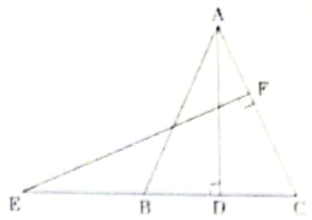
Subject: Mathematics (Basic)
Subject Code: 241

Time: 3 Hours
Max. Marks: 80

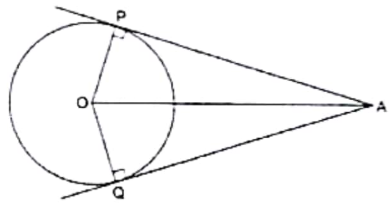
Marking scheme

	SECTION A	
1	(b) 7	1
2	(a) $\frac{1}{3}$	1
3	(c) no real roots	1
4	(d) 45°	1
5	(d) $\frac{1}{6}$	1
6	(a) $x^2 - 2x + 1$	1
7	(b) 24	1
8	(a) 30 cm	1
9	(d) 6	1
10	(a) 0	1
11	(a) $9\pi\ sq$.cm	1
12	(d) $\frac{1}{3}$	1
13	(b) -5	1
14	(a) 15	1
15	(b) 8 units	1
16	(b) (i) and (ii) only	1
17	(c) 3	1
18	(c) always less than OA	1
19	(d) Assertion (A) is false but Reason (R) is true.	1
20	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1
	SECTION B	
21	Let $5+2\sqrt{7}$ be a rational number. $5+2\sqrt{7}=\frac{p}{q}$, where p and q are integers, $q \neq 0$ $2\sqrt{7}=\frac{p}{q} - 5$ $\sqrt{7}=\frac{p-5q}{2q}$ We know that p and q are integers, $\frac{p-5q}{2q}$ is a rational number. $\therefore \sqrt{7}$ is also a rational number. But given that $\sqrt{7}$is an irrational number.	$^1/_2$ $^1/_2$ $^1/_2$

	This contradicts our assumption. $\therefore 5+2\sqrt{7}$ is an irrational number.	$^1/_2$
22	 In ΔABC, AB = AC which signifies $\angle ABC = \angle ACB$ as angles opposite to equal sides are equal In ΔABD and ΔECF $\angle ADB = \angle EFC = 90^\circ$ [$\because$ AD $\perp$ BC and EF $\perp$ AC] $\angle ABD = \angle ECF$ [proved above] Thus we have $\Delta ABD \sim \Delta ECF$ (AA criterion) **OR** In ΔBPE & ΔCPD $\angle BEP = \angle CDP$ (90°) $\angle BPE = \angle CPD$ (Vertically Opposite Angles) $\Delta BPE \sim \Delta CPD$ (AA similarity) $\frac{BP}{CP} = \frac{PE}{PD} = \frac{BE}{CD}$ (Corresponding parts of similar triangles) $\therefore BP \times PD = PE \times CP$	 $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ 1 $^1/_2$ $^1/_2$
23	Sum of the zeroes = Product of zeroes $\alpha + \beta = \frac{-b}{a} = \frac{-2}{k}$ $\alpha\beta = \frac{c}{a} = \frac{3k}{k}$ $\frac{-2}{k} = \frac{3k}{k}$ $k = \frac{-2}{3}$ **OR** $\alpha + \beta = \frac{-b}{a} = \frac{-(-1)}{2} = \frac{1}{2}$	 $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$

	$\alpha\beta = \frac{c}{a} = \frac{15}{2}$	$1/2$
	$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta}$	$1/2$
	$= \frac{1}{15}$	$1/2$
24	Let P(x,y) be equidistant from the points A(7,1) and B(3,5)	$1/2$
	Given that AP = BP. $\therefore AP^2 = BP^2$	$1/2$
	$(x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2$	$1/2$
	$x^2 - 14x + 49 + y^2 - 2y + 1 = x^2 - 6x + 9 + y^2 - 10y + 25$	$1/2$
	$x - y = 2$	
25	AP=BP--------(Tangents from an external point to the circle)	$1/2$
	BP= 5 cm	
	In ΔPAB $\angle BPA + \angle PAB + \angle PBA = 180°$ $60° + x + x = 180°$ $60° + 2x = 180°$	$1/2$
	$x = 60°$	
	$\therefore PAB$ is an equilateral Δ	$1/2$
	AB =5 cm	$1/2$
	SECTION C	
26	Greatest volume of each tin= HCF(120, 180)	$1/2$
	$120 = 2 \times 2 \times 2 \times 3 \times 5$ $180 = 2 \times 2 \times 3 \times 3 \times 5$	1
	HCF = 60	$1/2$
	Number of tins used = 120/60=2 , 180/60=3	1
	OR	
	The time to flash next together = LCM(80,90,110)	$1/2$
	$80 = 2^4 \times 5$ $90 = 2 \times 3^2 \times 5$ $110 = 2 \times 5 \times 11$	$1\frac{1}{2}$

	LCM = 7920 sec = 2 hours 12 min The three bulbs will flash all together again at 10:12 am	$^1/_2$ $^1/_2$
27	Probability of an event $=\frac{Number\ of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$ Total outcome=52 - 6 = 46 i) Total red cards= 26-6 =20 Probability of drawing a red colour card= $\frac{20}{46}=\frac{10}{23}$ ii) Probability of drawing a black king $=\frac{2}{46}=\frac{1}{23}$ iii) Probability of drawing an ace $=\frac{4}{46}=\frac{2}{23}$	$^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$
28	$a=12 \qquad a_n=96$ $a_n=a+(n-1)d$ $96=12+(n-1)4$ $n=22$ $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{22}=\frac{22}{2}[2\times 12+(22-1)4]$ =1188	$^1/_2$ 1 $^1/_2$ 1
29	Let $x-axis$ cuts the line segment joining the points A (4, -2) and B (-4, 6) at $(x,0)$ in the ratio $k:1$ Using section formula, $(x,0)=\left(\frac{m_1x_2+m_2x_1}{m_1+m_2},\frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$ $=\left(\frac{-4k+4}{k+1},\frac{6k-2}{k+1}\right)$ $0=\frac{6k-2}{k+1}$ $6k-2=0$ $6k=2$ $k=\frac{1}{3}$	$^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$

	the x-axis divides the line segment at the ratio 1 : 3 $x = \frac{m_1x_2+m_2x_1}{m_1+m_2} = \frac{1(-4)+3(4)}{4} = 2$ Coordinates of the point of division is (2,0)	½ ½
30	Length of the arc = 44cm $\frac{\theta}{360°} \times 2\pi r = 44$ $\frac{\theta}{360°} \times 2 \times \frac{22}{7} \times 42 = 44$ $\theta = 60°$ Area of minor sector = $\frac{\theta}{360°} \times \pi r^2$ $= \frac{60°}{360°} \times \frac{22}{7} \times 42 \times 42$ $= 924\ cm^2$	½ 1 ½ ½ ½
31	**Given :** Circle with centre O, a point A lying outside the circle and two tangents on the circle from A .  **Prove that:** AP = AQ. **Construction**: Join OP, OQ and OA. ∠ OQA and ∠ OPA are right angles, because these are angles between the radii and tangents, and they are right angles. **Proof:** Now in right triangles OQA and OPA, OQ = OP (Radii of the same circle) OA = OA (Common) ∠ OQA and ∠ OPA (=90 °proved) Therefore, Δ OQA ≅ Δ OPA (RHS congruence) AP = AQ (CPCT)	1 ½ 1 ½

	OR (a) We have AB, BC, CD and DA are the tangents touching the circle at P, Q, R and S respectively. AP=AS , BP= BQ , CR= CQ and DR =DS [Tangents from an external point to the circle are equal] On adding we get AP+ BP +CR+DR = AS+BQ+CQ+DR Thus AB + CD = AD + BC	1 ½ ½ 1
	SECTION D	
32	Let the present age of Tracy be x years Age before 5 years = (x-5) years $(x-5)^2 = 5x + 11$ $x^2 - 10x + 25 - 5x - 11 = 0$ $x^2 - 15x + 14 = 0$ $(x-1)(x-14) = 0$ $x = 1 \ or\ x = 14$ But present age cannot be 1 year ∴ Tracy's age is 14 years. **OR** For real and equal roots, $b^2 - 4ac = 0$ $a = (k+1)$ $b = 2(k+3)$ $c = k+8$ $2(k+3)^2 - 4(k+1)(k+8) = 0$ $4(k^2 + 6k + 9) - 4(k^2 + 9k + 8) = 0$ $4k^2 + 24k + 36 - 4k^2 - 36k - 32 = 0$ $-12k + 4 = 0$ $12k = 4$ $k = \frac{1}{3}$	½ 1 2 ½ ½ ½ 1 ½ 1 1 ½ ½ ½

33

Median = 50
Total frequency = 90

Marks Obtained	Number of students (f)	Cf
20 - 30	p	p
30 – 40	15	$p + 15$
40 – 50	25	$p + 40$
50 – 60	20	$p + 60$
60 – 70	q	$p + q + 60$
70 – 80	8	$p + q + 68$
80 - 90	10	$p + q + 78$

1

Median class is 50-60, $l = 50$ $f = 20$ $cf = p + 40$ — $\frac{1}{2}$

Median = $l + \frac{\frac{N}{2} - cf}{f} \times h$ — $\frac{1}{2}$

$50 = 50 + \frac{45-(40+p)}{20} \times 10$ — $\frac{1}{2}$

$50 = 50 + \frac{45 - 40 - p}{20} \times 10$
$0 = 5 - p$
$p = 5$ — $1\frac{1}{2}$

$p + q + 78 = 90$
$q = 7$ — 1

34

Cylinder
$r = 3\ cm \quad H = 12\ cm$

Cone
$l = 5\ cm \quad r = 3\ cm$
$\therefore h^2 = l^2 - r^2$
$= 5^2 - 3^2$
$h = 4\ cm$

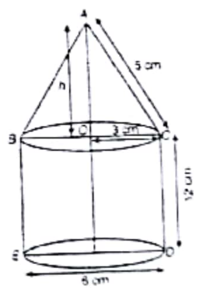


fig $\frac{1}{2}$

$\frac{1}{2}$

Volume of rocket = Volume of cylinder + Volume of cone
$= \pi r^2 H + \frac{1}{3}\pi r^2 h$ — 1

	$= \pi r^2 (H + \frac{1}{3} h)$ $= 3.14 \times 3^2 (12 + \frac{1}{3} \times 4)$ $= 3.14 \times 9 \times \frac{40}{3}$ $= 376.8\ cm^3$ Total Surface Area of the rocket = Curved Surface Area of Cone + Curved Surface Cylinder + Base area of Cylinder $= \pi r l + 2\pi r h + \pi r^2$ $= \pi r(l + 2h + r)$ $= 3.14 \times 3(5 + 2 \times 12 + 3)$ $= 3.14 \times 3 \times 32$ $= 301.44\ cm^2$ **OR** Length= 15 cm Breadth = 10 cm Height = 5 cm Diameter of the circular hole = 7 cm Radius of the circular hole = $\frac{7}{2}\ cm$ Surface Area of the cuboid = $2(lb + bh + lh)$ $= 2(15 \times 10 + 10 \times 5 + 5 \times 15)$ $= 2(150 + 50 + 75)$ $= 550\ cm^2$ CSA of cylinder = $2\pi r h$ $= 2 \times \frac{22}{7} \times \frac{7}{2} \times 5 = 110\ cm^2$ Area of two cylinderical hole =$2 \times \pi r^2$ $= 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = 77 cm^2$ Surface Area of the remaining solid =Surface area of the cuboid + CSA of Cylinder – Area of two cylindrical holes $= 550 + 110 - 77 = 583\ cm^2$	½ ½ ½ ½ ½ ½ ½ 1 1 1 ½ 1
35	LHS=$\sin^2 A + \text{cosec}^2 A + 2\sin A \text{cosec} A + \sec^2 A + \cos^2 A + 2\sec A \cos A$ $= 1 + 2 + 2 + \text{Sec}^2 A + \text{Cosec}^2 A$	2 1

	$=5+1+\tan^2A+1+\cot^2A$ $= 7+\tan^2A+\cot^2A=$ RHS	1 1
36 i)	In ΔPOB, $\cos 30° = \frac{OP}{OB}$ $\frac{\sqrt{3}}{2} = \frac{36}{OB}$ OB = 41.52 m	½ ½
ii)	In ΔPOA, $\tan 45° = \frac{AP}{OP}$ AP = OP = 36 m In ΔPOB, $\tan 30° = \frac{BP}{OP}$ BP $= \frac{36}{\sqrt{3}} = 12\sqrt{3} = 20.76$ m AB = AP- BP $= 36 - 20.76 = 15.24$ m **OR** $b = 36$ In ΔPOB, $\tan 30° = \frac{BP}{OP}$ BP $= \frac{36}{\sqrt{3}} = 12\sqrt{3} = 20.76$ m Area of $\Delta OPB = \frac{1}{2}bh$ $= \frac{1}{2} \times 36 \times 20.76 = 373.68\ m^2$	½ 1 ½ 1 1
iii)	OP=36-24 = 12 m In ΔPOB, $\tan \theta° = \frac{BP}{OP} = \frac{12\sqrt{3}}{12}$ $\tan \theta° = \sqrt{3}$ $\theta = 60°$	½ ½
37 i)	AAA similarity criteria	1
ii)	XY ∥ AC	

	Using Basic proportionality theorem $\frac{x+2}{x-6} = \frac{x}{x-2}$ $(x+2)(x-2) = x(x-6)$ $x = \frac{2}{3}$ OR $\frac{BX}{AB} = \frac{2}{3}$ $\therefore \frac{XY}{AC} = \frac{2}{3}$ $\frac{2}{3} = \frac{18}{AC}$ $\therefore AC = 27m$ $\frac{BY}{BY+11} = \frac{2}{3}$ 3 BY = 2(BY+11) BY = 22 m BC = 33 m	$^1/_2$ $^1/_2$ 1 $^1/_2$ $^1/_2$ $^1/_2$ $^1/_2$
iii)	$\frac{BX}{XA} = \frac{3}{4}$ $\frac{BY}{YC} = \frac{5}{9}$ $\frac{BX}{XA} \neq \frac{BY}{YC}$ By converse of basic proportionality theorem, XY is not parallel to AC	$^1/_2$ $^1/_2$
38 i)	$x + 5y = 27;$ $x + 11y = 45$	1
ii)	$x + 10y = 32$ ------ (1) $x + 8y = 28$ --------- (2) 2y = 4 y = 2 Additional Charge = AED 2	1 $^1/_2$

	Fixed charge = AED 12	1/2
	OR	
	$x + 5y = 27$---------- (1) $x + 11y = 45$----------------(2) -6y = -18 y = 3	1
	Additional charge = Dh 3	1/2
	Fixed price = Dh 12	1/2
	Amount paid for 10 km = Dh 42	1
iii)	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, lines intersect at a point.	