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

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 greatest number which divides both 83 and 138, leaving remainders 5 and 8 respectively, is : (a) 13 (b) 65 (c) 26 (d) 39	
Ans.	**(c) 26**	**1**
2.	If α and β are the zeroes of the polynomial $p(x) = 2x^2 - 7x + 3$, then the value of $\alpha^2 + \beta^2$ is : (a) 10 (b) $\frac{37}{4}$ (c) $\frac{23}{2}$ (d) 37	
Ans.	(b) $\frac{37}{4}$	**1**
3.	If the sum of the zeroes of the quadratic polynomial $p(x) = kx^2 + 2x + 3k$ is equal to the product of its zeroes, then the value of k is : (a) $-\frac{2}{3}$ (b) $\frac{2}{3}$ (c) $\frac{3}{2}$ (d) $-\frac{3}{2}$	
Ans.	**(a)** $-\frac{2}{3}$	**1**

4.	The pair of equations x = a and y = b represent the lines which are : (a) parallel (b) intersecting at (b, a) (c) coincident (d) intersecting at (a, b)	
Ans.	**(d) intersecting at (a,b)**	**1**
5.	If one equation of a pair of dependent equations is $-3x + 5y = 4$, then the second equation can be : (a) $6x + 10y = 8$ (b) $9x - 15y + 12 = 0$ (c) $-9x + 15y = -12$ (d) $-6x - 10y = 8$	
Ans.	**(b) $9x - 15y + 12 = 0$**	**1**
6.	If one root of the equation $2x^2 - 5x + (\lambda - 4) = 0$ be the reciprocal of the other, then the value of λ is : (a) 5 (b) 4 (c) 6 (d) 8	
Ans.	**(c) 6**	**1**
7.	The 4^{th} term from the end of an AP $-11, -8, -5, \ldots, 49$ is : (a) 40 (b) 37 (c) 43 (d) 58	
Ans.	**(a) 40**	**1**
8.	The perimeters of two similar triangles are 42 cm and 35 cm respectively. If one side of the first triangle is 12 cm, then the corresponding side of the second triangle is : (a) 5 cm (b) 7·5 cm (c) 8 cm (d) 10 cm	
Ans.	**(d) 10 cm**	**1**

9.	E and F are points on the sides PQ and PR respectively of a Δ PQR. If EF $\|\|$ QR and PE = 4 cm, QE = 3 cm and EF = 4 cm, then the length of QR is : (a) 3 cm (b) 4 cm (c) 7 cm (d) 6 cm	
Ans.	**(c) 7 cm**	**1**
10.	If two tangents inclined at an angle of 60° are drawn to a circle of radius 5 cm from an external point, then the length of each tangent is equal to : (a) $\frac{5\sqrt{3}}{2}$ cm (b) 10 cm (c) $\frac{5}{\sqrt{3}}$ cm (d) $5\sqrt{3}$ cm	
Ans.	**(d) $5\sqrt{3}$ cm**	**1**
11.	If $\tan A = \frac{3}{4}$, then the value of $\frac{4 \sin A - 2 \cos A}{4 \sin A + 2 \cos A}$ is : (a) 5 (b) $\frac{1}{5}$ (c) 6 (d) $\frac{1}{6}$	
Ans.	**(b) $\frac{1}{5}$**	**1**
12.	If $2 \sin 2A = \sqrt{3}$, then $\angle A$ is equal to : (a) 60° (b) 45° (c) 90° (d) 30°	
Ans.	**(d) 30°**	**1**

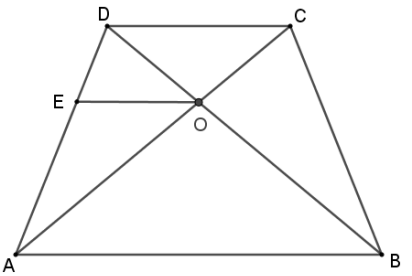
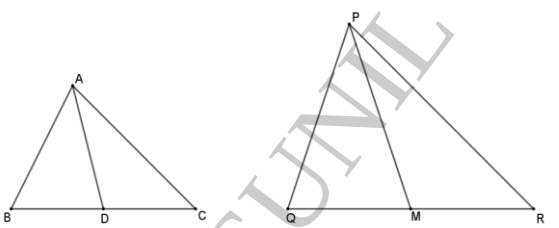
13.	It is found that on walking 20 m towards a chimney in a horizontal line through its base, the elevation of its top changes from 30° to 60°. The height of the chimney is : (a) $20\sqrt{3}$ m (b) $10\sqrt{3}$ m (c) $\frac{20\sqrt{2}}{3}$ m (d) $\frac{20}{\sqrt{3}}$ m	
Ans.	**(b) $10\sqrt{3}$ m**	**1**
14.	The area of a sector of a circle of radius 16 cm cut off by an arc of length 18·5 cm is : (a) 168 cm^2 (b) 148 cm^2 (c) 154 cm^2 (d) 176 cm^2	
Ans.	**(b) 148 cm^2**	**1**
15.	A hemispherical bowl is made of steel of thickness 1 cm. The inner radius of the bowl is 5 cm. The volume of steel used (in cm^3) is : (a) 182π (b) $\frac{182}{3}\pi$ (c) $\frac{682}{3}\pi$ (d) $\frac{364}{3}\pi$	
Ans.	**(b) $\frac{182}{3}\pi$**	**1**
16.	The mean and median of a frequency distribution are 43 and 43·4 respectively. The mode is : (a) 43·4 (b) 42·4 (c) 44·2 (d) 49·3	
Ans.	**(c) 44.2**	**1**

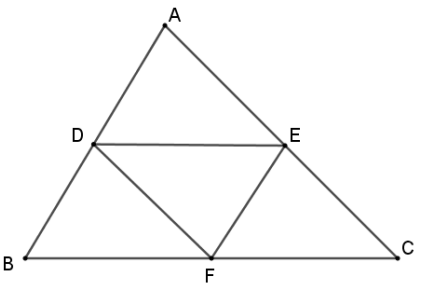
17.	The probability that a leap year selected at random will contain 53 Sundays and 53 Mondays, is : (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{4}{7}$	
Ans.	**(a) $\frac{1}{7}$**	**1**
18.	The probability for a randomly selected number out of 1, 2, 3, 4, . . . , 25 to be a prime number is : (a) $\frac{8}{25}$ (b) $\frac{10}{25}$ (c) $\frac{11}{25}$ (d) $\frac{9}{25}$	
Ans.	**(d) $\frac{9}{25}$**	**1**
	*For Questions number **19** and **20**, two statements are given — one labelled as Assertion (A) and the other 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 and Reason (R) is false. (d) Assertion (A) is false and Reason (R) is true.	
19.	*Assertion (A) :* The tangents drawn at the end points of a diameter of the circle are parallel to each other. *Reason (R) :* The tangent to a circle is perpendicular to the radius at the point of contact.	
Ans.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is **the correct explanation of Assertion (A).**	**1**
20.	*Assertion (A) :* The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end to end, is 160 cm^2. *Reason (R) :* Surface area of a cuboid of dimensions $l \times b \times h$ is $(lb + bh + hl)$	

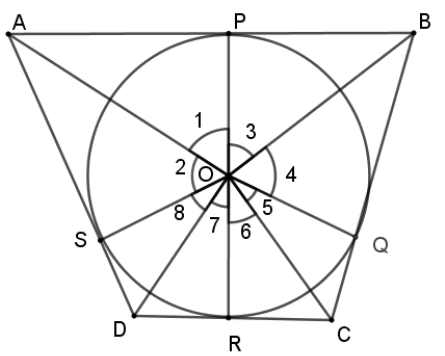
Ans.	**(c) Assertion (A) is true but Reason (R) is false**	**1**
	SECTION B **This section comprises very short answer (VSA) type questions of 2 marks each.**	
21.	Find the HCF and LCM of 84, 90 and 120 by prime factorization method.	
Ans.	$84 = 2^2 \times 3 \times 7$ $90 = 2 \times 3^2 \times 5$ $120 = 2^3 \times 3 \times 5$ **HCF = 6** **LCM = 2520**	**1** ½ ½
22.	If p and q are the zeroes of the quadratic polynomial $f(x) = 6x^2 + x - 2$, then find the value of $\frac{1}{p} + \frac{1}{q} - pq$.	
Ans.	$p + q = -\frac{1}{6}, pq = -\frac{1}{3}$ $\frac{1}{p} + \frac{1}{q} = \frac{p+q}{pq} = \frac{1}{2}$ $\therefore \frac{1}{p} + \frac{1}{q} - pq = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}$	**1** ½ ½
23(a).	If the point P (3, – 3) is equidistant from the points A (4, 9) and B (– 9, k), find the value(s) of k.	
Ans.	$(3-4)^2 + (-3-9)^2 = (3+9)^2 + (-3-k)^2$ $\Rightarrow k = -2, -4$	**1** **1**
	OR	
23(b).	Find the ratio in which the y-axis divides the line segment joining the points (5, – 6) and (– 1, – 4). Also, find the point of intersection.	
Ans.	 $0 = \frac{-k+5}{k+1}$ $\Rightarrow k = 5 \therefore$ required ratio is 5:1	½ ½

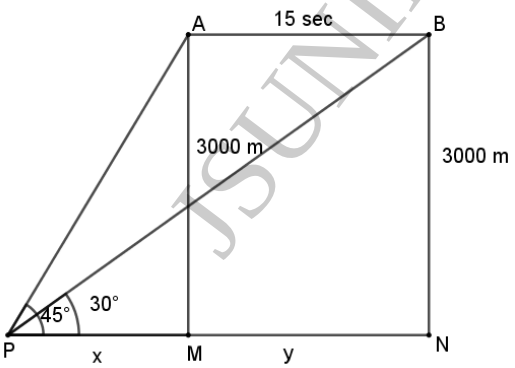
	$y = \frac{5(-4)+1(-6)}{6} = -\frac{13}{2}$ $\therefore$ point of intersection is $(0, -\frac{13}{2})$	½ ½
24.	If tan A = 1 and tan B = $\sqrt{3}$, then evaluate ; cos A cos B + sin A sin B.	
Ans.	$A = 45^\circ, B = 60^\circ$ $cos\,A\,cos\,B + sin\,A\,sin\,B$ $= \frac{1}{\sqrt{2}}.\frac{1}{2} + \frac{1}{\sqrt{2}}.\frac{\sqrt{3}}{2} = \frac{\sqrt{3}+1}{2\sqrt{2}}$	½+½ **1**
25(a).	Prove that $\frac{1-\cos\theta}{1+\cos\theta} = (\cot\theta - \text{cosec}\,\theta)^2$	
Ans.	LHS $= \frac{1-\cos\theta}{1+\cos\theta} \times \frac{1-\cos\theta}{1-\cos\theta}$ $= \frac{(1-\cos\theta)^2}{sin^2\theta}$ $= (cosec\,\theta - \cot\theta)^2 =$ RHS	**1** ½ ½
	OR	
25(b).	Prove that $\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A\,\text{cosec}\,A$	
Ans.	Getting $\frac{sin^2A}{\cos A(\sin A - \cos A)} + \frac{cos^2A}{\sin A(\cos A - \sin A)}$ $= \frac{sin^3A - cos^3A}{\sin A\cos A(\sin A - \cos A)} = \frac{sin^2A + cos^2A + \sin A\cos A}{\sin A\cos A}$ $= 1 + \sec A\,cosec\,A = RHS$	**1** ½ ½

	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26.	Prove that $\sqrt{5}$ is an irrational number.	
Ans.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where q≠0 and let p & q be co-primes. $5q^2 = p^2 \Longrightarrow p^2$ is divisible by 5 $\Longrightarrow$ p is divisible by 5 $\Longrightarrow$ p = 5a, where 'a' is some integer ----- (i) $25a^2 = 5q^2 \Longrightarrow q^2 = 5a^2 \Longrightarrow q^2$ is divisible by 5 $\Longrightarrow$ q is divisible by 5 $\Longrightarrow$ 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.	**1** **1** ½ ½
27.	A boat goes 30 km upstream and 44 km downstream in 10 hours. It goes 40 km upstream and 55 km downstream in 13 hours. Find the speed of the boat in still water and that of the stream.	
Ans.	Let the speed of the boat be x km/h and the speed of the stream be y km/h A.T.Q $\frac{30}{x-y} + \frac{44}{x+y} = 10; \frac{40}{x-y} + \frac{55}{x+y} = 13$ $\Longrightarrow x + y = 11, x - y = 5$ $\Longrightarrow x = 8, y = 3$ $\therefore$ Speed of boat = 8 km/h Speed of stream = 3 km/h	**1** **1** **1**

28.	ABCD is a trapezium in which AB ‖ DC and its diagonals AC and BD intersect at O. Show that $\frac{OA}{OB}=\frac{OC}{OD}$.	
Ans.	 **Draw $OE \parallel CD$** $\Rightarrow \frac{DE}{AE}=\frac{OD}{OB}$ **Also** $\frac{DE}{AE}=\frac{OC}{OA}$ $\Rightarrow \frac{OD}{OB}=\frac{OC}{OA} \Rightarrow \frac{OA}{OB}=\frac{OC}{OD}$	**1** **1** **1**
29(a).	Sides AB and BC and the median AD of a triangle ABC are respectively proportional to the sides PQ and QR and the median PM of Δ PQR. Show that Δ ABC ~ Δ PQR.	
Ans.	 Given $\frac{AB}{PQ}=\frac{BC}{QR}=\frac{AD}{PM} \Rightarrow \frac{AB}{PQ}=\frac{2BD}{2QM}=\frac{AD}{PM}$ $\therefore \Delta ABD \sim \Delta PQM \Rightarrow \angle B=\angle Q$ Now, $\frac{AB}{PQ}=\frac{BC}{QR}$ and $\angle B=\angle Q \Rightarrow \Delta ABC \sim \Delta PQR$	**1** **1** **1**
	OR	
29(b).	Prove that each of the four triangles formed by joining the mid-points of the sides of a triangle are similar to the original triangle.	

Ans.	 In ΔABC and ΔDEF $\angle A = \angle F$ (Opposite angles of ‖gm) Also $\frac{AB}{EF} = \frac{2}{1} = \frac{AC}{DF} \Longrightarrow \Delta ABC \sim \Delta FED$ Similarly, we can prove other pairs	**1** **1** **1**
30(a).	A horse is tied with a rope of length 6 m at the corner of a square grassy lawn of side 20 m. If the length of the rope is increased by 5·5 m, find the increase in area of the lawn in which the horse can graze.	
Ans.	Increase in Area = $\boldsymbol{\pi[(11.5)^2 - 6^2]\frac{90}{360}}$ $= \frac{22}{7} \times \frac{175}{10} \times \frac{55}{10} \times \frac{1}{4} = \mathbf{75.62}$ Hence increase in area is 75.62 m^2	**1½** **1½**
	OR	
30(b).	A chord of a circle of radius 14 cm makes a right angle at the centre of the circle. Find the area of the minor segment.	
Ans.	Area of segment = $\frac{22}{7} \times 14 \times 14 \times \frac{90}{360} - \frac{1}{2} \times 14 \times 14$ $= 154 - 98 = 56$ Hence area of segment = 56 $\boldsymbol{cm^2}$	**1½** **1½**
31.	Three different coins are tossed simultaneously. Find the probability of getting : (i) At least one head, (ii) At most two heads.	

Ans.	(i) P (at least one head) $= \frac{7}{8}$ (ii) P (at most two heads) $= \frac{7}{8}$	**1½** **1½**
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32(a).	Solve the equation for x : $-4 + (-1) + 2 + \ldots + x = 437$.	
Ans.	$S_n = 437, a = -4, d = 3, a_n = x$ $437 = \frac{n}{2}[-8 + (n-1)3]$ $\Rightarrow 3n^2 - 11n - 874 = 0$ or $(3n + 46)(n - 19) = 0$ $\Rightarrow n = 19$ $x = a_{19} = -4 + 18(3) = 50$	**1** **1** **1** **1** **1**
	OR	
32(b).	The sum of first n terms of an AP is $5n^2 + 3n$. If its n^{th} term is 168, find n. Also, find the 20^{th} term of the AP.	
Ans.	$S_n = 5n^2 + 3n \Rightarrow S_1 = 8 \Rightarrow a = 8$ $S_2 = a_1 + a_2 = 26 \Rightarrow a_2 = 18$ $\Rightarrow d = 18 - 8 = 10$ $a_n = 168 = 8 + (n-1)10 \Rightarrow n = 17$ $a_{20} = 8 + 190 = 198$	**1** **1½** **1½** **1**
33(a).	Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.	
Ans.		

	$\boldsymbol{AP = AS, so \angle 1 = \angle 2}$ Similarly, $\boldsymbol{\angle 3 = \angle 4}$ $\boldsymbol{\angle 7 = \angle 8}$ $\boldsymbol{\angle 6 = \angle 5}$ $\boldsymbol{\Rightarrow (\angle 1 + \angle 3) + (\angle 6 + \angle 7) = (\angle 2 + \angle 8) + (\angle 4 + \angle 5)}$ $\boldsymbol{\Rightarrow (\angle AOB + \angle COD) = (\angle AOD + \angle BOC) = 180^{\circ}}$ $\therefore$ Angles subtended by AB and CD or AD and BC are supplementary	**2** **1** **1** **1**
	OR	
33(b).	Prove that the lengths of the tangents drawn from an external point to a circle are equal.	
Ans.	**Correct Given, To prove and Construction** **Correct Proof**	**2** **3**
34.	The angle of elevation of an aeroplane from a point on the ground is 45°. After a flight of 15 seconds, the elevation changes to 30°. If the aeroplane is flying at a constant height of 3000 meters, find the speed of the aeroplane in km/h. [Take $\sqrt{3}$ = 1.732]	
Ans.	 $\frac{3000}{x} = \tan 45° = 1 \Rightarrow x = 3000$ m	 **1**

	$\frac{3000}{x+y} = \tan 30° = \frac{1}{\sqrt{3}} \Rightarrow 3000 + y = 3000\sqrt{3}$	**1½**
	$y = 3000(\sqrt{3} - 1) = 3000(0.732) = 2196$ m	**1½**
	Speed = $\frac{2196}{15} = 146.4$ m/s	**1**
35.	Find the mean and the median for the following frequency distribution :	

Class	*Frequency*
11 – 13	7
13 – 15	6
15 – 17	9
17 – 19	13
19 – 21	20
21 – 23	5
23 – 25	4

Ans.

x_i	f_i	$f_i x_i$	cf
12	7	84	7
14	6	84	13
16	9	144	22
18	13	234	35

2 for correct table

20	20	400	55
22	5	110	60
24	4	96	64
Total	64	1152	

Mean $= \frac{1152}{64} = 18$ **1**

Median group: 17-19 **½**

Median $= 17 + \frac{32-22}{13} \times 2 = 17 + \frac{20}{13}$ **1**

$= 18.54$ **½**

SECTION E

This section comprises of 3 case-study based questions of 4 marks each.

36.

Case Study – 1

In an auditorium, seats are arranged in rows and columns. The number of rows are equal to the number of seats in each row in the beginning. When the number of rows are doubled and the number of seats in each row is reduced by 10, the total number of seats increases by 300.

Based on the above, answer the following questions :

(a) Taking x as the number of rows in the beginning, represent the above situation by a quadratic equation. *1*

(b) (i) How many rows are there in the original arrangement ? *2*

OR

(ii) How many seats are there in the auditorium in the beginning ? *2*

(c) How many seats are there in the auditorium after re-arrangement ? *1*

Ans.	Let no. of rows be x = no. of seats in each row (a) $2x(x-10)-x^2=300$ Or $x^2-20x-300=0$ (b) (i) $(x-30)(x+10)=0 \Rightarrow x=30$ OR (ii) $(x-30)(x+10)=0 \Rightarrow x=30$ $\therefore x^2=900$ (c) $900+300=1200$	**1** **1+1=2** **1+1=2** **1**
37.	**Case Study – 2** Morning assembly is an integral part of every school's schedule. In the assembly, students always stand in rows and columns and this makes a coordinate system. In a school, there are 200 students and they all assemble for prayer in 10 rows. 4 students are at A, B, C and D with the following positions of the coordinate system : A (3, 4), B (6, 7), C (9, 4) and D (6, 1). Based on the above, answer the following questions : (a) Find the distance between A and B. *1* (b) Find the distance between C and D. *1* (c) Show that ABCD forms a parallelogram. *2* **OR** (c) Find the mid-point of the line segments AC and BD. *2*	

Ans.	(a) $AB = \sqrt{(6-3)^2 + (7-4)^2} = 3\sqrt{2}$ units	**1**
	(b) $CD = \sqrt{(6-9)^2 + (1-4)^2} = 3\sqrt{2}$ units	**1**
	(c) (i) $AB = CD$ $AD = \sqrt{(6-3)^2 + (1-4)^2} = 3\sqrt{2}$ units $BC = \sqrt{(9-6)^2 + (4-7)^2} = 3\sqrt{2}$ units $\Longrightarrow AD = BC$	**1**
	$\therefore$ ABCD is a ‖gm	**1**
	OR	
	(ii) mid-point of AC is (6,4)	**1**
	And mid-point of BD is (6,4)	**1**
38.	**Case Study – 3** For the Kumbh Mela, Uttar Pradesh Government prescribed the following for the contractors to pitch the tents. Each tent must be of cylindrical base of radius 21 m and height 5 m, surmounted by a conical part of height 20 m. The cylindrical part must have a while coloured thick fabric costing ₹ 60 per square meter, while the conical part must have PVC coated blue fabric costing ₹ 70 per square meter. Based on the above information, answer the following questions : (a) How much blue PVC (in sq.m) is required and what will be its total cost ? *2* (b) How much white fabric (in sq.m) is required and what will be its total cost ? *2*	
Ans.	(a) $\boldsymbol{l = \sqrt{20^2 + 21^2} = \sqrt{841} = 29}$ m **CSA of conical part=** $\boldsymbol{\pi rl = \frac{22}{7} \times 21 \times 29 = 1914\ m^2}$	½ ½

	Cost $= \mathbf{1914 \times 70 = ₹\,133980}$	**1**
	(b) Surface Area of cylindrical part $= \mathbf{2 \times \frac{22}{7} \times 21 \times 5 = 660\ m^2}$	**1**
	Cost $= \mathbf{660 \times 60 = ₹\,39600}$	**1**