Marking Scheme
Class X Session 2023-24
MATHEMATICS STANDARD (Code No.041)

TIME: 3 hours **MAX.MARKS: 80**

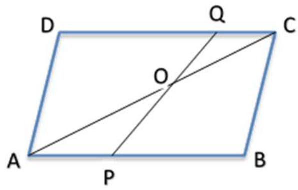
	SECTION A	
	Section A consists of 20 questions of 1 mark each.	
1.	(b) xy^2	1
2.	(b) 1 zero and the zero is '3'	1
3.	(b) $\frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$	1
4.	(c) 2 distinct real roots	1
5.	(c) 7	1
6.	(a) 1:2	1
7.	(d) infinitely many	1
8.	(b) $\frac{ac}{b+c}$	1
9.	(b) 100°	1
10.	(d) 11 cm	1
11.	(c) $\frac{\sqrt{b^2-a^2}}{b}$	1
12.	(d) cos A	1
13.	(a) 60°	1
14.	(a) 2 units	1
15.	(a) 10m	1
16.	(b) $\frac{4-\pi}{4}$	1
17.	(b) $\frac{22}{46}$	1
18.	(d) 150	1
19.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)	1
20.	(c) Assertion (A) is true but reason (R) is false.	1
	SECTION B	
	Section B consists of 5 questions of 2 marks each.	
21.	Let us assume, to the contrary, that $\sqrt{2}$ is rational. So, we can find integers *a* and *b* such that $\sqrt{2} = \frac{a}{b}$ where *a* and *b* are coprime. So, b $\sqrt{2}$ = a. Squaring both sides, we get $2b^2 = a^2$. Therefore, 2 divides a^2 and so 2 divides a. So, we can write a = 2c for some integer c. Substituting for a, we get $2b^2 = 4c^2$, that is, $b^2 = 2c^2$. This means that 2 divides b^2, and so 2 divides b Therefore, a and b have at least 2 as a common factor. But this contradicts the fact that a and b have no common factors other than 1. This contradiction has arisen because of our incorrect assumption that $\sqrt{2}$ is rational. So, we conclude that $\sqrt{2}$ is irrational.	½ ½ ½ ½

22. ABCD is a parallelogram. ½

AB = DC = a

Point P divides AB in the ratio 2:3

$AP = \frac{2}{5}a$, $BP = \frac{3}{5}a$



point Q divides DC in the ratio 4:1. ½

$DQ = \frac{4}{5}a$, $CQ = \frac{1}{5}a$

Δ APO ~ Δ CQO [AA similarity] ½

$$\frac{AP}{CQ} = \frac{PO}{QO} = \frac{AO}{CO}$$ ½

$$\frac{AO}{CO} = \frac{\frac{2}{5}a}{\frac{1}{5}a} = \frac{2}{1} \Rightarrow OC = ½\ OA$$

23.

PA = PB; CA = CE; DE = DB [Tangents to a circle] ½

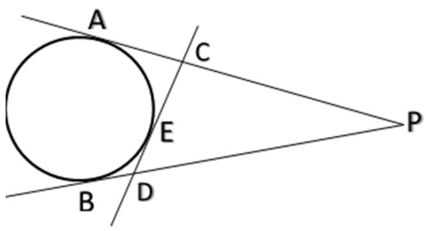
Perimeter of ΔPCD = PC + CD + PD

= PC + CE + ED + PD

= PC + CA + BD + PD

= PA + PB 1

Perimeter of ΔPCD = PA + PA = 2PA = 2(10) = 20 cm ½



24. $\because \tan(A+B) = \sqrt{3}$ $\quad\therefore A + B = 60^0$ ...(1) ½

$\because \tan(A-B) = \frac{1}{\sqrt{3}}$ $\quad\therefore A - B = 30^0$ ...(2) ½

Adding (1) & (2), we get $2A=90^0 \Longrightarrow A = 45^0$ ½

Also (1) –(2), we get $2B = 30^0 \Longrightarrow B = 45^0$ ½

[or]

$2\ \text{cosec}^2 30 + x \sin^2 60 - \frac{3}{4}\tan^2 30 = 10$

$\Rightarrow\quad 2(2)^2 + x\left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{4}\left(\frac{1}{\sqrt{3}}\right)^2 = 10$ 1

$\Rightarrow\quad 2(4) + x\left(\frac{3}{4}\right) - \frac{3}{4}\left(\frac{1}{3}\right) = 10$ ½

$\Rightarrow\quad 8 + x\left(\frac{3}{4}\right) - \frac{1}{4} = 10$

$\Rightarrow\quad 32 + x\,(3)\ -1\ = 40$ ½

$\Rightarrow\quad 3x\ = 9\quad \Rightarrow\quad x = 3$

25. Total area removed $= \frac{\angle A}{360}\pi r^2 + \frac{\angle B}{360}\pi r^2 + \frac{\angle C}{360}\pi r^2$ ½

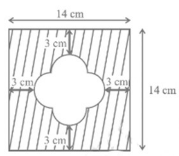
$= \frac{\angle A + \angle B + \angle C}{360}\pi r^2$

$= \frac{180}{360}\pi r^2$ ½

$= \frac{180}{360} \text{ X } \frac{22}{7} \text{ X } (14)^2$ ½ ½

$= 308\ cm^2$

[or]



The side of a square = Diameter of the semi-circle = a

Area of the unshaded region ½

= Area of a square of side 'a' + 4(Area of a semi-circle of diameter 'a')

The horizontal/vertical extent of the white region = 14-3-3 = 8 cm ½

Radius of the semi-circle + side of a square + Radius of the semi-circle = 8 cm

	2 (radius of the semi-circle) + side of a square = 8 cm $2a = 8$ cm $\Rightarrow a = 4$ cm Area of the unshaded region = Area of a square of side 4 cm + 4 (Area of a semi-circle of diameter 4 cm) $= (4)^2 + 4 \text{ X } \frac{1}{2}\pi(2)^2 = (16 + 8\pi)$ cm^2	½ ½
	SECTION C	
	Section C consists of 6 questions of 3 marks each	
26.	Number of students in each group subject to the given condition = HCF (60,84,108) HCF (60,84,108) = 12 Number of groups in Music = $\frac{60}{12} = 5$ Number of groups in Dance = $\frac{84}{12} = 7$ Number of groups in Handicrafts = $\frac{108}{12} = 9$ Total number of rooms required = 21	½ ½ ½ ½ ½ ½
27.	$P(x) = 5x^2 + 5x + 1$ $\alpha+\beta = \frac{-b}{a} = \frac{-5}{5} = -1$ $\alpha\beta = \frac{c}{a} = \frac{1}{5}$ $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$ $= (-1)^2 - 2\left(\frac{1}{5}\right)$ $= 1 - \frac{2}{5} = \frac{3}{5}$ $\alpha^{-1} + \beta^{-1} = \frac{1}{\alpha} + \frac{1}{\beta}$ $= \frac{(\alpha+\beta)}{\alpha\beta} = \frac{(-1)}{\frac{1}{5}} = -5$	½ ½ ½ ½ ½ ½
28.	Let the ten's and the unit's digits in the first number be x and y, respectively. So, the original number = 10x + y When the digits are reversed, x becomes the unit's digit and y becomes the ten's Digit. So the obtain by reversing the digits= 10y + x According to the given condition. (10x + y) + (10y + x) = 66 i.e., 11(x + y) = 66 i.e., x + y = 6 ---- (1) We are also given that the digits differ by 2, therefore, either x – y = 2 ---- (2) or y – x = 2 ---- (3) If x – y = 2, then solving (1) and (2) by elimination, we get x = 4 and y = 2. In this case, we get the number 42. If y – x = 2, then solving (1) and (3) by elimination, we get x = 2 and y = 4. In this case, we get the number 24. Thus, there are two such numbers 42 and 24.	½ ½ ½ ½ ½ ½
	[or]	
	Let $\frac{1}{\sqrt{x}}$ be 'm' and $\frac{1}{\sqrt{y}}$ be 'n', Then the given equations become 2m + 3n = 2 4m - 9n = -1	½ ½

(2m + 3n = 2) X- 2 $\Rightarrow -4m - 6n = -4$ ...(1)

4m - 9n = -1 $4m - 9n = -1$ ...(2)

Adding (1) and (2)

We get $-15n = -5 \Rightarrow n = \frac{1}{3}$ ½

Substituting n = $\frac{1}{3}$ in 2m + 3n = 2, we get ½

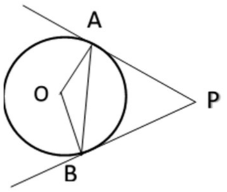
2m + 1 = 2

2m = 1

m = $\frac{1}{2}$ 1

m = $\frac{1}{2}$ $\Rightarrow \sqrt{x} = 2$ $\Rightarrow$ x = 4 and n = $\frac{1}{3}$ $\Rightarrow \sqrt{y} = 3$ $\Rightarrow$ y = 9

29.



∠OAB = 30°

∠OAP = 90° [Angle between the tangent and the radius at the point of contact]

∠PAB = 90° - 30° =60° ½

AP = BP [Tangents to a circle from an external point]

∠PAB = ∠PBA [Angles opposite to equal sides of a triangle] ½

In ΔABP, ∠PAB + ∠PBA + ∠APB = 180° [Angle Sum Property]

60° + 60° + ∠APB = 180°

∠APB = 60° ½

∴ ΔABP is an equilateral triangle, where AP = BP = AB.

PA = 6 cm ½

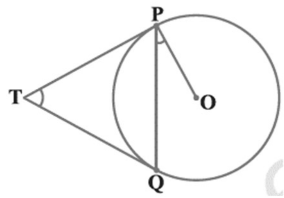
In Right ΔOAP, ∠OPA = 30°

tan 30° = $\frac{OA}{PA}$ ½

$\frac{1}{\sqrt{3}} = \frac{OA}{6}$

OA = $\frac{6}{\sqrt{3}} = 2\sqrt{3}cm$ ½

[or]



Let ∠ TPQ = θ

∠ TPO = 90° [Angle between the tangent and the radius at the point of contact] ½

∠ OPQ = 90° - θ

TP = TQ   [Tangents to a circle from an external point] ½

∠ TPQ = ∠ TQP = θ [Angles opposite to equal sides of a triangle] ½

In ΔPQT, ∠PQT + ∠QPT + ∠PTQ = 180° [Angle Sum Property] ½

$\theta + \theta$ + ∠PTQ = 180°

∠PTQ = 180° - 2 θ ½

∠PTQ = 2 (90° - θ) ½

∠PTQ = 2 ∠ OPQ [using (1)]

30. Given, 1 + $\sin^2\theta$ = 3 sin θ cos θ

Dividing both sides by $\cos^2\theta$,

$\frac{1}{\cos^2\theta} + \tan^2\theta = 3\tan\theta$ ½

$\sec^2\theta + \tan^2\theta = 3\tan\theta$ ½

$1 + \tan^2\theta + \tan^2\theta = 3\tan\theta$ ½

$1 + 2\tan^2\theta = 3\tan\theta$ ½

$2\tan^2\theta - 3\tan\theta + 1 = 0$

If tan θ = x, then the equation becomes $2x^2 - 3x + 1 = 0$

	$\Rightarrow (x-1)(2x-1) = 0$ x = 1 or $\frac{1}{2}$ tan θ = 1 or $\frac{1}{2}$	1
31.	(table below)	2 ½ ½

Length [in mm]	Number of leaves (f)	CI	Mid x	d	fd
118 – 126	3	117.5- 126.5	122	-27	-81
127 – 135	5	126.5– 135.5	131	-18	-90
136 – 144	9	135.5– 144.5	140	-9	-81
145 – 153	12	144.5 – 153.5	a = 149	0	0
154 – 162	5	153.5 – 162.5	158	9	45
163 – 171	4	162.5 – 171.5	167	18	72
172 – 180	2	171.5 – 180.5	176	27	54

Mean = a + $\frac{\sum fd}{\sum f}$ = 149 + $\frac{-8}{40}$

= 149 – 2.025 = 146.975

Average length of the leaves = 146.975

SECTION D

Section D consists of 4 questions of 5 marks each

32.

Let the speed of the stream be x km/h.
The speed of the boat upstream = (18 – x) km/h and
the speed of the boat downstream = (18 + x) km/h. 1

The time taken to go upstream = $\frac{distance}{speed} = \frac{24}{18-x}$ hours

the time taken to go downstream = $\frac{distance}{spe} = \frac{24}{18+x}$ hours 1

According to the question,

$$\frac{24}{18-x} - \frac{24}{18+x} = 1$$ 1

24(18 + x) – 24(18 – x) = (18 – x) (18 + x)

x^2 + 48x – 324 = 0

x = 6 or – 54 1

Since x is the speed of the stream, it cannot be negative.
Therefore, x = 6 gives the speed of the stream = 6 km/h. 1

[or]

32.

Let the time taken by the smaller pipe to fill the tank = x hr.
Time taken by the larger pipe = (x – 10) hr ½

Part of the tank filled by smaller pipe in 1 hour = $\frac{1}{x}$

Part of the tank filled by larger pipe in 1 hour = $\frac{1}{x-10}$ 1

The tank can be filled in $9\frac{3}{8} = \frac{75}{8}$ hours by both the pipes together. ½

Part of the tank filled by both the pipes in 1 hour = $\frac{8}{75}$ ½

Therefore, $\frac{1}{x} + \frac{1}{x-10} = \frac{8}{75}$ ½

$8x^2 - 230x + 750 = 0$

$x = 25, \frac{30}{8}$ 1

Time taken by the smaller pipe cannot be 30/8 = 3.75 hours, as the time taken by the larger pipe will become negative, which is logically not possible. ½

Therefore, the time taken individually by the smaller pipe is 25 hours and the larger pipe will be 25 – 10 =15 hours. ½

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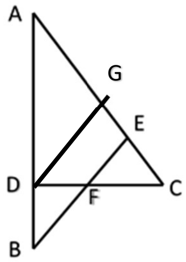
33. (a) Statement – ½

Given and To Prove – ½

Figure and Construction ½

Proof – 1 ½ 3



[b] Draw DG || BE

In Δ ABE, $\frac{AB}{BD} = \frac{AE}{GE}$ [BPT] ½

CF = FD [F is the midpoint of DC] ---(i) ½

In Δ CDG, $\frac{DF}{CF} = \frac{GE}{CE} = 1$ [Mid point theorem] ½

GE = CE ---(ii)

∠CEF = ∠CFE [Given]

CF = CE [Sides opposite to equal angles] ---(iii) ½

From (ii) & (iii) CF = GE ---(iv)

From (i) & (iv) GE = FD

$\therefore \frac{AB}{BD} = \frac{AE}{GE} \Rightarrow \frac{AB}{BD} = \frac{AE}{FD}$

34.

Length of the pond, l= 50m, width of the pond, b = 44m

Water level is to rise by, h = 21 cm = $\frac{21}{100}$ m

Volume of water in the pond = lbh = 50 x 44 x $\frac{21}{100}$ m^3 =462 m^3 1

Diameter of the pipe = 14 cm

Radius of the pipe, r = 7cm = $\frac{7}{100}$ m

Area of cross-section of pipe = πr^2

$= \frac{22}{7} \times \frac{7}{100} \times \frac{7}{100} = \frac{154}{10000}$ m^2 1 ½

Rate at which the water is flowing through the pipe, h = 15km/h = 15000 m/h

Volume of water flowing in 1 hour = Area of cross-section of pipe x height of water coming out of pipe ½

$= \left(\frac{154}{10000} \times 15000\right) m^3$ 1

Time required to fill the pond $= \frac{Volume\ of\ the\ pond}{Volume\ of\ water\ flowing\ in\ 1\ hour}$ 1

$= \frac{462 \times 10000}{154 \times 15000} = 2$ hours

Speed of water if the rise in water level is to be attained in 1 hour = 30km/h

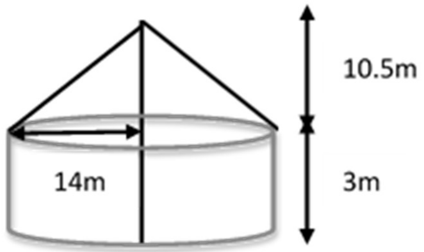
[or]

Radius of the cylindrical tent (r) = 14 m

Total height of the tent = 13.5 m

Height of the cylinder = 3 m

Height of the Conical part = 10.5 m ½



Slant height of the cone $(l) = \sqrt{h^2 + r^2}$

$= \sqrt{(10.5)^2 + (14)^2}$

$= \sqrt{110.25 + 196}$

$= \sqrt{306.25} = 17.5$ m 1

Curved surface area of cylindrical portion

= 2πrh

$= 2 \times \frac{22}{7} \times 14 \times 3$ 1

= 264 m²

Curved surface area of conical portion

=πrl

$= \frac{22}{7} \times 14 \times 17.5$ 1

=770 m² ½

Total curved surface area = 264 m² + 770 m² = 1034 m²

Provision for stitching and wastage = 26 m² ½

Area of canvas to be purchased = 1060 m²

Cost of canvas = Rate × Surface area ½

= 500 x 1060 = ₹ 5,30,000/-

35.

Marks obtained	Number of students	Cumulative frequency
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
	90	

1

½

½

p + q + 78 = 90

p + q = 12

Median $= (l) + \frac{\frac{n}{2} - c}{f} \cdot h$

$50 = 50 + \frac{45-(p+40)}{20} \cdot 10$ ½

$\frac{45-(p+40)}{20} \cdot 10 = 0$ ½

$45 - (p + 40) = 0$ ½

P = 5 ½

5 + q = 12

q = 7 1

Mode $= l + \frac{f1-f0}{2f1-f0-f2} \cdot h$

	$= 40 + \frac{25-15}{2(25)-15-20} \cdot 10$ $= 40 + \frac{100}{15} = 40 + 6.67 = 46.67$	
	SECTION E	
36.	(i) Number of throws during camp. a = 40; d = 12 $t_{11} = a + 10d$ $= 40 + 10 \times 12$ $= 160\ throws$	1
	(ii) a = 7.56 m; d = 9cm = 0.09 m n = 6 weeks $t_n = a + (n-1)\,d$ $= 7.56 + 6(0.09)$ $= 7.56 + 0.54$ Sanjitha's throw distance at the end of 6 weeks = 8.1 m (or) a = 7.56 m; d = 9cm = 0.09 m $t_n = 11.16$ m $t_n = a + (n-1)\,d$ $11.16 = 7.56 + (n-1)(0.09)$ $3.6 = (n-1)(0.09)$ $n-1 = \frac{3.6}{0.09} = 40$ n = 41 Sanjitha's will be able to throw 11.16 m in 41 weeks.	½ ½ ½ ½ ½ ½ ½ ½
	(iii) a = 40; d = 12; n = 15 $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_n = \frac{15}{2}[2(40) + (15-1)(12)]$ $= \frac{15}{2}[80 + 168]$ $= \frac{15}{2}[248]$ =1860 throws	 ½ ½
37.	(i) Let D be (a,b), then Mid point of AC = Midpoint of BD $\left(\frac{1+6}{2}, \frac{2+6}{2}\right) = \left(\frac{4+a}{2}, \frac{3+b}{2}\right)$ 4 + a = 7 3+ b = 8 a = 3 b = 5 Central midfielder is at (3,5)	 ½ ½

	(ii) GH = $\sqrt{(-3-3)^2+(5-1)^2} = \sqrt{36+16} = \sqrt{52} = 2\sqrt{13}$ GK = $\sqrt{(0+3)^2+(3-5)^2} = \sqrt{9+4} = \sqrt{13}$ HK = $\sqrt{(3-0)^2+(1-3)^2} = \sqrt{9+4} = \sqrt{13}$ GK +HK = GH ⇒G,H & K lie on a same straight line [or] CJ = $\sqrt{(0-5)^2+(1+3)^2} = \sqrt{25+16} = \sqrt{41}$ CI = $\sqrt{(0+4)^2+(1-6)^2} = \sqrt{16+25} = \sqrt{41}$ Full-back J(5,-3) and centre-back I(-4,6) are equidistant from forward C(0,1) Mid-point of IJ = $\left(\frac{5-4}{2}, \frac{-3+6}{2}\right) = \left(\frac{1}{2}, \frac{3}{2}\right)$ C is NOT the mid-point of IJ	½ ½ ½ ½ ½ ½ ½ ½
	(iii) A,B and E lie on the same straight line and B is equidistant from A and E ⇒ B is the mid-point of AE $\left(\frac{1+a}{2}, \frac{4+b}{2}\right) = (2,-3)$ $1+a=4$; a = 3. 4+b = -6; b = -10 E is (3,-10)	½ ½
38.	(i) tan 45° = $\frac{80}{CB}$ ⇒ CB = 80m	1
	(ii) tan 30° = $\frac{80}{CE}$ ⇒ $\frac{1}{\sqrt{3}} = \frac{80}{CE}$ ⇒ CE = $80\sqrt{3}$ Distance the bird flew = AD = BE = CE-CB = $80\sqrt{3} - 80 = 80(\sqrt{3} - 1)$ m (or) tan 60° = $\frac{80}{CG}$ ⇒ $\sqrt{3} = \frac{80}{CG}$ ⇒ CG = $\frac{80}{\sqrt{3}}$ Distance the ball travelled after hitting the tree =FA=GB = CB -CG GB = 80 - $\frac{80}{\sqrt{3}} = 80\left(1 - \frac{1}{\sqrt{3}}\right)$ m	½ ½ ½ ½ ½ ½ ½ ½
	(iii) Speed of the bird = $\frac{Distance}{Time\ taken} = \frac{20(\sqrt{3}+1)}{2}$ m/sec $= \frac{20(\sqrt{3}+1)}{2}$ x 60 m/min = $600(\sqrt{3}+1)$ m/min	½ ½