COMMON PRE-BOARD EXAMINATION 2022-23

Subject: MATHEMATICS (BASIC) 241

MARKING SCHEME - SET 1

SECTION A			
Section A consists of 20 questions of 1 mark each.			
Q.1.	**(C)** (6, -12)	**Q.11.**	**(B)** 6 cm
Q.2.	**(D)** 81	**Q.12.**	**(C)** 3
Q.3.	**(A)** -12	**Q.13.**	**(B)** 25
Q.4.	**(C)** 1	**Q.14.**	**(A)** (2, 0)
Q.5.	**(D)** $\frac{1}{9}$	**Q.15.**	**(D)** 7, 13
Q.6.	**(C)** 22 cm	**Q.16.**	**(C)** $\frac{7}{24}$
Q.7.	**(D)** (3, 5)	**Q.17.**	**(A)** 6 cm
Q.8.	**(C)** $2^3 \times 3^3$	**Q.18.**	**(A)** 45°
Q.9.	**(B)** 2 units	**Q.19.**	**(c)**
Q.10.	**(A)** 1	**Q.20.**	**(b)**
SECTION B			
Section B consists of 5 questions of 2 marks each.			
Q.21.	r = 35cm $C = 2\pi r$ 1/2		

	$= 2 \times \frac{22}{7} \times 35 = 220cm$	1/2
	Distance covered in one revolution = 220 cm	
	Total distance = 11 m = 11 x 100 cm = 1100 cm	1/2
	Number of revolution $= \frac{\text{Total distance}}{\text{Distance in one revolution}} = \frac{1100}{220} = 5$	1/2
	OR	
	$C = 22\,cm$ $\Rightarrow 2\pi r = 22\,cm$ $\Rightarrow 2 \times \frac{22}{7} \times r = 22$	1/2
	$r = \frac{7}{2}$ cm	1/2
	Area of quadrant $= \frac{1}{4} \times$ area of circle $= \frac{1}{4}(\pi r^2)$ $= \frac{1}{4} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$ $= \frac{1}{4} \times \frac{22}{7} \times \frac{7 \times 7}{2 \times 2}$ $= \frac{1}{2} \times \frac{11}{1} \times \frac{7}{4}$ $= \frac{77}{8}\ cm^2$	1/2 1/2
Q.22.	$\angle AOP + \angle POB = 180°$ (∵ A, O & B are collinear)	
	$\Rightarrow \angle AOP = 180° - \angle POB = 180° - 115° = 65°$.	1/2
	$\angle PAO = 90°$ (radius ⊥ tangent)	1/2
	In triangle AOP, $\angle APO + \angle AOP + \angle PAO = 180°$ (angle sum property of triangle)	1/2
	$\Rightarrow \angle APO = 180° - \angle AOP - \angle PAO$ $= 180° - 90° - 65° = 25°$	
	Hence, $\angle APO = 25°$.	1/2

Q.23.

Given pair of equations are

2x + 3y = 7 and

(k + 2) x – 3 (1 – k) y = 5k + 1

For a pair of linear equations to have infinitely many solutions

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \qquad -(1)$$ 1/2

$$\frac{2}{k+2} = \frac{3}{-3(1-k)} = \frac{7}{5k+1}$$ 1/2

$$\Rightarrow \frac{2}{k+2} = \frac{\cancel{3}}{-\cancel{3}(1-k)}$$

$$\Rightarrow -2(1-k) = k+2$$ 1/2

$$\Rightarrow -2+2k = k+2$$

$$\Rightarrow k = 4$$ 1/2

Q.24

Given $\frac{AX}{AB} = \frac{1}{4}$ 1/2

$\frac{AY}{AC} = \frac{2}{2+6} = \frac{2}{8} = \frac{1}{4}$ 1

Since $\frac{AX}{AB} = \frac{AY}{AC}$, XY ∥ BC (Converse of BPT) 1/2

Q.25.

$4\ cot^2 45° - sec^2 60° + sin^2 60° + cos^2 90°$

$= 4 \times 1^2 - 2^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + 0$ 1

$= 4 - 4 + \frac{3}{4} + 0$ 1/2

$= \frac{3}{4}$ 1/2

OR

Given AB = 12 cm, CA = 5 cm and BC = 13 cm

(1/2 x 4 = 2)

$\sin B = \frac{AC}{BC} = \frac{5}{13}$ $\quad \tan B = \frac{AC}{AB} = \frac{5}{12}$

$\cos B = \frac{AB}{BC} = \frac{12}{13}$ $\quad \operatorname{cosec} B = \frac{BC}{AC} = \frac{13}{5}$

SECTION C

Section C consists of 6 questions of 3 marks each.

Q.26.

Given, x = a sinθ + b cosθ and y = a cosθ – b sin θ

$x^2 + y^2 = (a \sin\theta + b \cos\theta)^2 + (a \cos\theta - b \sin\theta)^2$ 1/2

$= a^2 \sin^2\theta + 2ab \sin\theta \cos\theta + b^2 \cos^2\theta + a^2 \cos^2\theta - 2ab \sin\theta \cos\theta + b^2 \sin^2\theta$ 1

$= a^2 (\sin^2\theta + \cos^2\theta) + b^2 (\sin^2\theta + \cos^2\theta)$ 1

$= a^2 + b^2$ 1/2

OR

LHS = $(\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2$

$= (\sin^2\theta + \operatorname{cosec}^2\theta + 2\sin\theta\operatorname{cosec}\theta) + (\cos^2\theta + \sec^2\theta + 2\cos\theta\sec\theta)$ (1 1/2)

$= (\sin^2\theta + \cos^2\theta) + (1 + \cot^2\theta) + 2 + (1 + \tan^2\theta) + 2$ 1/2

$= 1 + 6 + \tan^2\theta + \cot^2\theta$ 1/2

$= 7 + \tan^2\theta + \cot^2\theta$ 1/2

Hence proved.

Q.27.

Let $3 + 2\sqrt{5}$ be rational.

So, $3 + 2\sqrt{5} = \frac{a}{b}$; where a and b are co-primes and b≠ 0. 1/2

$2\sqrt{5} = \frac{a}{b} - 3$ 1/2

$2\sqrt{5} = \frac{a - 3b}{b}$ 1/2

$\sqrt{5} = \frac{a - 3b}{2b}$ 1/2

Here LHS is irrational and RHS is rational. 1/2

This contradiction has arisen due to our incorrect assumption. Hence our assumption is wrong.

∴ $3 + 2\sqrt{5}$ is irrational. 1/2

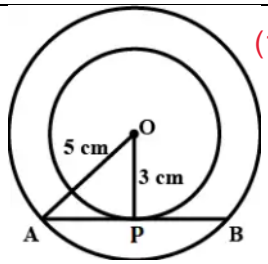
Q.28.

Let the two concentric circles with centre O.

AB be the chord of the larger circle which touches the smaller circle at point P.

∴ AB is tangent to the smaller circle to the point P.

⇒ OP ⊥ AB



(1)

By Pythagoras theorem in ΔOPA,

$OA^2 = AP^2 + OP^2$ 1/2

$\Rightarrow 5^2 = AP^2 + 3^2$ 1/2

$\Rightarrow AP^2 = 25 - 9$

$\Rightarrow AP = 4$ cm 1/2

Since OP ⊥ AB,

AP = PB (Perpendicular from the centre of the circle bisects the chord)

AB = 2AP = 2 × 4 = 8 cm 1/2

Q.29

Let the numerator be x and the denominator be y.

Then the fraction is $\frac{x}{y}$. 1/2

According to the question,

CASE 1 :

$x = y - 4$

$x = y - 4$.....(1)

CASE 2 :

$8(x - 2) = y + 1$

$8x - y = 17 \ldots\ldots\ldots\ldots(2)$ 1/2 + 1/2

from (1)

$8(y - 4) - y = 17$

$8y - 32 - y = 17$

$7y = 49$

$y = 7$ (1/2)

from (1)

$x = y - 4 \Rightarrow 3$ 1/2

thus

$\text{Fraction} = \frac{x}{y} = \frac{3}{7}$ 1/2

Q.30.

Let $f(x) = 5x^2 - 8x - 4$

By splitting the middle term, we get

$f(x) = 5x^2 - 10x + 2x - 4$ 1/2

$= 5x(x - 2) + 2(x - 2)$ 1/2

$= (5x + 2)(x - 2)$

$\Rightarrow 5x + 2 = 0$ or $x - 2 = 0$ 1/2

$x = -2/5$ or $x = 2$ 1/2

Sum of zeroes $= \alpha + \beta = \frac{-2}{5} + 2$

$= \frac{-2+10}{5} = \frac{8}{5}$ **or**

$= -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2} = -\frac{(-8)}{5} = \frac{8}{5}$ 1/2

Product of zeroes $= \alpha\beta = \frac{-2}{5} \times 2 = \frac{-4}{5}$ **or**

$= \frac{\text{Constant term}}{\text{Coefficient of } x^2} = \frac{-4}{5}$ 1/2

Hence verified.

Q.31.

Total number of possible outcomes = 52 – 6 = 46.

(i) P (a black king) $= \frac{2}{46} = \frac{1}{23}$ 1

(ii) P (a card of red colour) $= \frac{20}{46} = \frac{10}{23}$ 1

(iii) P (a card of black colour) $= \frac{26}{46} = \frac{13}{23}$ 1

OR

Total no. of outcomes = 4

(i) P (at least one head) $= \frac{3}{4}$ (1 x 3 = 3)

(ii) P (at most one head) $= \frac{3}{4}$ (iii) P (no head) $= \frac{1}{4}$

SECTION D

Section D consists of 4 questions of 5 marks each.

Q.32.

Given, to prove, construction

Fig — 2

Proof — 3

Q.33.

Classes	f_i	x_i	$d_i = x_i$ - a	$f_i d_i$
100 – 110	4	105	-20	-80
110 – 120	14	115	-10	-140
120 – 130	21	125=a	0	0
130 – 140	8	135	10	80
140 – 150	3	145	20	60
	50			-80

1 x 3 = 3

Mean $\bar{x}$ = a + $\frac{\sum f_i d_i}{\sum f_i}$ = 125 +($\frac{-80}{50}$) — 1/2 + 1/2

= 125 + (-1.6) — 1/2

= 123.4 — 1/2

Q.34.

TSA of the block = TSA of cube + CSA of hemisphere – Base area of hemisphere. — 1

total surface area of cube = $6 \times 6^2 = 216$

Total surface area of the block

$216 - \pi r^2 + 2\pi r^2$ 1/2

$= 216 + \pi r^2$

$= 216 + \frac{22}{7} \times \left(\frac{4.2}{2}\right)^2$ 1/2

$= 216 + \frac{22}{7} \times \frac{17.64}{4}$ 1/2

$= 216 + \frac{388.08}{28}$

$= 229.86 \text{ cm}^2$ 1/2

The volume of the block formed = volume of hemisphere+ volume of a cube 1/2

$= \frac{2}{3}\pi r^3 + a^3$ 1/2

$= \frac{2}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1 + 216$ 1/2

$= 19.404 + 216 = 235.40\ cm^3$ 1/2

OR

Given r = 2m, H = 21 m 1/2

Volume of earth taken out = $\pi r^2 H$ 1

$= \frac{22}{7} \times 2 \times 2 \times 21$ 1/2

$= 264\ m^3$ 1/2

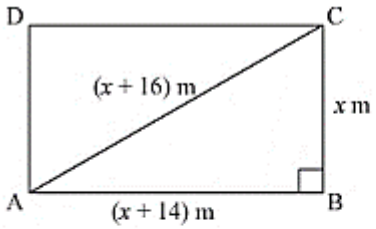
	And the volume of embankment of width 3 m which forms a shape of circular ring $= \pi ((5)^2 - (2)^2) \times h$	1
	$= \frac{22}{7} (25 - 4) \times h = 66\, h\ \text{m}^3$	1/2
	[$\because$ Outer radius $= 2 + 3 = 5$ cm]	
	$\because$ Volume of earth dug out = Volume of embankment	1/2
	$\therefore \quad 264 = 66h$	
	$\Rightarrow \quad h = \frac{264}{66} = 4$ m	1/2
	Hence, the height of the embankment is 4 m.	
Q.35.	Let the average speed of the train be x km/hr.	1/2
	Then, new average speed of the train $= (x + 6)$ km/hr	1/2
	Time taken by train to cover 54 km $= \frac{54}{x}$ hrs	
	And time taken by train to cover 63 km $= \frac{63}{(x+6)}$ hrs	
	According to the question, $\frac{54}{x} + \frac{63}{x+6} = 3$	
	According to the question, $\frac{54}{x} + \frac{63}{x+6} = 3$	1
	$\frac{54(x+6)+63x}{x(x+6)} = 3$	1/2
	$54x + 324 + 63x = 3x(x + 6)$	
	$324 + 117x = 3x^2 + 18x$	
	$3x^2 - 99x - 324 = 0$	
	$x^2 - 33x - 108 = 0$	1
	$x^2 - 36x + 3x - 108 = 0$	
	$x(x - 36) + 3(x - 36) = 0$	
	$(x + 3)(x - 36) = 0$	1/2
	$x = -3$ or 36	1/2

Since, speed cannot be negative

$x = 36$

so, First speed of train = 36 km/hr 1/2

OR



1

Let the shorter side of the rectangular field be x m.

Then, diagonal of the rectangular field = (x+ 16) m

Also, longer side of the rectangular field = (x +14) m

In right ΔABC

$(AB)^2 + (BC)^2 = (AC)^2$

$\Rightarrow (x + 14)^2 + x^2 = (x + 16)^2$ 1

$\Rightarrow x^2 + 196 + 28x + x^2 = x^2 + 256 + 32x$

$\Rightarrow x^2 - 4x - 60 = 0$ 1

$\Rightarrow x^2 - 10x + 6x - 60 = 0$

$\Rightarrow x(x - 10) + 6(x - 10) = 0$ 1/2

$\Rightarrow x + 6 = 0$ or $x - 10 = 0$

$\Rightarrow x = -6$ or $x = 10$ 1/2

Since length cannot be negative, so x = 10

therefore, the length of the shorter side = 10 m 1/2

Length of the diagonal = 10 +16 = 26m

Length of the longer side = 10 +14 = 24 1/2

SECTION E

Case study- based questions are compulsory.

Q.36.

Case Study- Based 1

(i) 80, 88, 96, ...

a = 80, d = 8

a_{10} = a + 9d — 1/2

= 80 + 9 x 8

= 80 + 72 = 152 — 1/2

(ii) a_{15} = a + 14d — 1/2

= 80 + 14 x 8

= 80 + 112 = 192 — 1/2

(iii) $S_{25} = \frac{25}{2}$ [2 x 80 + (25 – 1) 8] — 1

$= \frac{25}{2}$ (160 + 192) = $\frac{25}{2}$ x 352 = 25 x 176 = 4400 — (1/2 + 1/2)

OR

a_n = a + (n-1) d — 1/2

200 = 80 + (n – 1) x 8 — 1/2

120 = (n – 1) x 8 — 1/2

n – 1 = 15

n = 16 — 1/2

Q.37.

Case Study Based-2

(i) OC = $\sqrt{5^2 + 3^2} = \sqrt{25 + 9} = \sqrt{34}$ units — 1/2

C is nearest to the office. — 1/2

(ii) AC = $\sqrt{(5-2)^2 + (3-8)^2} = \sqrt{9 + 25} = \sqrt{34}$ units — (1/2 + 1/2)

(iii) D = ($\frac{7+5}{2}, \frac{7+3}{2}$) = (6, 5) — (1 + 1)

OR

AB = $\sqrt{(7-2)^2 + (7-8)^2} = \sqrt{25 + 1} = \sqrt{26}$ units — 1

BC = $\sqrt{(5-7)^2 + (3-7)^2} = \sqrt{4 + 16} = \sqrt{20}$ units — 1/2

Shortest distance is BC. — 1/2

Q.38.	**Case Study Based-3**	
	(i) 45°	1
	(ii) $\tan 30° = \frac{BC}{36}$	1/2
	$\frac{1}{\sqrt{3}} = \frac{BC}{36}$	
	$BC = \frac{36}{\sqrt{3}} = 12\sqrt{3}$ m	1/2
	(iii) $\tan 45° = \frac{AC}{36}$	1/2
	$1 = \frac{AC}{36}$; AC = 36m	1/2
	AB = AC – BC = $36 - 12\sqrt{3} = 12(3 - \sqrt{3})$ m.	1
	OR	
	(iv) $\cos 30° = \frac{36}{OB}$	1/2
	$\frac{\sqrt{3}}{2} = \frac{36}{OB}$; OB = $\frac{72}{\sqrt{3}} = 24\sqrt{3}$m	(1/2 + 1)

COMMON PRE-BOARD EXAMINATION 2022-23

Subject: MATHEMATICS (BASIC) 241

MARKING SCHEME

SET 1, 2, 3

Set 1		Set 2		Set 3	
Section A (1m each)		***Section A (1m each)***		***Section A (1m each)***	
Q.1.	**(C)** (6, -12)	**Q.1.**	**(D)** (3, 5)	**Q.1.**	**(B)** 6 cm
Q.2.	**(D)** 81	**Q.2.**	**(C)** $2^3 \times 3^3$	**Q.2.**	**(C)** 3
Q.3.	**(A)** -12	**Q.3.**	**(A)** -12	**Q.3.**	**(B)** 25
Q.4.	**(C)** 1	**Q.4.**	**(C)** 1	**Q.4.**	**(C)** $2^3 \times 3^3$
Q.5.	**(D)** $\frac{1}{9}$	**Q.5.**	**(D)** $\frac{1}{9}$	**Q.5.**	**(B)** 2 units
Q.6.	**(C)** 22 cm	**Q.6.**	**(C)** 22 cm	**Q.6.**	**(A)** 1
Q.7.	**(D)** (3, 5)	**Q.7.**	**(C)** (6, -12)	**Q.7.**	**(D)** (3, 5)
Q.8.	**(C)** $2^3 \times 3^3$	**Q.8.**	**(D)** 81	**Q.8.**	**(C)** 1
Q.9.	**(B)** 40	**Q.9.**	**(A)** (2, 0)	**Q.9.**	**(D)** $\frac{1}{9}$
Q.10.	**(A)** 1	**Q.10.**	**(D)** 7, 13	**Q.10.**	**(C)** 22 cm
Q.11.	**(B)** 6 cm	**Q.11.**	**(B)** 6 cm	**Q.11.**	**(C)** (6, -12)
Q.12.	**(C)** 3	**Q.12.**	**(C)** 3	**Q.12.**	**(D)** 81
Q.13.	**(B)** 25	**Q.13.**	**(B)** 25	**Q.13.**	**(A)** -12
Q.14.	**(A)** (2, 0)	**Q.14.**	**(B)** 2 units	**Q.14.**	**(A)** 45°
Q.15.	**(D)** 7, 13	**Q.15.**	**(A)** 1	**Q.15.**	**(D)** 7, 13

Q.16.	**(C)** $\frac{7}{24}$	**Q.16.**	**(A)** 6 cm	**Q.16.**	**(C)** $\frac{7}{24}$
Q.17.	**(A)** 6 cm	**Q.17.**	**(C)** $\frac{7}{24}$	**Q.17.**	**(A)** 6 cm
Q.18.	**(A)** 45°	**Q.18.**	**(A)** 45°	**Q.18.**	**(A)** (2, 0)
Q.19.	**(c)**	**Q.19.**	**(b)**	**Q.19.**	**(c)**
Q.20.	**(b)**	**Q.20.**	**(c)**	**Q.20.**	**(b)**
Section B (2m each)		***Section B (2m each)***		***Section B (2m each)***	
Q.21.		**Q.21.**	Q.21 [Set 1]	**Q.21.**	Q.25 [Set 1]
Q.22.		**Q.22.**	Q.24 [Set 1]	**Q.22.**	Q.22 [Set 1]
Q.23.		**Q.23.**	Q.25 [Set 1]	**Q.23.**	Q.23 [Set 1]
Q.24.		**Q.24.**	Q.22 [Set 1]	**Q.24.**	Q.21 [Set 1]
Q.25.		**Q.25.**	Q.23 [Set 1]	**Q.25.**	Q.24 [Set 1]
Section C (3m each)		***Section C (3m each)***		***Section C (3m each)***	
Q.26.		**Q.26.**	Q.30 [Set 1]	**Q.26.**	Q.28 [Set 1]
Q.27.		**Q.27.**	Q.31 [Set 1]	**Q.27.**	Q.29 [Set 1]
Q.28.		**Q.28.**	Q.28 [Set 1]	**Q.28.**	Q.26 [Set 1]
Q.29.		**Q.29.**	Q.29 [Set 1]	**Q.29.**	Q.27 [Set 1]
Q.30.		**Q.30.**	Q.26 [Set 1]	**Q.30.**	Q.30 [Set 1]
Q.31.		**Q.31.**	Q.27 [Set 1]	**Q.31.**	Q.31 [Set 1]
Section D (5m each)		***Section D (5m each)***		***Section D (5m each)***	
Q.32.		**Q.32.**	Q.34 [Set 1]	**Q.32.**	Q.33 [Set 1]
Q.33.		**Q.33.**	Q.33 [Set 1]	**Q.33.**	Q.32 [Set 1]
Q.34.		**Q.34.**	Q.32 [Set 1]	**Q.34.**	Q.35 [Set 1]
Q.35.		**Q.35.**	Q.35 [Set 1]	**Q.35.**	Q.34 [Set 1]
Section E (4m each)		***Section E (4m each)***		***Section E (4m each)***	
Q.36.		**Q.36.**	Q.37 [Set 1]	**Q.36.**	Q.36 [Set 1]

Q.37.		**Q.37.**	Q.36 [Set 1]	**Q.37.**	Q.38 [Set 1]
Q.38.		**Q.38.**	Q.38 [Set 1]	**Q.38.**	Q.37 [Set 1]