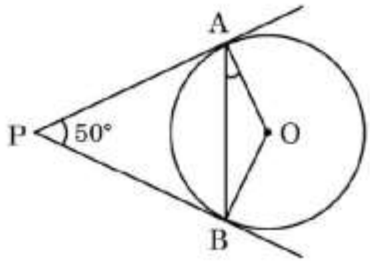
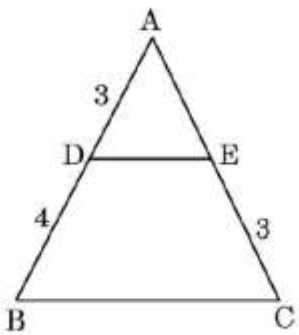
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/C/2)

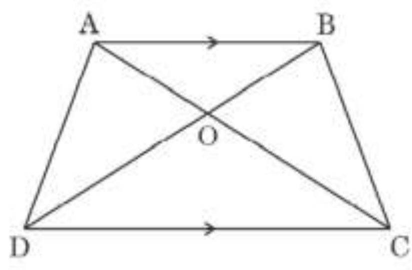
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each**	
1.	The value of k for which the quadratic equation $2x^2 - 10x + k = 0$ has real and equal roots, is : (a) $\frac{25}{2}$ (b) $\frac{1}{5}$ (c) $-\frac{5}{2}$ (d) $\frac{1}{2}$	
Sol.	(a) $\frac{25}{2}$	**1**
2.	If AB is a chord of a circle with centre at O(2, 3), where the coordinates of A and B are (4, 3) and (x, 5) respectively, then the value of x is : (a) 3 (b) 2 (c) 5 (d) 4	
Sol.	(b) 2	**1**
3.	The zeroes of the polynomial $3x^2 + 11x - 4$ are : (a) $\frac{1}{2}, -4$ (b) $\frac{1}{4}, -3$ (c) $\frac{1}{3}, -4$ (d) $\frac{1}{3}, 4$	
Sol.	(c) $\frac{1}{3}, -4$	**1**
4.	In a family of two children, the probability of having at least one girl is : (a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{3}{4}$ (d) $\frac{1}{4}$	
Sol.	(c) $\frac{3}{4}$	**1**

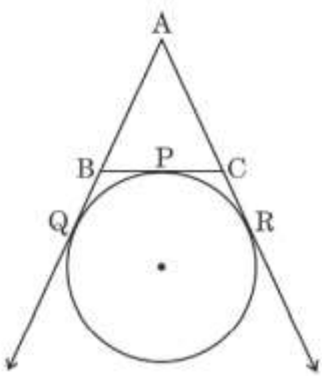
5.	The distance of the point (4, 7) from the x-axis is : (a) 7 units (b) 5 units (c) 4 units (d) 10 units	
Sol.	(a) 7 units	**1**
6.	$2\cos^2\theta\,(1+\tan^2\theta)$ is equal to : (a) 0 (b) 1 (c) 2 (d) 3	
Sol.	(c) 2	**1**
7.	Graphically, the pair of equations $-6x - 2y = 21$ and $2x - 3y + 7 = 0$ represents two lines which are : (a) intersecting exactly at one point (b) intersecting exactly at two points (c) coincident (d) parallel	
Sol.	(a) intersecting exactly at one point	**1**
8.	If a bicycle wheel makes 5000 revolutions in moving 11 km, then the diameter of the wheel is : (a) 65 cm (b) 35 cm (c) 70 cm (d) 50 cm	
Sol.	(c) 70 cm	**1**
9.	The length of the tangent drawn from a point P, whose distance from the centre of a circle is 25 cm, and the radius of the circle is 7 cm, is : (a) 22 cm (b) 24 cm (c) 25 cm (d) 28 cm	
Sol.	(b) 24 cm	**1**

10.	In the figure, PA and PB are two tangents to the circle with centre O such that $\angle APB = 50°$. Then, the measure of $\angle OAB$ is :  (a) 25° (b) 50° (c) 75° (d) 100°	
Sol.	(a) 25°	**1**
11.	OACB is a quadrant of a circle with centre O and radius 7 cm where ACB is the arc. Then the perimeter of the quadrant is : (a) 15 cm (b) 50 cm (c) 25 cm (d) 44 cm	
Sol.	(c) 25 cm	**1**
12.	If $2x,\ x + 10,\ 3x + 2$ are three consecutive terms of an A.P., then the value of x is : (a) 4 (b) 5 (c) 6 (d) 8	
Sol.	(c) 6	**1**
13.	In a single throw of two dice, the probability of getting a sum of 10 is : (a) $\frac{1}{12}$ (b) $\frac{1}{36}$ (c) $\frac{1}{6}$ (d) $\frac{1}{4}$	
Sol.	(a) $\frac{1}{12}$	**1**

14.	The height of a tower is 20 m. The length of its shadow made on the level ground when the Sun's altitude is 60°, is : (a) $\frac{20}{\sqrt{3}}$ m (b) $\frac{20}{3}$ m (c) $20\sqrt{3}$ m (d) 20 m	
Sol.	(a) $\frac{20}{\sqrt{3}}$ m	**1**
15.	In the given figure, DE ∥ BC and all measurements are given in centimetres. The length of AE is :  (a) 2 cm (b) 2·25 cm (c) 2·5 cm (d) 2·75 cm	
Sol.	(b) 2.25 cm	**1**
16.	A number is chosen from the numbers 1, 2, 3 and denoted as x, and a number is chosen from the numbers 1, 4, 9 and denoted as y. Then P(xy < 9) is : (a) $\frac{1}{9}$ (b) $\frac{3}{9}$ (c) $\frac{5}{9}$ (d) $\frac{7}{9}$	
Sol.	(c) $\frac{5}{9}$	**1**

17.	A vertical pole 10 m long casts a shadow of length 5 m on the ground. At the same time, a tower casts a shadow of length 12·5 m on the ground. The height of the tower is : (a) 20 m (b) 22 m (c) 25 m (d) 24 m	
Sol.	(c) 25 m	**1**
18.	Using empirical relationship, the mode of a distribution whose mean is 7·2 and the median 7·1, is : (a) 6·2 (b) 6·3 (c) 6·5 (d) 6·9	
Sol.	(d) 6.9	**1**
	*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.* (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the 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 fair die is thrown once. The probability of getting a prime number is $\frac{1}{2}$. *Reason (R) :* A natural number is a prime number if it has only two factors.	
Sol.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	**1**
20.	*Assertion (A) :* Two players, Sania and Ashnam play a tennis match. The probability of Sania winning the match is 0·79 and that of Ashnam winning the match is 0·21. *Reason (R) :* The sum of probabilities of two complementary events is 1.	
Sol.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	**1**

	SECTION B **This section comprises very short answer (VSA) type questions of 2 marks each.**	
21 (a).	If A(– 2, – 1), B(a, 0), C(4, b) and D(1, 2) are the vertices of a parallelogram ABCD, then find the values of a and b.	
Sol.	Coordinates of the mid-point of AC = Coordinates of the mid-point of BD $\left(\frac{-2+4}{2}, \frac{-1+b}{2}\right) = \left(\frac{a+1}{2}, \frac{0+2}{2}\right)$ $\therefore \frac{-2+4}{2} = \frac{a+1}{2} \quad \Rightarrow a = 1$ and $\frac{-1+b}{2} = \frac{0+2}{2} \quad \Rightarrow b = 3$	**1** ½ ½
	OR	
21 (b).	The three vertices of a parallelogram ABCD, taken in order, are A(– 1, 0), B(3, 1) and C(2, 2). Find the coordinates of the fourth vertex D.	
Sol.	Let the coordinates of fourth vertex D be (x, y) Coordinates of the mid-point of AC = Coordinates of the mid-point of BD $\left(\frac{-1+2}{2}, \frac{0+2}{2}\right) = \left(\frac{3+x}{2}, \frac{1+y}{2}\right)$ $\therefore \frac{-1+2}{2} = \frac{3+x}{2} \quad \Rightarrow x = -2$ and $\frac{0+2}{2} = \frac{1+y}{2} \quad \Rightarrow y = 1$	**1** ½ ½
22.	In the given figure, $\frac{AO}{OC} = \frac{BO}{OD} = \frac{1}{2}$ and AB = 5 cm. Find the length of DC.  	
Sol.	In ΔAOB and ΔCOD $\frac{AO}{OC} = \frac{BO}{OD}$ (Given) ∠AOB =∠COD (V.O.A.) ∴ ΔAOB ~ ΔCOD (SAS rule)	 **1**

	$\frac{AO}{OC} = \frac{AB}{CD}$ (C.P.S.T.) $\frac{1}{2} = \frac{5}{CD}$ $\Rightarrow$CD = 10 cm	**1**
23 (a).	If $\sqrt{2}$ is given as an irrational number, then prove that $(5 - 2\sqrt{2})$ is an irrational number.	
Sol.	Let us assume that $5 - 2\sqrt{2}$ be a rational number. $\therefore 5 - 2\sqrt{2} = \frac{p}{q}$, where p and q are integers and $q \neq 0$. $\Rightarrow \sqrt{2} = \frac{5q - p}{2q}$ RHS is a rational number. So, LHS is also a rational number which contradict the given fact that $\sqrt{2}$ is an irrational number. So, our assumption is wrong. Hence, $5 - 2\sqrt{2}$ is an irrational number.	**1** ½ ½
	OR	
23 (b).	Check whether 6^n can end with the digit 0 for any natural number n.	
Sol.	If the number 6^n ends with the digit 0, then it should be divisible by 2 and 5. But prime factorisation of 6^n is $(2 \times 3)^n$. $\therefore$ Prime factorisation of 6^n does not contain prime number 5. Hence, 6^n can't end with the digit 0.	**1** **1**
24.	A circle is touching the side BC of a Δ ABC at the point P and touching AB and AC produced at points Q and R respectively. Prove that AQ = $\frac{1}{2}$ (Perimeter of Δ ABC). 	

Sol.	Perimeter of Δ ABC = AB + BC + CA = AB + BP + CP + CA = AB + BQ + CR + CA [BP = BQ ; CP = CR] = AQ + AR = AQ + AQ [AQ = AR] = 2 AQ $\therefore$ AQ = $\frac{1}{2}$ (Perimeter of Δ ABC)	½ ½ ½ ½
25.	Find the ratio in which the point (– 1, k) divides the line segment joining the points (– 3, 10) and (6, – 8). Hence, find the value of k.	
Sol.	Let C (– 1, k) be divides the line segment joining the points A (– 3, 10) and B (6, – 8) in the ratio m : 1. Using section formula $-1 = \frac{-3+6m}{m+1}$ $\Rightarrow m = \frac{2}{7}$ Hence, required ratio is 2 : 7 $k = \frac{10\times7-8\times2}{2+7} = 6$	 **1** **1**
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26.	State and prove Basic Proportionality theorem.	
Sol.	Correct statement of Basic Proportionality Correct figure, given, to prove and construction Correct proof	½ **1** **1½**
27 (a).	Find the sum of all integers between 50 and 500, which are divisible by 7.	
Sol.	56, 63, …, 497 Here a = 56 and d = 7 Let a_n = 497 $\Rightarrow$ 56 + (n – 1) × 7 = 497 $\Rightarrow$ n = 64 $S_{64} = \frac{64}{2} \times (56 + 497) = 17696$	**1** ½ ½ **1**
	OR	

27 (b).	How many numbers lie between 10 and 300, which when divided by 4 leave a remainder 3 ? Also, find their sum.	
Sol.	11, 15, …, 299 Here a = 11 and d = 4 Let $a_n = 299$ $\Rightarrow$ 11 + (n – 1) × 4 = 299 $\Rightarrow$ n = 73 $S_{73} = \frac{73}{2} \times (11 + 299) = 11315$	**1** ½ ½ **1**
28.	Sum of the areas of two squares is 468 m^2. If the difference of their perimeters is 24 m, find the lengths of the sides of the two squares.	
Sol.	Let the lengths of the sides of the two squares be 'x' m and 'y' m s.t. x > y A.T.Q. $x^2 + y^2 = 468$ ----- (1) 4x – 4y = 24 $\Rightarrow$ x – y = 6 -----(2) From (1) and (2), we get $y^2 + 6y - 216 = 0$ $\Rightarrow$ y = 12 and y = – 18 But side of a square is always positive, So, y = 12 and x = 18 Hence, the lengths of the sides of two squares are 12 m and 18 m.	 ½ ½ **1** $\left.\begin{matrix}\\ \\ \end{matrix}\right\}$ **1**
29.	Two water taps together can fill a tank in $3\frac{1}{3}$ hours. The tap of larger diameter takes 5 hours less than the smaller one to fill the tank separately. Find the time in which each tap can fill the tank separately.	
Sol.	Let the time taken by the tap of smaller diameter to fill the tank separately be 'x' hours and the time taken by the tap of larger diameter to fill the tank separately be (x – 5) hours. A.T.Q. $$\frac{1}{x} + \frac{1}{x-5} = \frac{3}{10}$$ $\Rightarrow 3x^2 - 35x + 50 = 0$ $\Rightarrow (x - 10)(3x - 5) = 0$ $\Rightarrow x = 10 \text{ or } x = \frac{5}{3}$ But $x = \frac{5}{3}$ is not possible, so x = 10	 **1** **1** ½

	∴ time taken by the tap of smaller diameter to fill the tank separately is 10 hours and time taken by the tap of larger diameter to fill the tank separately is $10 - 5 = 5$ hours	½
30 (a).	Find the area of the minor and the major sectors of a circle with radius 6 cm, if the angle subtended by the minor arc at the centre is 60°. (Use $\pi = 3{\cdot}14$)	
Sol.	Area of minor sector = $\frac{3.14 \times (6)^2 \times 60^\circ}{360^\circ}$ $= 18.84$ Hence, area of minor segment is 18.84 cm^2 Area of major sector = Area of circle – Area of minor sector $= 3.14 \times (6)^2 - 18.84$ $= 94.2$ Hence, area of major segment is 94.2 cm^2	**1** ½ **1** ½
	OR	
30 (b).	If a chord of a circle of radius 10 cm subtends an angle of 60° at the centre of the circle, find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)	
Sol.	Area of minor segment = $\frac{3.14 \times (10)^2 \times 60^\circ}{360^\circ} - \frac{1}{2} \times (10)^2 \times \frac{\sqrt{3}}{2}$ $= \frac{314}{6} - \frac{173}{4}$ $= 9\frac{1}{12}$ or 9.08 Hence, area of minor segment is 9.08 cm^2.	**2** ½ ½
31.	In a Δ ABC, ∠ A = x°, ∠ B = (3x – 2)° and ∠ C = y°. Also, ∠ C – ∠ B = 9°. Determine the three angles of the triangle.	
Sol.	∠A + ∠B + ∠C = 180° ∴ x + (3x – 2) + y = 180 ⟹ 4x + y = 182 ----- 1 Given, ∠C – ∠B = 9° ∴ y – (3x – 2) = 9 ⟹ y – 3x = 7 ----- 2 Solving 1 and 2, we get x = 25 and y = 82 Hence, ∠A = 25° , ∠B = (3 × 25 – 2)° = 73° and ∠C = 82°	 **1** ½ **1** ½

SECTION D

This section comprises of Long Answer (LA) type questions of 5 marks each.

32. A survey regarding the heights (in cm) of 50 girls of class X of a school was conducted and the following data was obtained :

Height (in cm)	Number of girls
120 – 130	2
130 – 140	8
140 – 150	12
150 – 160	20
160 – 170	8
Total	50

Find the mean and mode of the above data.

Sol.

Height (in cm)	No. of girls	x_i	u_i	f_iu_i
120 – 130	2	125	– 2	– 4
130 – 140	8	135	– 1	– 8
140 – 150	12	145 = a	0	0
150 – 160	20	155	1	20
160 – 170	8	165	2	16
Total	50			24

Correct table **1½**

Mean = $145 + \frac{24}{50} \times 10$ **1**

$= 149.8$ **½**

∴ mean height is 149.8 cm

Modal class is 150 – 160 **½**

Mode = $150 + \frac{(20-12)}{(2\times20-12-8)} \times 10$ **1**

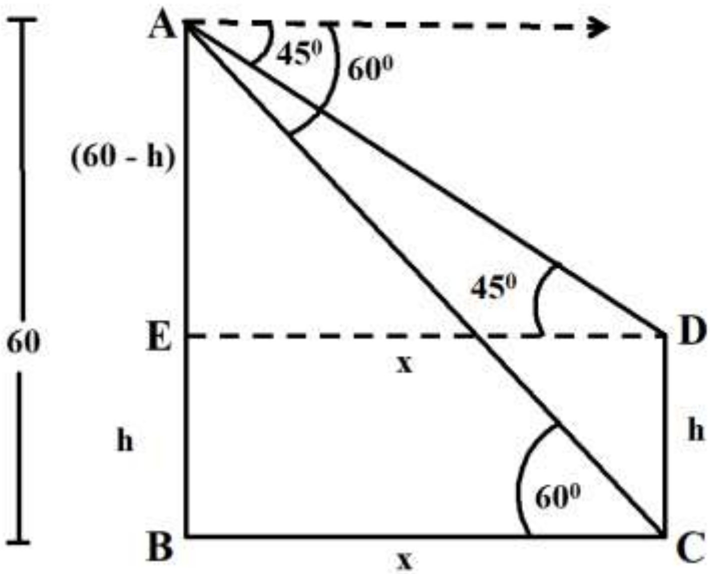
$= 154$ **½**

∴ modal height is 154 cm

33 (a).	A tent is in the shape of a right circular cylinder up to a height of 3 m and then a right circular cone, with a maximum height of 13·5 m above the ground. Calculate the cost of painting the inner side of the tent at the rate of ₹ 2 per square metre, if the radius of the base is 14 m.	
Sol.	Height of conical part = 13.5 – 3 = 10.5 m Slant height = $\sqrt{(14)^2 + (10.5)^2}$ = 17.5 m SA of tent = CSA of conical part + CSA of cylindrical part $= \left(\frac{22}{7} \times 14 \times 17.5\right) + \left(2 \times \frac{22}{7} \times 14 \times 3\right)$ = 1034 m^2 Cost of painting @ ₹ 2 per m^2 = 1034 × 2 = ₹ 2068	½ 1 2 ½ 1
	OR	
33 (b).	A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere of same radius. If the radius of the hemisphere is 4·2 cm and the total height of the toy is 10·2 cm, find the volume of the wooden toy. Also, find the total surface area of the toy.	
Sol.	Height of conical part = 10.2 – 4.2 = 6 cm Volume of toy = Volume of conical part + Volume of hemispherical part $= \left(\frac{1}{3} \times \frac{22}{7} \times (4.2)^2 \times 6\right) + \left(\frac{2}{3} \times \frac{22}{7} \times (4.2)^3\right)$ = 266.112 Hence, Volume of toy is 266.112 cm^3 Slant height of conical part = $\sqrt{(4.2)^2 + (6)^2} \approx 7.32$ cm TSA of the toy = CSA of hemispherical part + CSA of conical part $= \left(2 \times \frac{22}{7} \times (4.2)^2\right) + \left(\frac{22}{7} \times 4.2 \times 7.32\right)$ = 207.504 Hence, TSA of toy is 207.504 cm^2	½ **1** **1** **1** **1** ½

34. From the top of a 60 m high building, the angles of depression of the top and bottom of a cable tower are observed to be 45° and 60° respectively. Find the height of the tower. (Use $\sqrt{3} = 1{\cdot}73$)

Sol. Correct figure **2**



Let height of the tower be 'h' m and ED = BC = 'x' m

In Δ AED

$\frac{60-h}{x} = \tan 45° = 1$

$\Rightarrow 60 - h = x$ ------ ① ½

In Δ ABC

$\frac{60}{x} = \tan 60° = \sqrt{3}$

$\Rightarrow 60 = \sqrt{3}\,x$ ½

$\Rightarrow 60 = \sqrt{3}\,(60 - h)$

$\Rightarrow h = \frac{60\,(\sqrt{3}-1)}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ **1**

$\Rightarrow h = 20\,(3 - \sqrt{3})$

$\Rightarrow h = 20\,(3 - 1.73)$ ½

$\Rightarrow h = 25.4$ ½

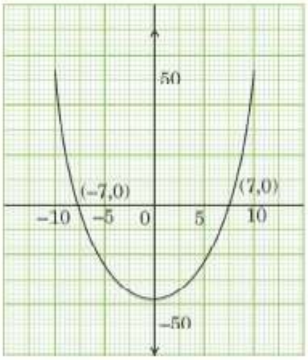
Hence, height of the tower is 25.4 m.

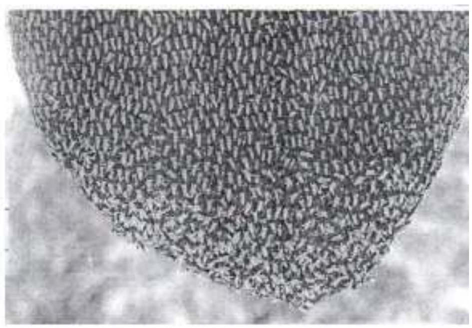
35 (a).	Prove that : $$\frac{1+\sin\theta}{1-\sin\theta}-\frac{1-\sin\theta}{1+\sin\theta}=4\tan\theta\sec\theta$$	
Sol.	LHS $= \frac{(1+\sin\theta)^2-(1-\sin\theta)^2}{(1+\sin\theta)\,(1-\sin\theta)}$ $= \frac{4\sin\theta}{1-sin^2\theta}$ $= \frac{4\sin\theta}{cos^2\theta}$ $= 4\tan\theta\sec\theta$ = RHS	**2** **1** **1** **1**
	OR	
35 (b).	Evaluate : $$\frac{\tan^2 60^\circ + 4\sin^2 45^\circ + 3\sec^2 60^\circ + 5\cos^2 90^\circ}{\text{cosec } 30^\circ + \sec 60^\circ - \cot^2 30^\circ}$$	
Sol.	$\frac{(\sqrt{3})^2+4\left(\frac{1}{\sqrt{2}}\right)^2+3(2)^2+5(0)^2}{2+2-(\sqrt{3})^2}$ $= \frac{3+2+12+0}{4-3}$ $= 17$	**3** **1** **1**
	SECTION E **This section comprises of 3 case-study based questions of 4 marks each.**	

36.	February 14 is celebrated as International Book Giving Day and many countries in the world celebrate this day. Some people in India also started celebrating this day and donated the following number of books of various subjects to a public library : History = 96, Science = 240, Mathematics = 336. These books have to be arranged in minimum number of stacks such that each stack contains books of only one subject and the number of books on each stack is the same. Based on the above information, answer the following questions : (i) How many books are arranged in each stack ? (ii) How many stacks are used to arrange all the Mathematics books ? (iii) (a) Determine the total number of stacks that will be used for arranging all the books. **OR** (iii) (b) If the thickness of each book of History, Science and Mathematics is 1·8 cm, 2·2 cm and 2·5 cm respectively, then find the height of each stack of History, Science and Mathematics books.	
Sol.	(i) HCF (96, 240, 336) = 48 (ii) Number of stacks = $\frac{336}{48} = 7$ (iii) (a) Total number of stacks = $\frac{96}{48} + \frac{240}{48} + \frac{336}{48}$ $= 14$ OR (b) Height of each stack of History = $48 \times 1.8 = 86.4$ cm Height of each stack of Science = $48 \times 2.2 = 105.6$ cm Height of each stack of Mathematics = $48 \times 2.5 = 120$ cm	**1** **1** **1** **1** **1 mark for 1 correct answer, 1½ mark for two correct answer and 2 marks for all correct answers.**

37.

While playing in a garden, Samaira saw a honeycomb and asked her mother what is that. Her mother replied that it's a honeycomb made by honey bees to store honey. Also, she told her that the shape of the honeycomb formed is a mathematical structure. The mathematical representation of the honeycomb is shown in the graph.





Based on the above information, answer the following questions :

(i) How many zeroes are there for the polynomial represented by the graph given ?

(ii) Write the zeroes of the polynomial.

(iii) (a) If the zeroes of a polynomial $x^2 + (a + 1)x + b$ are 2 and – 3, then determine the values of a and b.

OR

(iii) (b) If the square of difference of the zeroes of the polynomial $x^2 + px + 45$ is 144, then find the value of p.

Sol.

(i) Two — **1**

(ii) 7 and – 7 — **1**

(iii) (a) $-(a + 1) = 2 + (-3) \Rightarrow a = 0$ — **1**

$b = 2 \times (-3) \Rightarrow b = -6$ — **1**

OR

(b) Let α and β be the zeroes of given polynomial

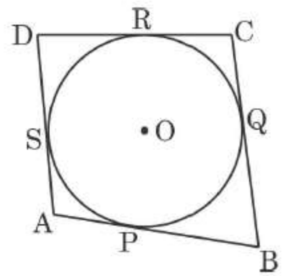
Here, $\alpha + \beta = -p$ and $\alpha\beta = 45$ — ½

$(\alpha - \beta)^2 = 144$ — ½

$\Rightarrow (\alpha + \beta)^2 - 4\alpha\beta = 144$

$\Rightarrow (-p)^2 - 4 \times 45 = 144$ — ½

$\Rightarrow p = \pm 18$ — ½

38.	In a park, four poles are standing at positions A, B, C and D around the circular fountain such that the cloth joining the poles AB, BC, CD and DA touches the circular fountain at P, Q, R and S respectively as shown in the figure.  Based on the above information, answer the following questions : (i) If O is the centre of the circular fountain, then $\angle$ OSA = ... (ii) If AB = AD, then write the name of the figure ABCD. (iii) (a) If DR = 7 cm and AD = 11 cm, then find the length of AP. **OR** (iii) (b) If O is the centre of the circular fountain with $\angle$ QCR = 60°, then find the measure of $\angle$ QOR.	
Sol.	(i) 90° (ii) AB + DC = BC + DA Given, AB = AD $\Rightarrow$ BC = DC So, ABCD is a Kite (iii) (a) DS = DR = 7 cm AD = 11 cm 7 + SA = 11 $\Rightarrow$ SA = 4 cm $\therefore$ AP = SA = 4 cm OR (b) $\angle$QOR = 180° – 60° = **120°**	**1** **1** **½** **½** **½** **½** **1** **1**