\frac{1}{2}$

On solving (1) and (2) for a and d

$d = \frac{-2(p+q)}{pq}$ $\frac{1}{2}$

$a = \frac{q^2 + p^2 - p + pq - q}{pq}$ $\frac{1}{2}$

$S_{p+q} = \frac{p+q}{2}(2a + (p+q-1)d)$

$$= \frac{p+q}{2}\left[2\left(\frac{q^2+p^2-p+pq-q}{pq}\right) + (p+q-1)\left(\frac{-2(p+q)}{pq}\right)\right]$$ 1

$$= (p+q)\left[\frac{\cancel{a^2} + \cancel{p^2} - \cancel{p} + pq - \cancel{q} - \cancel{p^2} - \cancel{q^2} - 2pq + \cancel{p} + \cancel{q}}{pq}\right]$$

$$= (p+q)\times\frac{-pq}{pq} = -(p+q)$$ $\frac{1}{2}$

Alternatively:

$$\frac{p}{2}(2a+(p-1)d) = q$$

$$\Rightarrow \; 2a + (p-1)d = \frac{2q}{p} \qquad ...(1)$$ 1

$$\frac{q}{2}[(2a+(q-1)d] = p$$

$$\Rightarrow \; 2a + (q-1)d = \frac{2p}{q} \qquad ...(2)$$ $\frac{1}{2}$

Solving (1) and (2) for d

$$d = \frac{-2(p+q)}{pq}$$ 1

$$S_{p+q} = \frac{(p+q)}{2}[2a + (p+q-1)d]$$

$$= \frac{(p+q)}{2}[2a + (p-1)d + qd]$$

$$= \frac{(p+q)}{2}\left[\frac{2q}{p} + \frac{q\times(-2)(p+q)}{pq}\right]$$ 1

$$= \frac{(p+q)}{2}\times 2\left[\frac{q-p-q}{p}\right] = -(p+q)$$ $\frac{1}{2}$

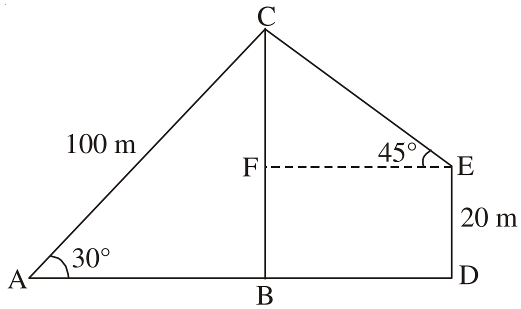
25. For Correct Given, To Prove, Construction, Figure $4\times\frac{1}{2} = 2$

For Correct Proof 2

26. For Correct Construction of triangle 2

For construction of similar triangle 2

27.



Correct Figure 1

In ΔABC

$$\sin 30° = \frac{BC}{100}$$

$\Rightarrow BC = 50$ m 1

$CF = 50 - 20 = 30$ m $\frac{1}{2}$

In ΔCFE

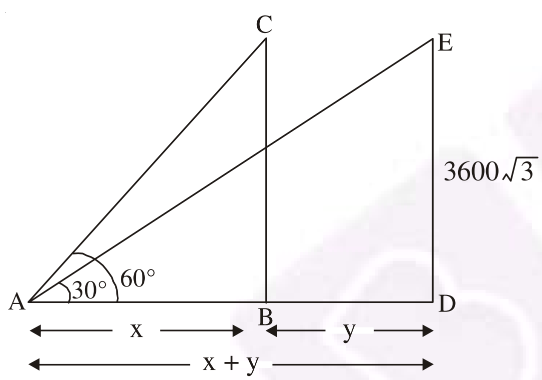
$$\sin 45° = \frac{30}{CE}$$

$CE = 30\sqrt{2}$ 1

$= 30 \times 1.414$

$= 42.42$ m $\frac{1}{2}$

OR



Correct Figure 1

In ΔABC, $\tan 60° = \frac{3600\sqrt{3}}{x}$

$x = 3600$ 1

In ΔADE, $\tan 30° = \frac{3600\sqrt{3}}{x+y}$

$3600 + y = 3600 \times 3$

$y = 7200$ 1

Speed $= \frac{7200}{30} = 240$ m/s 1

28.

Marks	**fi**	**cf**
0–10	10	10
10–20	x	10 + x
20–30	25	35 + x
30–40	30	65 + x
40–50	y	65 + x + y
50–60	10	75 + x + y
Total	100	

Correct Table 1

Median class = 30 – 40 $\frac{1}{2}$

75 + x + y = 100

x + y = 25 $\frac{1}{2}$

$$32 = 30 + \left(\frac{50-35-x}{30}\right)\times 10$$ 1

$$2 = \frac{15-x}{3}$$

x = 9 $\frac{1}{2}$

y = 16 $\frac{1}{2}$

OR

Class	cf
More than or equal to 0	100
More than or equal to 10	95
More than or equal to 20	80
More than or equal to 30	60
More than or equal to 40	37
More than or equal to 50	20
More than or equal to 60	9

Correct Table $\frac{1}{2}$

Plotting of points (0, 100), (10, 95), (20, 80), (30, 60), (40, 37), (50, 20) and (60, 9) $1\frac{1}{2}$

Joining the points to get curve $\frac{1}{2}$

Median = 35 (approx.) $\frac{1}{2}$

29. LHS $= \dfrac{(1+\cot\theta+\tan\theta)(\sin\theta-\cos\theta)}{\sec^3\theta-\operatorname{cosec}^3\theta}$

$$= \frac{\left(1+\dfrac{\cos\theta}{\sin\theta}+\dfrac{\sin\theta}{\cos\theta}\right)(\sin\theta-\cos\theta)}{\dfrac{1}{\cos^3\theta}-\dfrac{1}{\sin^3\theta}}$$ 1

$$= \frac{\dfrac{(\cos\theta\sin\theta+\cos^2\theta+\sin^2\theta)(\sin\theta-\cos\theta)}{\cos\theta\sin\theta}}{\dfrac{\sin^3\theta-\cos^3\theta}{\cos^3\theta\sin^3\theta}}$$ 1

$$= \frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\times\frac{\cos^3\theta\sin^3\theta}{\sin^3\theta-\cos^3\theta}$$ 1

$= \cos^2\theta\ \sin^2\theta = \text{RHS}$ 1

30. $l^2 = (24)^2 + \left(\frac{45}{2} - \frac{25}{2}\right)^2$

$l^2 = 576 + 100 = 676$

$l = 26$ cm 1

$\text{TSA} = \frac{22}{7} \times 26\left(\frac{25}{2} + \frac{45}{2}\right) + \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$

$= 2860 + 491.07$

$= 3351.07 \text{ cm}^2$ $1\frac{1}{2}$

$\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times 24\left(\frac{625}{4} + \frac{2025}{4} + \frac{1125}{4}\right)$

$= \frac{1}{\cancel{3}} \times \frac{22}{7} \times \cancel{6}^{2}\ \cancel{24} \times \frac{3775}{\cancel{4}}$

$= \frac{166100}{7} \text{ cm}^3$

or 23728.57 cm^3 $1\frac{1}{2}$