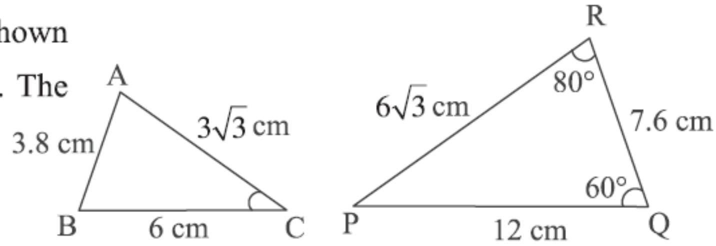
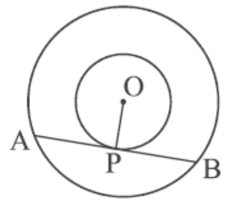
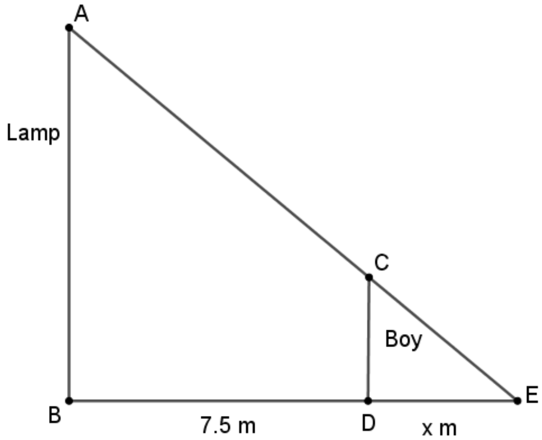
SOLUTIONS
MATHEMATICS (Subject Code–
041) (PAPER CODE: 30/4/2)

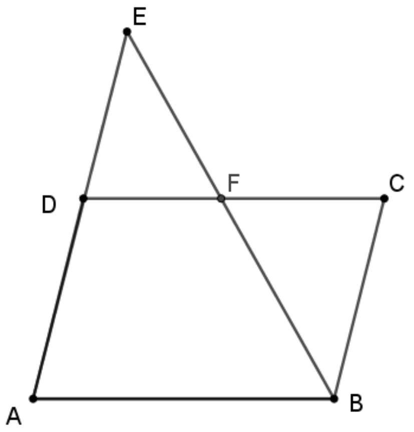
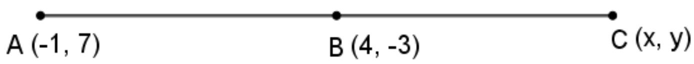
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION - A **This section consists of 20 questions of 1 mark each.**	
1.	Which of the following statements is true for a polynomial $p(x)$ of degree 3? (a) $p(x)$ has at most two distinct zeroes. (b) $p(x)$ has at least two distinct zeroes. (c) $p(x)$ has exactly three distinct zeroes. (d) $p(x)$ has at most three distinct zeroes.	
Sol.	(d) $p(x)$ has at most three distinct zeroes.	**1**
2.	A pair of dice is thrown once. The probability that sum of numbers appearing on top faces is at least 4 is : (a) $\frac{1}{11}$ (b) $\frac{10}{11}$ (c) $\frac{5}{6}$ (d) $\frac{11}{12}$	
Sol.	(d) $\frac{11}{12}$	**1**
3.	If $x = ab^3$ and $y = a^3b$, where a and b are prime numbers, then [HCF (x, y) – LCM (x, y)] is equal to : (a) $1 - a^3b^3$ (b) $ab\,(1 - ab)$ (c) $ab - a^4b^4$ (d) $ab\,(1 - ab)\,(1 + ab)$	
Sol.	(d) $ab(1 - ab)(1 + ab)$	**1**
4.	$\left(1+\sqrt{3}\right)^2 - \left(1-\sqrt{3}\right)^2$ is : (a) a positive rational number. (b) a negative integer. (c) a positive irrational number. (d) a negative irrational number.	
Sol.	(c) a positive irrational number	**1**
5.	The value of 'a' for which $ax^2 + x + a = 0$ has equal and positive roots is : (a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$	
Sol.	(d) $-\frac{1}{2}$	**1**
6.	The distance of which of the following points from origin is less than 5 units ? (a) (3, 4) (b) (2, 6) (c) (– 3, – 4) (d) (1, 4)	
Sol.	(d) (1,4)	**1**

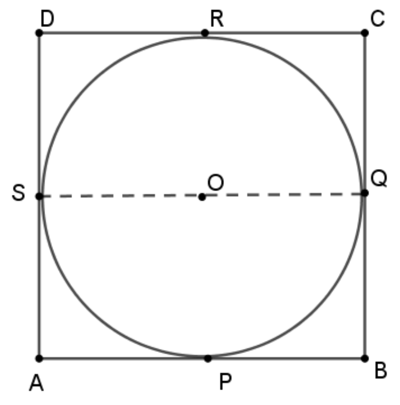
7.	The number of red balls in a bag is 10 more than the number of black balls. If the probability of drawing a red ball at random from this bag is $\frac{3}{5}$, then the total number of balls in the bag is : (a) 50 (b) 60 (c) 80 (d) 40	
Sol.	(a) 50	**1**
8.	The value of 'p' for which the equations $px + 3y = p - 3$, $12x + py = p$ has infinitely many solutions is : (a) -6 only (b) 6 only (c) ± 6 (d) Any real number except ± 6	
Sol.	(b) 6 only	**1**
9.	ΔABC and ΔPQR are shown in the adjoining figures. The measure of $\angle C$ is :  (a) 140° (b) 80° (c) 60° (d) 40°	
Sol.	(d) 40°	**1**
10.	Which of the following is a trigonometric identity ? (a) $\sin^2\theta = 1 + \cos^2\theta$ (b) $\text{cosec}^2\theta + \cot^2\theta = 1$ (c) $\sec^2\theta = 1 + \tan^2\theta$ (d) $\sin 2\theta = 2\sin\theta$	
Sol.	(c) $sec^2\theta = 1 + tan^2\theta$	**1**
11.	Which of the following statements is true ? (a) $\sin 20° > \sin 70°$ (b) $\sin 20° > \cos 20°$ (c) $\cos 20° > \cos 70°$ (d) $\tan 20° > \tan 70°$	
Sol.	(c) $\cos 20° > \cos 70°$	**1**
12.	A 30 m long rope is tightly stretched and tied from the top of pole to the ground. If the rope makes an angle of 60° with the ground, the height of the pole is : (a) $10\sqrt{3}$ m (b) $30\sqrt{3}$ m (c) 15 m (d) $15\sqrt{3}$ m	
Sol.	(d) $15\sqrt{3}$ m	**1**
13.	If mean and mode of given set of observations are 10 and 13 respectively, then the value of median is : (a) 19 (b) 4 (c) 11 (d) 43	
Sol.	(c) 11	**1**

14.	In the adjoining figure, AB is the chord of larger circle which touches the smaller circle at P. If length of AB = diameter of inner circle = $2r$, then the diameter of larger circle is : (a) $2r$ (b) $4r$ (c) $2\sqrt{2}r$ (d) $\sqrt{2}r$ 	
Sol.	(c) $2\sqrt{2}r$	**1**
15.	On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is : (a) 400 (b) 100 (c) 20 (d) 10	
Sol.	(b) 100	**1**
16.	The cumulative frequency for calculating median is obtained by adding the frequencies of all the : (a) classes up to the median class (b) classes following the median class (c) classes preceding the median class (d) all classes	
Sol.	(c) classes preceding the median class	**1**
17.	A parallelogram having one of its sides 5 cm circumscribes a circle. The perimeter of parallelogram is : (a) 20 cm (b) less than 20 cm (c) more than 20 cm but less than 40 cm (d) 40 cm	
Sol.	(a) 20 cm	**1**
18.	E and F are points on the sides AB and AC respectively of a ΔABC such that $\frac{AE}{EB} = \frac{AF}{FC} = \frac{1}{2}$. Which of the following relation is true ? (a) EF = 2BC (b) BC = 2EF (c) EF = 3BC (d) BC = 3 EF	
Sol.	(d) BC = 3 EF	**1**
	Directions : **In question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :** (a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A). (b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). (c) Assertion (A) is true but Reason (R) is false. (d) Assertion (A) is false but Reason (R) is true.	
19.	**Assertion (A) :** A line drawn perpendicular to the tangent at point of contact passes through the centre of the circle. **Reason (R) :** Lengths of tangents drawn from external point to a circle are equal.	

Sol.	(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).	**1**
20	**Assertion (A) :** 4^n ends with digit 0 for some natural number *n*. **Reason (R) :** For a number '*x*' having 2 and 5 as its prime factors, x^n always ends with digit 0 for every natural number *n*.	
Sol.	(d) Assertion (A) is false but Reason (R) is true.	**1**
	SECTION - B **This section consists of 5 questions of 2 marks each.**	
21 (A).	Find the value of x for which $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$	
Sol.	$(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$ $\Rightarrow \sin^2 A + \operatorname{cosec}^2 A + 2 + \cos^2 A + \sec^2 A + 2 = x + \tan^2 A + \cot^2 A$ $\Rightarrow 1 + 2 + 2 + 1 + \cot^2 A + 1 + \tan^2 A = x + \tan^2 A + \cot^2 A$ $\therefore x = 7$	 ½ **1** ½
	OR	
21 (B).	Evaluate the following : $\dfrac{3\sin 30° - 4\sin^3 30°}{2\sin^2 50° + 2\cos^2 50°}$	
Sol.	$\dfrac{3\sin 30° - 4\sin^3 30°}{2\sin^2 50° + 2\cos^2 50°}$ $= \dfrac{3\times\frac{1}{2} - 4\times\frac{1}{8}}{2(\sin^2 50° + \cos^2 50°)}$ $= \dfrac{\frac{3}{2} - \frac{1}{2}}{2\times 1}$ $= \dfrac{1}{2}$	 **1** ½ ½
22.	Saima and Aryaa were born in the month of June in the year 2012. Find the probability that : (i) they have different dates of birth. (ii) they have same date of birth.	
Sol.	Number of days in June 2012 = 30 (i) P (different dates of birth) = $\frac{29}{30}$ (ii) P (same date of birth) = $\frac{1}{30}$	 **1** **1**

23.	Solve the following system of equations algebraically : $37x+63y=137$ $63x+37y=163$	
Sol.	Adding and subtracting the given equations, we get $x+y=3$ … (i) and $x-y=1$ … (ii) Solving (i) and (ii), we get $x=2, y=1$	 ½ ½ ½+½
24 (A).	A 1.5 m tall boy is walking away from the base of a lamp post which is 12 m high, at the speed of 2.5 m/sec. Find the length of his shadow after 3 seconds.	
Sol.	Let AB be the lamp post and CD be the boy 1.5 m tall.  For correct figure Let the length of shadow be x m Speed of boy = 2.5 m/sec ∴ Distance covered in 3 seconds = 7.5 m Now, Δ ABE~Δ CDE $\Rightarrow \frac{CD}{AB}=\frac{DE}{BE}$ $\Rightarrow \frac{1.5}{12}=\frac{x}{7.5+x}$ Solving, we get x = $\frac{15}{14}$ or 1.07 approx. Hence length of shadow is 1.07 m	 ½ ½ ½ ½
	OR	

24 (B).	In parallelogram ABCD, side AD is produced to a point E and BE intersects CD at F. Prove that $\Delta ABE \sim \Delta CFB$	
Sol.	 For correct figure In Δ ABE and Δ CFB, $\angle AEB = \angle CBF$ $\angle A = \angle C$ $\therefore \; \Delta ABE \sim \Delta CFB$	½ **1** ½
25.	Find the coordinates of the point C which lies on the line AB produced such that AC = 2BC, where coordinates of points A and B are (– 1, 7) and (4, – 3) respectively.	
Sol.	 Let coordinates of point C be (x, y) $AC = 2\ BC$ $\Rightarrow$ B is mid-point of AC $\Rightarrow \frac{-1+x}{2} = 4 \Rightarrow x = 9$ $\frac{7+y}{2} = -3 \Rightarrow y = -13$ $\therefore$ Coordinates of C are $(9, -13)$	 ½ ½ ½ ½
	SECTION - C **This section consists of 6 questions of 3 marks each.**	
26.	α and β are zeroes of a quadratic polynomial $x^2 - ax - b$. Obtain a quadratic polynomial whose zeroes are $3\alpha + 1$ and $3\beta + 1$.	
Sol.	$\alpha + \beta = a, \;\; \alpha\beta = -b$ Sum of zeroes of required polynomial $= (3\alpha + 1) + (3\beta + 1)$	½

	$= 3(\alpha + \beta) + 2$ $= 3a + 2$ Product of zeroes of required polynomial $= (3\alpha + 1)(3\beta + 1)$ $= 9\alpha\beta + 3(\alpha + \beta) + 1$ $= -9b + 3a + 1$ ∴ The required polynomial is $x^2 - (3a + 2)\, x + (3a - 9b + 1)$	**1** **1** ½
27.	Rectangle ABCD circumscribes the circle of radius 10 cm. Prove that ABCD is a square. Hence, find the perimeter of ABCD.	
Sol.	 For correct figure AP = AS BP = BQ CR = CQ DR = DS Adding the above four equations, AP + BP + CR + DR = AS + BQ + CQ + DS ⟹ AB + CD = AD + CB --- (i) Since ABCD is a rectangle ∴ AB = CD and BC = AD ⟹ from (i), 2 AB = 2 AD or AB = AD Hence ABCD is a square Clearly side of square = diameter of circle = 20 cm ∴ Perimeter of square = 4 × 20 cm = 80 cm	½ 1 ½ ½ ½

28 (A).	Prove that $\sqrt{2}$ is an irrational number.	
Sol.	Let $\sqrt{2}$ be a rational number. $\therefore \sqrt{2} = \frac{p}{q}$, where $q \neq 0$ and let p & q be co-primes. $2q^2 = p^2 \implies p^2$ is divisible by 2 $\implies p$ is divisible by 2 ----- (i) $\implies p = 2a$, where 'a' is some integer $4a^2 = 2q^2 \implies q^2 = 2a^2 \implies q^2$ is divisible by 2 $\implies q$ is divisible by 2 ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{2}$ is an irrational number.	½ 1 1 ½
	OR	
28 (B).	Let x and y be two distinct prime numbers and $p = x^2 y^3$, $q = xy^4$, $r = x^5 y^2$. Find the HCF and LCM of p, q and r. Further check if HCF $(p, q, r) \times$ LCM $(p, q, r) = p \times q \times r$ or not.	
Sol.	$p = x^2y^3, q = xy^4, r = x^5y^2$ HCF $(p,q,r) = xy^2$ LCM $(p,q,r) = x^5y^4$ HCF $\times$ LCM $= x^6y^6$ $p \times q \times r = x^8y^9$ $\implies$ HCF $(p,q,r) \times$ LCM $(p,q,r) \neq p \times q \times r$	1 1 1
29.	The two angles of a right angled triangle other than 90° are in the ratio $2:3$. Express the given situation algebraically as a system of linear equations in two variables and hence solve it.	
Sol.	Let the measures of two angles be x and y ATQ $x + y = 90°$ … (i) and $\frac{x}{y} = \frac{2}{3} \implies 3x - 2y = 0$ … (ii) Solving (i) and (ii), we get $x = 36°, y = 54°$	1 1 ½ + ½
30.	P (x, y), Q $(-2, -3)$ and R $(2, 3)$ are the vertices of a right triangle PQR right angled at P. Find the relationship between x and y. Hence, find all possible values of x for which $y = 2$.	
Sol.	In Δ PQR, $\angle P = 90°$ $PQ^2 + PR^2 = QR^2$	

	$\Rightarrow (x+2)^2 + (y+3)^2 + (x-2)^2 + (y-3)^2 = 4^2 + 6^2$ $\Rightarrow\ x^2 + 4x + 4 + y^2 + 6y + 9 + x^2 - 4x + 4 + y^2 - 6y + 9 = 52$ gives, $x^2 + y^2 = 13$ Now for $y = 2, x = \pm 3$	**1** **1** **1**
31 (A).	Prove that $\dfrac{\cos A + \sin A - 1}{\cos A - \sin A + 1} = \operatorname{cosec} A - \cot A$	
Sol.	LHS $= \dfrac{\cos A + \sin A - 1}{\cos A - \sin A + 1}$ $= \dfrac{\cot A + 1 - \operatorname{cosec} A}{\cot A - 1 + \operatorname{cosec} A}$ $= \dfrac{\cot A - \operatorname{cosec} A + \operatorname{cosec}^2 A - \cot^2 A}{\cot A - 1 + \operatorname{cosec} A}$ $= \dfrac{(\operatorname{cosec} A - \cot A)(-1 + \operatorname{cosec} A + \cot A)}{\cot A - 1 + \operatorname{cosec} A}$ $= \operatorname{cosec} A - \cot A = \text{RHS}$	 **1** **1** ½ ½
	OR	
31 (B).	If $\cot\theta + \cos\theta = p$ and $\cot\theta - \cos\theta = q$, prove that $p^2 - q^2 = 4\sqrt{pq}$	
Sol.	LHS $= p^2 - q^2$ $= (\cot\theta + \cos\theta)^2 - (\cot\theta - \cos\theta)^2$ $= [(\cot\theta + \cos\theta) + (\cot\theta - \cos\theta)][(\cot\theta + \cos\theta) - (\cot\theta - \cos\theta)]$ $= 2\cot\theta \times 2\cos\theta = 4\cot\theta\cos\theta$ RHS $= 4\sqrt{pq}$ $= 4\sqrt{(\cot\theta + \cos\theta)(\cot\theta - \cos\theta)}$ $= 4\sqrt{cot^2\theta - cos^2\theta}$ $= 4\sqrt{cos^2\theta(cosec^2\theta - 1)}$ $= 4\sqrt{cos^2\theta \times cot^2\theta}$ $= 4\cot\theta\cos\theta$ $\therefore$ LHS = RHS	 **1** ½ ½ ½ ½

	SECTION - D **This section consists of 4 questions of 5 marks each.**	
32.	The following table shows the number of traffic challans issued in the month of April by the traffic police : Number of Challans / Number of Days: 0-10: 3; 10-20: 5; 20-30: 10; 30-40: 9; 40-50: 2; 50-60: 1; **Total**: **30** Find the 'mean' and 'mode' of the above data.	
Sol.	(table below)	**1½ marks for correct table**

Number of Challans	Number of Days
0-10	3
10-20	5
20-30	10
30-40	9
40-50	2
50-60	1
Total	**30**

Number of Challans	Number of days (f_i)	Class Mark (x_i)	$f_i\ x_i$
0-10	3	5	15
10-20	5	15	75
20-30	10	25	250
30-40	9	35	315
40-50	2	45	90
50-60	1	55	55
Total	$\sum f_i$ =30		$\sum f_i x_i$ =800

Mean $= \frac{800}{30}$ **1**

$= \frac{80}{3}$ or 26.67 or 27 (approx.) **½**

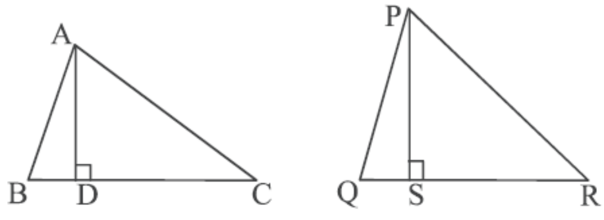
Modal class is 20-30 **½**

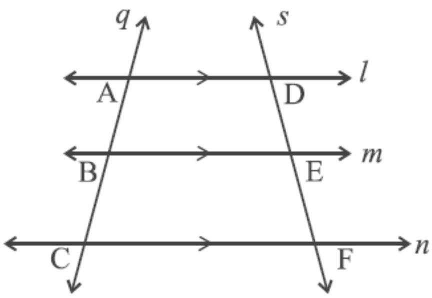
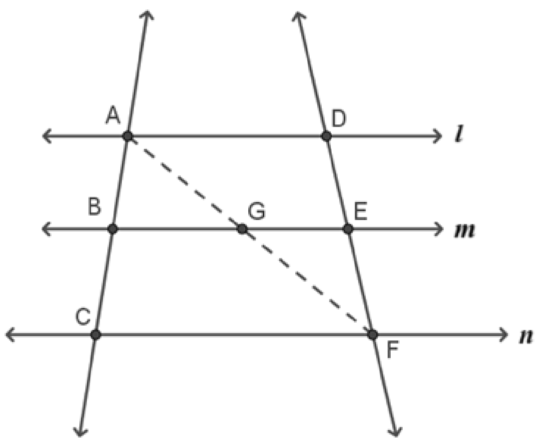
Mode $= 20 + \frac{10-5}{2\times10-5-9} \times 10$ **1**

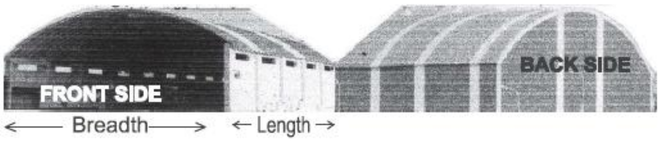
$= \frac{85}{3}$ or 28.3 or 28 (approx.) **½**

33 (A). The sides of a right triangle are such that the longest side is 4 m more than the shortest side and the third side is 2 m less than the longest side. Find the length of each side of the triangle. Also, find the difference between the numerical values of the area and the perimeter of the given triangle.

Sol. Let the length of shortest side be x m

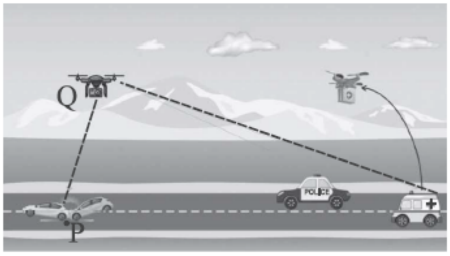
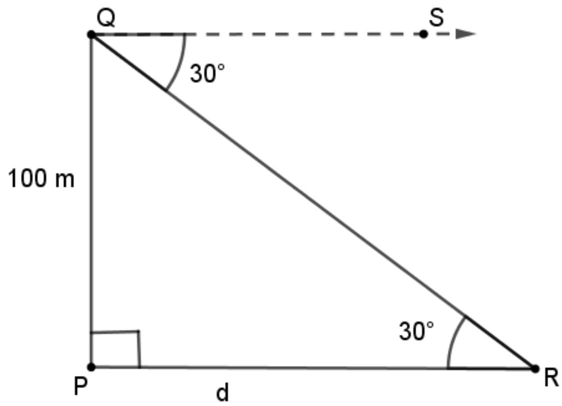
	$\therefore$ length of longest side $= (x+4)$ m and length of third side $= (x+2)$ m Now, $(x+4)^2 = x^2 + (x+2)^2$ $\Rightarrow x^2 - 4x - 12 = 0$ $\Rightarrow (x-6)(x+2) = 0$ $\Rightarrow x = 6$ $\therefore$ sides are 6 m, 8 m and 10 m Area $= \frac{1}{2} \times 6 \times 8 = 24$ m^2 Perimeter $= 6 + 8 + 10 = 24$ m Difference $= 0$	**1** **1** **1** ½ ½ ½ ½
	OR	
33 (B).	Express the equation $\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$; $(x \neq 3, 5)$ as a quadratic equation in standard form. Hence, find the roots of the equation so formed.	
Sol.	$\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$ $\Rightarrow \frac{(x-2)(x-5)+(x-4)(x-3)}{(x-3)(x-5)} = \frac{10}{3}$ Simplifying, we get $2x^2 - 19x + 42 = 0$ $\Rightarrow (x-6)(2x-7) = 0$ $\Rightarrow x = 6$ or $x = \frac{7}{2}$	 **1½** **1½** **1** **1**
34 (A).	The corresponding sides of ΔABC and ΔPQR are in the ratio 3 : 5. $AD \perp BC$ and $PS \perp QR$ as shown in the following figures :  (i) Prove that $\Delta ADC \sim \Delta PSR$ (ii) If AD = 4 cm, find the length of PS. (iii) Using (ii) find ar (ΔABC) : ar (ΔPQR)	
Sol.	As, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{3}{5}$	

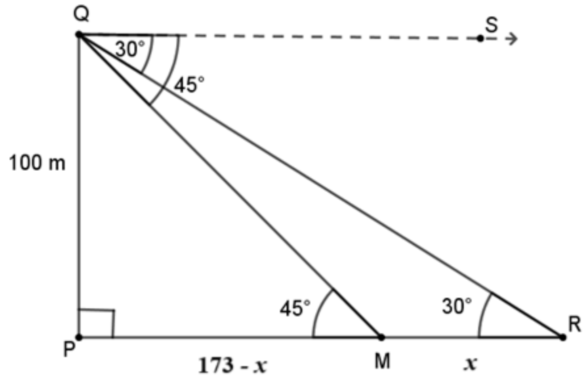
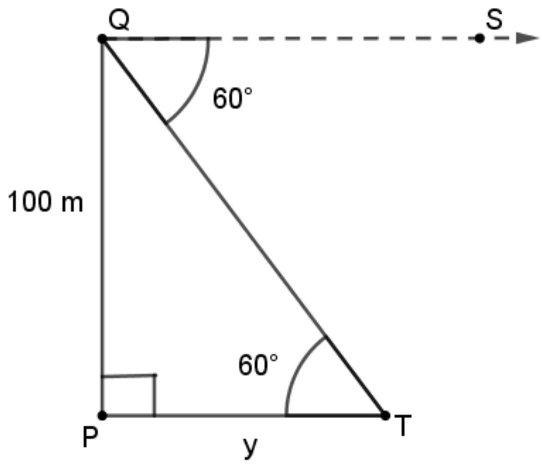
	$\Rightarrow\ \Delta\,ABC \sim \Delta\,PQR$ $\Rightarrow\ \angle C = \angle R$ (i) In $\Delta\,ADC$ and $\Delta\,PSR$, $\angle\,ADC = \angle\,PSR = 90°$ and $\angle\,C = \angle R$ $\therefore\ \Delta\,ADC \sim \Delta\,PSR$ (ii) $\frac{AD}{PS} = \frac{AC}{PR} = \frac{3}{5}$ $\Rightarrow\ \frac{4}{PS} = \frac{3}{5}$ $\Rightarrow PS = \frac{20}{3}$ cm (iii) $\frac{ar\,(\Delta\,ABC)}{ar\,(\Delta\,PQR)} = \frac{\frac{1}{2}\times BC\times AD}{\frac{1}{2}\times QR\times PS}$ $= \frac{3}{5}\times\frac{3}{5} = \frac{9}{25}$ $\therefore\ ar\,(\Delta\,ABC) : ar\,(\Delta\,PQR) = 9 : 25$	½ 1 ½ ½ ½ ½ 1 ½
	OR	
34 (B).	State basic proportionality theorem. Use it to prove the following : If three parallel lines l, m, n are intersected by transversals q and s as shown in the adjoining figure, then $\frac{AB}{BC} = \frac{DE}{EF}$.  	
Sol.	Correct statement  	1

	Join AF intersecting line m at G In Δ ACF, BG $\parallel$ CF $\Rightarrow \frac{AB}{BC} = \frac{AG}{GF}$ … (i) In Δ FDA, GE $\parallel$ AD $\Rightarrow \frac{EF}{DE} = \frac{GF}{AG}$ or $\frac{DE}{EF} = \frac{AG}{GF}$ … (ii) From, (i) and (ii), we get $\frac{AB}{BC} = \frac{DE}{EF}$	**1** **1** **1** **1**
35.	In order to provide shelter to flood victims, a shed was constructed using tin sheets which is in the form of cuboid surmounted by a half cylinder as shown below :  The length, breadth and height of cuboidal portion are 10 m, 7 m and 3 m respectively. The diameter of the cylindrical portion is 7 m. Find the cost of tin sheets required to make the shed at the rate of ₹ 70 per square metre, given that the shed is open from the front side and closed from the back side.	
Sol.	Area of the sheet required for the shed = (lateral surface area of the cuboid − front area) $+ \frac{1}{2}$ CSA of cylinder + area of semicircle $= [2 \times (10+7) \times 3 - 7 \times 3] + \frac{1}{2} \times 2 \times \frac{22}{7} \times \frac{7}{2} \times 10 + \frac{1}{2} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$ $= \frac{841}{4}\ m^2$ Cost of sheet $= \frac{841}{4} \times 70 = ₹\ 14717.50$	 **1+1+1** **1** **1**

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>SECTION - E
This section consists of 3 case-study based questions of 4 marks each.</td><td></td></tr>
<tr><td>36.</td><td>Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves.

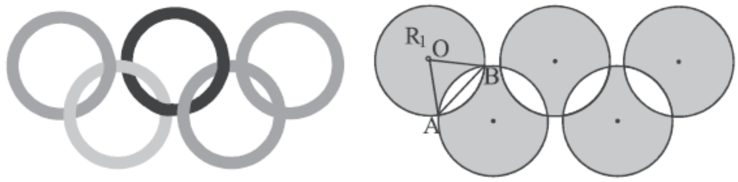
The distance of first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m.
Based on above information, answer the following questions using Arithmetic Progression :
(i) Find the distance of 10th pole from the base.
(ii) Find the distance between 15th pole and 25th pole.
(iii) (a) Find the time taken by cable car to reach 15th pole from the top if it is moving at the speed of 5m/sec and coming from top.
OR
(iii) (b) Find the total number of poles installed along the entire journey.</td><td></td></tr>
<tr><td>Sol.</td><td>AP formed is $200, 350, 500, \ldots$
(i) Distance of 10th pole from base $= a_{10}$
$= 200 + 9 \times 150$
$= 1550$ m</td><td>1</td></tr>
<tr><td></td><td>(ii) Distance between 15th pole and 25th pole $= a_{25} - a_{15}$
$= 10 \times 150 = 1500$ m</td><td>1</td></tr>
<tr><td></td><td>(iii) (a) Distance of 15th pole from the top $= 300 + 14 \times 150$
$= 2400$ m</td><td>1</td></tr>
<tr><td></td><td>Time taken by cable car $= \frac{2400}{5} = 480$ seconds or 8 minutes</td><td>1</td></tr>
<tr><td></td><td>OR</td><td></td></tr>
<tr><td></td><td>(iii) (b) Distance of last pole from the base $= (5000 - 300)$ m $= 4700$ m</td><td>½</td></tr>
<tr><td></td><td>$\therefore\ a_n = 4700$
$\Rightarrow 200 + (n-1)150 = 4700$</td><td>1</td></tr>
<tr><td></td><td>Solving, we get $n = 31$</td><td>½</td></tr>
</table>

37.	A drone was used to facilitate movement of an ambulance on the straight highway to a point P on the ground where there was an accident. The ambulance was travelling at the speed of 60 km/h. The drone stopped at a point Q, 100 m vertically above the point P. The angle of depression of the ambulance was found to be 30° at a particular instant.  Based on above information, answer the following questions : (i) Represent the above situation with the help of a diagram. (ii) Find the distance between the ambulance and the site of accident (P) at the particular instant. (Use $\sqrt{3} = 1.73$) (iii) (a) Find the time (in seconds) in which the angle of depression changes from 30° to 45°. **OR** (iii) (b) How long (in seconds) will the ambulance take to reach point P from a point T on the highway such that angle of depression of the ambulance at T is 60° from the drone ?	
Sol.	(i)  For correct figure	**1**
	(ii) In Δ PQR, $\frac{100}{d} = \tan 30° = \frac{1}{\sqrt{3}}$	½
	$\Rightarrow d = 100\sqrt{3} = 173$ m	½

	(iii) (a)  For correct figure	½
	In Δ PQM, $\frac{100}{173-x}$ = tan 45° = 1	½
	$\Rightarrow x = 73$ m	½
	Time taken $=\frac{73\times18}{60\times5}=\frac{219}{50}$ or 4.4 seconds (approx.)	½
	OR	
	(iii) (b)  For correct figure	½
	In Δ PQT, $\frac{100}{y}$ = tan 60° = $\sqrt{3}$	½
	$\Rightarrow$ y = $\frac{100}{\sqrt{3}}=\frac{100\sqrt{3}}{3}$ or $\frac{173}{3}$ m	½
	Time taken $=\frac{100\sqrt{3}\times18}{3\times60\times5}=2\sqrt{3}$ or 3.5 seconds (approx.)	½

38. The Olympic symbol comprising five interlocking rings represents the union of the five continents of the world and the meeting of athletes from all over the world at the Olympic games. In order to spread awareness about Olympic games, students of Class-X took part in various activities organised by the school. One such group of students made 5 circular rings in the school lawn with the help of ropes. Each circular ring required 44 m of rope.

Also, in the shaded regions as shown in the figure, students made rangoli showcasing various sports and games. It is given that ΔOAB is an equilateral triangle and all unshaded regions are congruent.



Based on above information, answer the following questions :

(i) Find the radius of each circular ring.

(ii) What is the measure of $\angle AOB$?

(iii) (a) Find the area of shaded region R_1.

OR

(iii) (b) Find the length of rope around the unshaded regions.

Sol.

(i) $2 \times \frac{22}{7} \times r = 44$ — ½

$\Rightarrow r = 7$ m — ½

(ii) $\angle AOB = 60°$ — **1**

(iii) (a) Area of shaded region R_1 = area of circle − area of 2 segments

$= \frac{22}{7} \times 7 \times 7 - 2 \times \left(\frac{60}{360} \times \frac{22}{7} \times 7 \times 7 - \frac{\sqrt{3}}{4} \times 7 \times 7\right)$ — **1**

$= \left(\frac{308}{3} + \frac{49\sqrt{3}}{2}\right) m^2$ or $145.05\ m^2$ (approx.) — **1**

OR

(iii) (b) Length of rope around unshaded regions

$= 8 \times$ length of arc — ½

$= 8 \times 2 \times \frac{60}{360} \times \frac{22}{7} \times 7$ — **1**

$= \frac{176}{3}$ m or 58.66 m (approx.) — ½