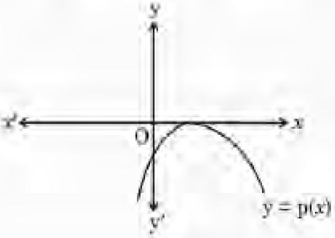
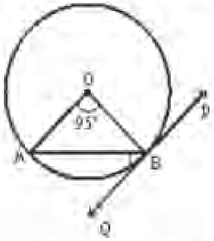
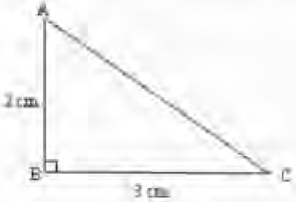
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/1/1)

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 graph of $y = p(x)$ is given, for a polynomial $p(x)$. The number of zeroes of p(x) from the graph is (A) 3 (B) 1 (C) 2 (D) 0 	
Sol.	(B) 1	1
2.	The value of k for which the pair of equations $kx = y + 2$ and $6x = 2y + 3$ has infinitely many solutions, (A) is $k = 3$ (B) does not exist (C) is $k = -3$ (D) is $k = 4$	
Sol.	(B) does not exist	1
3.	If $p - 1$, $p + 1$ and $2p + 3$ are in A.P., then the value of p is (A) -2 (B) 4 (C) 0 (D) 2	
Sol.	(C) 0	1
4.	In what ratio, does x-axis divide the line segment joining the points $A(3,6)$ and $b(-12,-3)$? (A) 1:2 (B) 1:4 (C) 4:1 (D) 2:1	

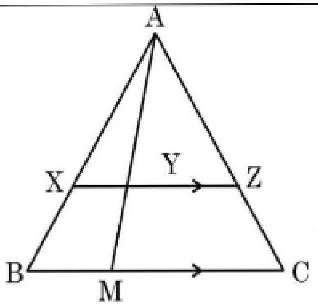
Sol.	(D) 2 : 1	1
5.	In the given figure, PQ is tangent to the circle centred at O. If $\angle AOB = 95^\circ$, then the measure of $\angle ABQ$ will be  (A) 47.5° (B) 42.5° (C) 85° (D) 95°	
Sol.	(A) 47.5°	1
6.	If $2\tan A = 3$, then the value of $\frac{4\sin A + 3\cos A}{4\sin A - 3\cos A}$ is (A) $\frac{7}{\sqrt{13}}$ (B) $\frac{1}{\sqrt{13}}$ (C) 3 (D) does not exist	
Sol.	(C) 3	1
7.	If α, β are the zeroes of a polynomial $p(x) = x^2 + x - 1$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ equals to (A) 1 (B) 2 (C) -1 (D) $\frac{-1}{2}$	
Sol.	(A) 1	1
8.	The least positive value of k, for which the quadratic equation $2x^2 + kx - 4 = 0$ has rational roots, is (A) $\pm 2\sqrt{2}$ (B) 2 (C) ± 2 (D) $\sqrt{2}$	
Sol.	(B) 2	1
9.	$\left[\frac{3}{4}\tan^2 30^0 - \sec^2 45^0 + \sin^2 60^0\right]$ is equal to (A) -1 (B) $\frac{5}{6}$ (C) $\frac{-3}{2}$ (D) $\frac{1}{6}$	
Sol.	(A) -1	1

<table>
<tr><td>10.</td><td>Curved surface area of a cylinder of height 5 cm is 94.2 cm^2. Radius of the cylinder is (Take $\pi = 3.14$)
(A) 2 cm (B) 3 cm (C) 2.9 cm (D) 6 cm</td><td></td></tr>
<tr><td>Sol.</td><td>(B) 3</td><td>1</td></tr>
<tr><td>11.</td><td>The distribution below gives the marks obtained by 80 students on a test :
<table>
<tr><td>Marks</td><td>Less than 10</td><td>Less than 20</td><td>Less than 30</td><td>Less than 40</td><td>Less than 50</td><td>Less than 60</td></tr>
<tr><td>Number of Students</td><td>3</td><td>12</td><td>27</td><td>57</td><td>75</td><td>80</td></tr>
</table>
The modal class of this distribution is :
(A) 10-20 (B) 20-30
(C) 30-40 (D) 50-60</td><td></td></tr>
<tr><td>Sol.</td><td>(C) 30 – 40</td><td>1</td></tr>
<tr><td>12.</td><td>The curved surface area of a cone having height 24 cm and radius 7 cm. is
(A) 528 cm^2 (B) 1056 cm^2 (C) 550 cm^2 (D) 500 cm^2</td><td></td></tr>
<tr><td>Sol.</td><td>(C)550cm^2</td><td>1</td></tr>
<tr><td>13.</td><td>The distance between the points $(0,2\sqrt{5})$ and $(-2\sqrt{5},0)$ is
(A) $2\sqrt{10}$ units (B) $4\sqrt{10}$units (C) $2\sqrt{20}$ units (D) 0</td><td></td></tr>
<tr><td>Sol.</td><td>(A) $2\sqrt{10}$ units</td><td>1</td></tr>
<tr><td>14.</td><td>Which of the following is a quadratic polynomial having zeroes $\frac{-2}{3}$ and $\frac{2}{3}$?
(A) $4x^2-9$ (B) $\frac{4}{9}(9x^2+4)$ (C) $x^2+\frac{9}{4}$ (D) $5(9x^2-4)$</td><td></td></tr>
<tr><td>Sol.</td><td>(D) $5\,(9x^2-4)$</td><td>1</td></tr>
<tr><td>15.</td><td>If the value of each observation of a statistical data is increased by 3, then the mean of the data
(A) remains unchanged (B) increases by 3
(C) increases by 6 (D) increases by 3n</td><td></td></tr>
<tr><td>Sol.</td><td>(B) increases by 3</td><td>1</td></tr>
</table>

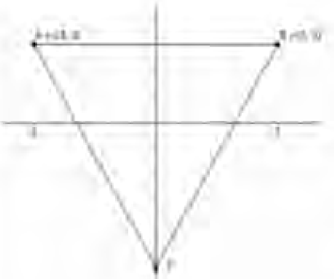
16.	Probability of happening of an event is denoted by p and probability of non-happening of the event is denoted by q. Relation between p and q is (A) $p+q=1$ (B) $p=1, q=1$ (C) $p=q-1$ (D) $p+q+1=0$	
Sol.	(A) **p** + q = 1	1
17.	A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought? (A) 40 (B) 240 (C) 480 (D) 750	
Sol.	(C) 480	1
18.	In a group of 20 people, 5 can't swim. If one person is selected at random, then the probability that he/she can swim, is (A) $\frac{3}{4}$ (B) $\frac{1}{3}$ (C) 1 (D) $\frac{1}{4}$	
Sol.	(A) 3/4	1
	Assertion-Reason Type Questions In Question **19** and **20**, an **Assertion (A)** statement is followed by a statement of **Reason (R)**. Select the correct option out of the following : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the 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): Point $P\ (0,\ 2)$ is the point of intersection of y-axis with the line $3x + 2y = 4$. Reason (R): The distance of point $P\ (0,\ 2)$ from x-axis is 2 units.	
Sol.	(B) Both Assertion (A) and Reason (R) are correct but Reason (R) is not the correct explanation of Assertion (A)	1

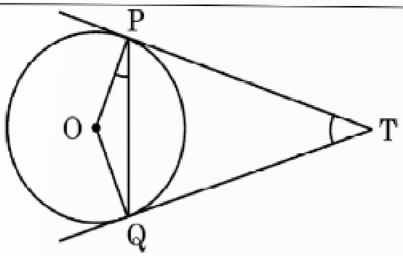
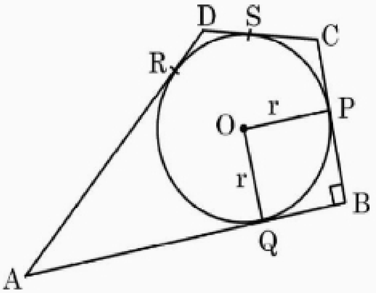
20.	Assertion (A): The perimeter of ΔABC is a rational number. Reason (R): The sum of the squares of two rational numbers is always rational. 	
Sol.	(D) Assertion (A) is false but Reason (R) is true	1

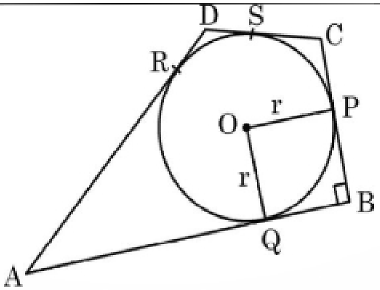
	SECTION B This section comprises of Very Short Answer (VSA) type questions of 2 marks each.	
21(a).	Solve the pair of equations $x = 3$ and $y = -4$ graphically.	
Sol.	Correct graph of both the equations. Solution of equation is x = 3, y = – 4	1 1
	OR	
21(b).	Using graphical method, find whether following system of linear equations is consistent or not: $x = 0$ and $y = -7$	
Sol.	Correct graph of y = – 7 and x = 0 As y = – 7 is intersecting x = 0 at (0, – 7) So, system of equations is consistent	1 1
22.	In the given figure, XZ is parallel to BC. AZ = 3 cm, ZC = 2 cm, BM =3 cm and MC = 5 cm. Find the length of XY.	

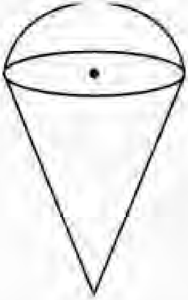
		
Sol.	As $XZ \parallel BC$ Therefore $\frac{AX}{XB} = \frac{3}{2} = \frac{AZ}{ZC}$ – (i) Δ AXY ~ Δ ABM $\Rightarrow \frac{AX}{AB} = \frac{XY}{BM}$ or $\frac{3}{5} = \frac{XY}{3}$ $\Rightarrow XY = \frac{9}{5}$ or 1·8 cm	½ ½ ½ ½
23(a).	If $sin\theta + cos\theta = \sqrt{3}$, then find the value of $sin\theta \cdot cos\theta$.	
Sol.	sin θ + cos θ = $\sqrt{3}$ squaring both sides $\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow 1 + 2\sin\theta\cos\theta = 3$ $\Rightarrow \sin\theta\cos\theta = 1$	1 ½ ½
	OR	
23(b).	If $\sin\alpha = \frac{1}{\sqrt{2}}$ and $\cot\beta = \sqrt{3}$, then find the value of coseca+ cosecβ	

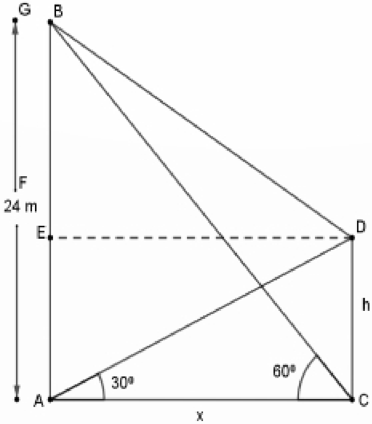
Sol.	$\text{cosec}\ \alpha = \dfrac{1}{\sin\ \alpha} = \sqrt{2}$ $\text{cosec}\ \beta = \sqrt{1+\cot^2\beta} = \sqrt{1+3} = 2$ $\therefore\ \text{cosec}\ \alpha - \text{cosec}\ \beta = \sqrt{2} + 2 \text{ or } \sqrt{2}\ (\sqrt{2} + 1)$	½ 1 ½
24.	Find the greatest number which divides 85 and 72 leaving remainders 1 and 2 respectively.	
Sol.	We have to find HCF of 85 – 1 = 84 and 72 – 2 = 70. HCF of 84 and 70 = 14	1 1
25.	A bag contains 4 red, 3 blue and 2 yellow balls. One ball is drawn at random from the bag. Find the probability that drawn ball is (i) red (ii) yellow.	
Sol.	Total No of Balls=9 (i) P(drawn ball is red) = $\dfrac{4}{9}$ (ii) P(drawn ball is yellow) = $\dfrac{2}{9}$	1 1
	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.	Half of the difference between two numbers is 2. The sum of the greater number and twice the smaller number is 13. Find the numbers.	
Sol.	Let the numbers be x and y, x > y Therefore $\dfrac{1}{2}\ (x - y) = 2$ — (i) and $2y + x = 13$ — (ii) Solving equations (i) and (ii) $x = 7, y = 3$	1 1 1

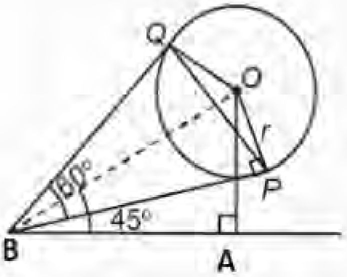
27.	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where $q \neq 0$ and let p & q be co-primes. $5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5 $\Rightarrow p = 5a$, where 'a' is some integer ----- (i) $25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 $\Rightarrow q = 5b$, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{5}$ is an irrational number.	½ 1 ½ 1
28.	If (−5,3) and (5,3) are two vertices of an equilateral triangle, then find coordinates of the third vertex, given that origin lies inside the triangle. (Take $\sqrt{3} = 1.7$)	
Sol.	 Let the third vertex be (x,y) A (-5,3) B(5,3) C(x,y) AB=10=AC $AC^2=100$ $(-5-x)^2+(3-y)^2 = (5-x)^2+(3-y)^2$ $20x = 0$ $x=0$ $(3-y)^2=75$ $3-y = \pm 5\sqrt{3}$ $y=3-5\sqrt{3}$ $y= -5.5$ The coordinates of the third vertex are (0,-5.5)	1 1 ½ ½
29(a).	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$.	

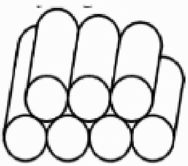
		
Sol.	TP = TQ	
	⇒ $\angle$ TPQ = $\angle$ TQP	1
	Let $\angle$ PTQ be θ	
	⇒ $\angle$ TPQ = $\angle$ TQP = $\frac{180^\circ - \theta}{2} = 90^\circ - \frac{\theta}{2}$	1
	Now $\angle$ OPT = 90°	
	⇒ $\angle OPQ = 90^\circ - (90^\circ - \frac{\theta}{2}) = \frac{\theta}{2}$	
	$\angle$ PTQ = 2 $\angle$ OPQ	1
	OR	
29(b).	In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90^0$. If AD=17 cm, AB = 20 cm and DS = 3 cm, then find the radius of the circle. 	

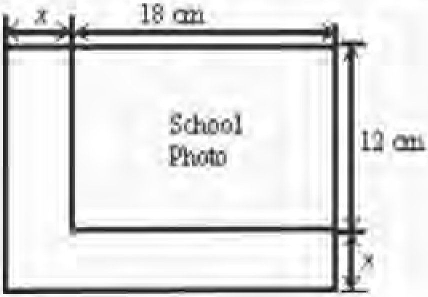
Sol.		
	DR = DS = 3 cm	½
	∴ AR = AD – DR = 17 – 3 = 14 cm	1
	⇒ AQ = AR = 14 cm	½
	∴ QB = AB – AQ = 20 – 14 = 6 cm	½
	Since QB = OP = r ∴ radius = 6 cm	½
30.	Prove that: $\frac{\tan\theta+\sec\theta-1}{\tan\theta-\sec\theta+1}=\frac{1+\sin\theta}{\cos\theta}$	
Sol.	LHS= $\frac{(\tan\ \theta+\sec\ \theta)-(\sec^2\theta-\tan^2\theta)}{\tan\ \theta-\sec\ \theta+1}$	1
	$=\frac{(\tan\ \theta+\sec\ \theta)\ (1-\sec\ \theta+\tan\ \theta)}{\tan\ \theta-\sec\ \theta+1}$	**1**
	$=\tan\theta+\sec\theta$	½
	$=\frac{1+\sin\ \theta}{\cos\ \theta}$ = RHS	½
31(a).	A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\frac{1408}{21}\right)m^3$ of air. Take $\left(\pi=\frac{22}{7}\right)$	

Sol.	Let h be height of cylindrical part and r be radius of hemisphere Volume of room $= 2\pi r^3 + \frac{2}{3}\pi r^3 = \frac{1408}{21}$ $\Rightarrow r = 2$ Therefore, h=4 Height of the room is = 6m	½ 1 ½ ½ ½
	OR	
31(b).	An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\frac{1}{6}\right)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$) 	
Sol.	Volume of the cone = $= \frac{1}{3}\times\pi\times9\times12 = 36\pi cm^3$ Volume of ice-cream in the cone $= \frac{5}{6}\times 36\times\pi = 30\pi cm^3$ Volume of ice-cream on top $= \frac{2}{3}\times 27\times\pi = 18\pi cm^3$ Total volume of the ice-cream $= (30\pi + 18\pi) = 48\pi cm^3$ $= 48\times3.14 = 150.72 cm^3$	1 ½ 1 ½
	SECTION D This section comprises of Long Answer (LA) type questions of 5 marks each.	

32.	If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, prove that the other two sides are divided in the same ratio.	
Sol.	Correct Given, to prove, figure, construction Correct proof	2 3
33(a).	The angle of elevation of the top of a tower 24 m high from the foot of another tower in the same plane is 60^0. The angle of elevation of the top of second tower from the foot of the first tower is 30^0. Find the distance between two towers and the height of the other tower. Also, find the length of the wire attached to the tops of both the towers.	
Sol.		1 mark for correct figure
	Let AB and CD be the given towers.	
	$\tan 30° = \frac{1}{\sqrt{3}} = \frac{h}{x} \Rightarrow x = h\sqrt{3}$ __ (i)	1
	$\tan 60° = \sqrt{3} = \frac{24}{x} \Rightarrow x = \frac{24}{\sqrt{3}}$ or $8\sqrt{3}$ __ (ii)	1
	using (i) and (ii)	
	$x = 8\sqrt{3}$ and $h = 8$	$\frac{1}{2}+\frac{1}{2}$
	length of wire = $\sqrt{BE^2 + x^2} = \sqrt{256 + 192} = \sqrt{448}$ m = $8\sqrt{7}$ m	1

	OR	
33(b).	A spherical balloon of radius r subtends an angle of 60^0 at the eye of an observer. If the angle of elevation of its centre is 45^0 from the same point, then prove that height of the centre of the balloon is $\sqrt{2}$ times its radius.	
Sol.	 Let Point B represents observer. $\therefore\ \angle QBP = 60°; \angle ABO = 45°$ Using geometry $\angle PBO = \frac{1}{2}\times 60° = 30°$ Now, $\frac{r}{OB} = \sin 30° = \frac{1}{2} \Rightarrow OB = 2r$ — (i) Also $\frac{OA}{OB} = \sin 45° = \frac{1}{\sqrt{2}} \Rightarrow OB = OA\ \sqrt{2}$ (ii) Using (i) and (ii) $OA = \sqrt{2}\ r$ or height of center of balloon = $\sqrt{2}$ r units	1 mark for correct figure 1 1 1 1
34.	A chord of a circle of radius 14 cm subtends an angle of 60^0 at the centre. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle.	
Sol.	Area of minor segment $= \frac{22}{7}\times 14\times 14\times \frac{60}{360} - \frac{1}{2}\times 14\times 14\times \frac{\sqrt{3}}{2}$ $= \left(\frac{308}{3} - 49\sqrt{3}\right) cm^2$ or $17.9 cm^2$	1+1 1

	Area of major segment $= \frac{22}{7} \times 14 \times 14 - \left(\frac{308}{3} - 49\sqrt{3}\right)$ $= 616 - \frac{308}{3} + 49\sqrt{3}$ $= \left(\frac{1540}{3} + 49\sqrt{3}\right) cm^2$ or 598.1cm^2	1 1
35(a).	The ratio of the 11th term to 17th term of an A.P. is 3:4. Find the ratio of 5th term to 21st term of the same A.P. Also, find the ratio of the sum of first 5 terms to that of first 21 terms.	
Sol.	Given $\frac{a+10d}{a+16d} = \frac{3}{4}$ $\Rightarrow 4a + 40d = 3a + 48d$ $\Rightarrow a = 8d$ (i) therefore $\frac{a_5}{a_{21}} = \frac{a+4d}{a+20d} = \frac{3}{7}$ using(i) $a_5 : a_{21} = 3 : 7$ $\frac{s_5}{s_{21}} = \frac{\frac{5}{2}(2a+4d)}{\frac{21}{2}(2a+20d)} = \frac{5 \times 20d}{21 \times 36d} = \frac{25}{189}$ Therefore, S_5:S_{21}=25:189	1 1 1 2
	OR	
35(b).	250 logs are stacked in the following manner: 22 logs in the bottom row, 21 in the next row, 20 in the row next to it and so on (as shown by an example). In how many rows, are the 250 logs placed and how many logs are there in the top row?  (Example)	
Sol.	Let the number of rows be n. A.P. formed is 22, 21, 20, 19, ...	

	Here $a = 22, d = -1$ $Sn = 250$	1
	$\therefore\ 250 = \frac{n}{2}[44 + (n-1)(-1)]$	1
	$\Rightarrow n^2 - 45n + 500 = 0$	1
	$\Rightarrow (n-25)(n-20) = 0$	
	$n \neq 25 \therefore n = 20$	1
	logs in top row $= a_{20} = 22 - 19(-1) = 3$	1
	SECTION E This section comprises of 3 case-study based questions of 4 marks each.	
36.	While designing the school year book, a teacher asked the student that the length and width of a particular photo is increased by x units each to double the area of the photo. The original photo is 18 cm long and 12 cm wide. Based on the above information, answer the following questions: (I) Write an algebraic equation depicting the above information. (II) Write the corresponding quadratic equation in standard form. (III) What should be the new dimensions of the enlarged photo?  OR Can any rational value of x make the new area equal to $220cm^2$	
Sol.	(i) $(18 + x)(12 + x) = 2(18 \times 12)$	1
	(ii) $x^2 + 30x - 216 = 0$	1
	(iii) Solving : $x^2 + 30x - 216 = 0$	
	$\Rightarrow (x + 36)(x - 6) = 0$ $x \neq -36 \therefore \Rightarrow x = 6.$	1
	new dimensions are 24 cm × 18 cm	1

OR

(iii) If (18 + x) (12 + x) = 220

then $x^2 + 30x - 4 = 0$ 1

Here D = 900 + 16 = 916 which is not a perfect square. 1

Thus we can't have any such rational value of x.

37. India meteorological department observes seasonal and annual rainfall every year in different sub-divisions of our country.

It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018:

Rainfall (mm)	Number of Sub-divisions
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400 -1600	1
1600-1800	1

Based on the above information, answer the following questions:

(I) Write the modal class.

(II) Find the median of the given data.

OR

(II) Find the mean rainfall in this season.

(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall?

Sol. (i) Modal Class is 600-800 1

(ii) $\frac{N}{2} = 12$, median class is 600 – 800 ½

Rainfall	x_i	f_i	cf.
200 – 400	300	2	2
400 – 600	500	4	6
600 – 800	700	7	13
800 – 1000	900	4	17
1000 – 1200	1100	2	19
1200 – 1400	1300	3	22
1400 – 1600	1500	1	23
1600 – 1800	1700	1	24
		24	

½ for correct table

$$\text{Median} = 600 + \frac{200}{7}\,(12 - 6)$$

$$= \frac{5400}{7} \text{ or } 771{\cdot}4$$

1

OR

(ii)

Rainfall	x_i	f_i	f_ix_i
200 – 400	300	2	600
400 – 600	500	4	2000

600 – 800	700	7	4900
800 – 1000	900	4	3600
1000 – 1200	1100	2	2200
1200 – 1400	1300	3	3900
1400 – 1600	1500	1	1500
1600 – 1800	1700	1	1700
		24	20400

1 for correct table

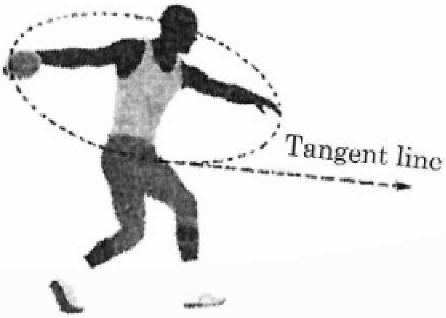
$$\text{Mean} = \frac{20400}{24} = 850$$

1

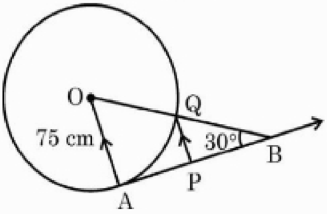
(iii) Sub-divisions having good rainfall = 2 + 3 + 1 + 1 = 7.

1

38. The discus throw is an event in which an athlete attempts to throw a discus. The athlete spins anti-clockwise around one and a half times through a circle, then releases the throw. When released, the discus travels along tangent to the circular spin orbit.



In the given figure, AB is one such tangent to a circle of radius 75 cm. Point O is centre of the circle and $\angle ABO = 30^0$. PQ is parallel to OA.



	Based on above information: (a) find the length of AB. (b) find the length of OB. (c) find the length of AP. OR Find the length of PQ	
Sol.	(i)tan 30° = $\frac{1}{\sqrt{3}} = \frac{75}{AB}$	$\frac{1}{2}$
	⇒ AB = $75\sqrt{3}$ cm	$\frac{1}{2}$
	(ii)sin 30° = $\frac{1}{2} = \frac{75}{OB}$	$\frac{1}{2}$
	⇒ OB = 150 cm	$\frac{1}{2}$
	(iii) QB = 150 – 75 = 75 cm ⇒ Q is mid point. of OB	1
	Since PQ ll AO therefore P is mid point of AB Hence AP = $\frac{75\sqrt{3}}{2}$ cm.	1
	OR	
	(iii) QB = 150 – 75 = 75 cm Now, Δ BQP ~ Δ BOA	$\frac{1}{2}$
	⇒ $\frac{QB}{OB} = \frac{PQ}{OA}$ ⇒ $\frac{1}{2} = \frac{PQ}{75}$	1
	⇒ PQ = $\frac{75}{2}$ cm	$\frac{1}{2}$