Basic Mathematics (241)
Marking Scheme
2023-24

Section A

1)	(b) xy^2	1
2)	(c) 20	1
3)	(b) ½	1
4)	(d) No Solution	1
5)	(d) 0,8	1
6)	(c) 5 Unit	1
7)	(a) $\Delta PQR \sim \Delta CAB$	1
8)	(d) RHS	1
9)	(b) 70°	1
10)	(b) ¾	1
11)	(b) 45°	1
12)	(a) $\sin^2 A$	1
13)	(c) $\pi : 2$	1
14)	(a) 7 cm	1
15)	(d) $\frac{1}{6}$	1
16)	(a) 15	1
17)	(a) 3.5 cm	1
18)	(b) 12-18	1
19)	(a) Both assertion and reason are true and reason is the correct explanation of assertion.	1
20)	(d) Assertion (A) is false but reason(R) is true.	1

SECTION B

21) $3x+2y = 8$	
$6x- 4y = 9$	
a_1=3, b_1=2, $c_1 = 8$	
a_2=6, b_2=-4, $c_2 = 9$	1
$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2}$ $\frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2}$ $\frac{c_1}{c_2} = \frac{8}{9}$	1/2
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ The given pair of linear equations are consistent.	1/2

22) Given:-AB II CD II EF		
To prove:- $\frac{AE}{ED} = \frac{BF}{FC}$		
Construction:- Join BD to intersect EF at G.		1/2
Proof:- in Δ ABD		
EG II AB (EF II AB)		
$\frac{AE}{ED} = \frac{BG}{GD}$ (by BPT)_____(1)		1/2
In ΔDBC		
GF II CD (EF II CD)		
$\frac{BF}{FC} = \frac{BG}{GD}$ (by BPT)_____(2)		1/2
$from$ (1) & (2)		
$\frac{AE}{ED} = \frac{BF}{FC}$		1/2
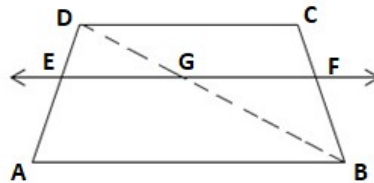
OR

Given AD=6cm, DB=9cm		
AE=8cm, EC=12cm, ∠ADE=48		
To find:- ∠ABC=?		
Proof:		
In ΔABC		
$\frac{AD}{DB} = \frac{6}{9} = \frac{2}{3}$ ……(1)		
$\frac{AE}{EC} = \frac{8}{12} = \frac{2}{3}$ ……..(2)		
From (1) & (2)		1
$\frac{AD}{DB} = \frac{AE}{EC}$		
DE II BC (Converse of BPT)		
∠ADE=∠ABC (Corresponding angles)		
⇒ ∠ABC=48˚		1
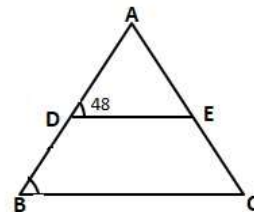
23) In Δ OTA, ∠OTA = 90°

By Pythagoras theorem

$OA^2 = OT^2 + AT^2$

$(5)^2 = OT^2 + (4)^2$ 1/2

$25 - 16 = OT^2$

$9 = OT^2$ 1/2

OT = 3cm

radius of circle = 3cm.   1
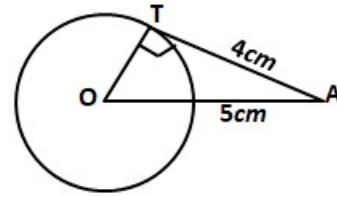
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24) $\sin^2 60° + 2\tan 45° - \cos^2 30°$

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

$= \frac{3}{4} + 2 - \frac{3}{4}$

$= 2$ 1

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25) Area of the circle= sum of areas of 2 circles

$\pi R^2 = \pi(40)^2 + \pi(9)^2$ 1/2

$\pi R^2 = \pi \times (40^2 + 9^2)$ 1/2

$R^2 = 1600 + 81$

$R^2 = 1681$

$R = 41\ cm.$ 1/2

$Diameter\ of\ given\ circle = 41 \times 2 = 82cm$ 1/2

OR

radius of circle = 10cm, $\theta = 90°$

Area of minor segment = $\frac{\theta}{360°}\pi r^2$ - Area of Δ

$= \frac{\theta}{360°} \times \pi\ r^2 - \frac{1}{2} \times b \times h$ 1/2

$= \frac{90°}{360°} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10$ 1/2

$= \frac{314}{4} - 50$

$= 78.5 - 50 = 28.5\ cm^2$ 1/2

Area of minor segment = 28.5 cm²   1/2

Section C

26) Let us assume that $\sqrt{3}$ be a rational number

$\sqrt{3} = \frac{a}{b}$ where a and b are co-prime.   1

squaring both the sides

$\left(\sqrt{3}\right)^2 = \left(\frac{a}{b}\right)^2$ 1/2

$3 = \frac{a^2}{b^2} \Rightarrow a^2 = 3b^2$

a^2 is divisible by 3 so a is also divisible by 3_____(1)

let a=3c for any integer *c*.

$(3c)^2 = 3b^2$ 1/2

$9c^2 = 3b^2$

$b^2 = 3c^2$

since b^2 is divisible by 3 so, b is also divisible by 3 _____(2)

From (1) & (2) we can say that 3 in a factor of a and b   1/2

which is contradicting the fact that a and b are co- prime.

Thus, our assumption that $\sqrt{3}$ is a rational number is wrong.

Hence, $\sqrt{3}$ is an irrational number.   1/2

27) P(S)= $4S^2$ -4S+1

$4S^2$ -2S-2S+1=0

2S(2S-1)-1(2S-1)=0

(2S-1) (2S-1)=0

S = ½   S = ½   1

a = 4   b = - 4   c = 1 $\propto = ½$ $\beta = ½$

$\propto + \beta = \frac{-b}{a}$, $\propto \beta = \frac{c}{a}$

$\frac{1}{2} + \frac{1}{2} = \frac{-4}{4}$, $\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{4}$ 1

$\frac{1+1}{2} = \frac{+4}{4}$, $\frac{1}{4} = \frac{1}{4}$

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

$1 = 1$ 1

28) Let cost of one bat be Rs x

Let cost of one ball be Rs y 1/2

ATQ

$4x + 1y$ = 2050_____(1)

$3x + 2y$ = 1600_____(2)   1/2

from (1)$4x + 1y$ = 2050

$y = 2050 - 4x$ 1/2

Substite value of y in (2)

$3x + 2(2050 - 4x) = 1600$

$\qquad$ 3x + 4100 - 8x = 1600

$\qquad\qquad$ -5x = -2500

$\qquad\qquad\qquad x = 500$ $\qquad$ 1/2

Substiture value of x in (1)

$\quad 4x + 1y = 2050$

$\quad 4(500) + y = 2050$

$\quad 2000 + y = 2050$

$\quad y = 50$ $\qquad$ 1/2

Hence

Cost of one bat = Rs. 500 $\qquad$ 1/2

Cost of one ball = Rs. 50

OR

Let the fixed charge for first 3 days= Rs. x

And additional charge after 3 days= Rs. y $\qquad$ 1/2

ATQ

$x + 4y = 27$--------------(1)

$x + 2y = 21$ -------------(2) $\qquad$ 1/2

Subtract eqⁿ (2) from (1)

$2y = 6$

$y = 3$ $\qquad$ 1

Substitute value of y in (2)

$x + 2(3) = 21$

$x = 21 - 6$

$x = 15$ $\qquad$ 1

Fixed charge= Rs. 15

Additional charge per day = Rs. 3

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29) Given circle touching sides of ABCD at P,Q,R and S

To prove- AB+CD=AD+BC

Proof-

AP=AS-------(1) $\qquad$ tangents from an external point

PB=BQ-------(2) $\qquad$ to a circle are equal in length

DR=DS-------(3)

CR=CQ-------(4) $\qquad$ 1

Adding eqⁿ (1),(2),(3) & (4)

AP+BP+DR+CR=AS+DS+BQ+CQ

AB+DC=AD+BC $\qquad$ 1

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30) $(cosec\theta - \cot\theta)^2 = \frac{1-cos\theta}{1+cos\theta}$

LHS$=(cosec\theta - cot\theta)^2$

$= \left(\frac{1}{sin\theta} - \frac{cos\theta}{sin\theta}\right)^2$ $\qquad$ 1/2
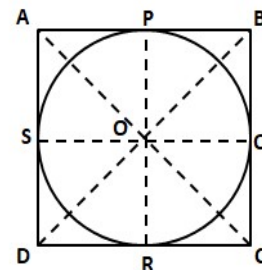
$= \left(\frac{1-cos\theta}{sin\theta}\right)^2$ $\qquad$ 1/2

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta}$$

$$= \frac{(1-\cos\theta)^2}{1-\cos^2\theta} \qquad\qquad 1$$

$$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)(1+\cos\theta)}$$

$$= \frac{1-\cos\theta}{1+\cos\theta} = \text{RHS} \qquad\qquad 1$$

LHS = RHS, Hence Proved

OR

$secA\,(1-sinA)(\sec A + tanA)=1$

$LHS = \frac{1}{cosA}(1-sinA)\left(\frac{1}{cosA}+\frac{sinA}{cosA}\right)$ 1

$= \frac{(1-\sin A)}{\cos A}\frac{(1+\sin A)}{\cos A}$

$= \frac{(1-\sin A)\,(1+\sin A)}{cos^2 A}$

$= \frac{1-sin^2 A}{cos^2 A} \qquad (1-sin^2 A = cos^2 A)$ 1

$= \frac{cos^2 A}{cos^2 A}$

= 1 = RHS   1

LHS=RHS. Hence Proved

31) (i) Red balls= 6 , Black balls = 4 , White balls = x	
P(white ball) = $\frac{x}{10+x} = \frac{1}{3}$	1
$\Rightarrow$ 3x = 10 + x $\Rightarrow$ x= 5 white balls	1/2
(ii) Let y red balls be removed, black balls = 4, white balls = 5	
P(white balls)= $\frac{5}{(6-y)+4+5} = \frac{1}{2}$	1
$\Rightarrow \frac{5}{15-y} = \frac{1}{2} \Rightarrow 10 = 15 - y \Rightarrow y = 5$	½
So 5 balls should be removed.	

Section D

32) Let the speed of train be $x\ km/hr$	1/2
distance= 360 km	
Speed = $\frac{distance}{time}$	
Time = $\frac{360}{x}$	1/2
New speed = $(x+5)km/hr$	
Time = $\frac{D}{5}$	
$x + 5 = \frac{360}{\left(\frac{360}{x}-1\right)}$ 1	
$(x+5)\left(\frac{360}{x}-1\right) = 360$	

$(x + 5)(360 - x) = 360x$

$-x^2 - 5x + 1800 = 0$

$x^2 + 5x - 1800 = 0$ 1

$x^2 + 45x - 40x - 1800 = 0$

$x(x + 45) - 40(x + 45) = 0$

$(x + 45)(x - 40) = 0$ 1

$x + 45 = 0$, $x - 40 = 0$

$x = -45$, $x = 40$

Speed cannot be negative

Speed of train =40km/hr   1

<center>**OR**</center>

Let the speed of the stream=$x km/hr$ 1/2

Speed of boat= $18\ km/hr$

Upstream speed= $(18 - x)km/hr$

Downstream speed=$(18 + x)km/hr$ 1/2

Time taken (upstream)=$\dfrac{24}{(18-x)}$

Time taken (downstream)=$\dfrac{24}{(18+x)}$

ATQ

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

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

$24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$

$24(18 + x - 18 + x) = (18)^2 - x^2$

$24(2x) = 324 - x^2$

$48x - 324 + x^2 = 0$

$x^2 + 48x - 324 = 0$ 1

$x^2 - 6x + 54x - 324 = 0$

$x(x - 6) + 54(x - 6) = 0$

$(x - 6)(x + 54) = 0$ 1

$x - 6 = 0$, $x + 54 = 0$

$x = 6$, $x = -54$

Speed cannot be negative   1

Speed of stream=$6 km/hr$

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33) Given ΔABC , DE || BC

To prove $\dfrac{AD}{DB} = \dfrac{AE}{EC}$

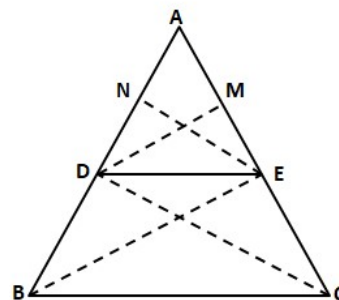Construction: join BE and CD   1/2

Draw DM $\perp$ AC and EN $\perp$ AB

Proof: $Area\ of\ \Delta ADE = \dfrac{1}{2}$ x b x h

$= \dfrac{1}{2}$x AD x EN----------------------(1)

Area $(\Delta DBE) = \dfrac{1}{2}$x DB x EN--------(2)

Divide eq^n (1) by (2)

$\dfrac{\text{ar } \Delta ADE}{\text{ar } \Delta DBE} = \dfrac{\frac{1}{2}\text{X AD X EN}}{\frac{1}{2}\text{X DB X EN}} = \dfrac{AD}{DB}$-----------(3)   1

area $\Delta ADE = \frac{1}{2}$ x AE x DM -------(4)

area $\Delta DEC = \frac{1}{2}$ x EC x DM -------(5)

Divide eqⁿ (4) by (5)

$\frac{\text{ar } \Delta ADE}{\text{ar } \Delta DEC} = \frac{\frac{1}{2} X\ AE\ X\ DM}{\frac{1}{2} X\ EC\ X\ DM} = \frac{AE}{EC}$-----------(6)   1

ΔBDE and ΔDEC are on the same base DE and between same parallel lines BC and DE

$\therefore area\ (\Delta DBE) = ar\ (\ DEC)$

hence

$\frac{ar(\Delta ADE)}{ar\ (\Delta DBE)} = \frac{ar(\Delta ADE)}{ar\ (\Delta DEC)}$ [LHS of (3) =RHS of (6)]

$\frac{AD}{DB} = \frac{AE}{EC}$ [RHS of (3) = RHS of (6)   1/2

Since $\frac{PS}{SQ} = \frac{PT}{TR}$ $\therefore ST \parallel QR$ (*by converse of BPT*)
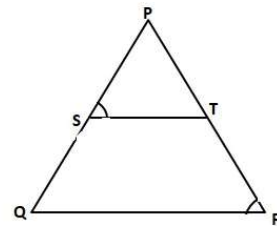
∠PST = ∠PQR   (Corresponding angles)   1

But ∠PST = ∠PRQ (given)

∠PQR = ∠PRQ

PR = PQ (sides opposite to equal angles are equal

Hence ΔPQR is isosceles.   1

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34) Diameter of cylinder and hemisphere = 5mm radius, (r) = $\frac{5}{2}$

Total length = 14mm

Height of cylinder = 14 - 5 = 9mm   1

CSA of cylinder = 2πrh

= 2 x $\frac{22}{7}$ x $\frac{5}{2}$ x 9

= $\frac{990}{7}$ mm²   1

CSA of hemispheres = 2πr²

= 2x $\frac{22}{7}$ x $\left(\frac{5}{2}\right)^2$

= $\frac{275}{7}$ mm²   1

CSA of 2 hemispheres = 2 x $\frac{275}{7}$

= $\frac{550}{7}$ mm²   1

Total area of capsule = $\frac{990}{7} + \frac{550}{7}$

= $\frac{1540}{7}$

= 220 mm²   1

OR

Diameter of cylinder = 2.8 cm

$radius$ of cylinder = $\frac{2.8}{2}$ = 1.4 cm

$radius$ of cylinder = $radius$ of hemisphere = 1.4 cm

Height of cylinder = 5-2.8   1

= 2.2 cm

Volume of 1 Gulab jamun = vol. of cylinder + 2 x vol. of hemisphere

= $\wedge r^2$h + 2 x $\frac{2}{3} \wedge r^3$ 1

$\frac{22}{7}$ x $(1.4)^2$ x 2.2 + 2 x $\frac{2}{3}$x $\frac{22}{7}$ x $(1.4)^3$

= 13.55 + 11.50

= 25.05 cm^3 1

$volume\ of\ 45\ Gulab\ jamun = 45\ x25.05$

$syrup\ in\ 45\ Gulab\ jamun = 30\%\ x\ 45\ x\ 25.05$

= $\frac{30}{100}$ x 45 x 25.05   1

= 338.175 cm³

≈ 338 cm³

35)

Life time (in hours)	Number of lamps(f)	Mid x	d	fd
1500-2000	14	1750	-1500	-21000
2000-2500	56	2250	-1000	-56000
2500-3000	60	2750	-500	-30000
3000-3500	86	3250	0	0
3500-4000	74	3750	500	37000
4000-4500	62	4250	1000	62000
4500-5000	48	4750	1500	72000
	400			64000

2

Mean = a + $\frac{\Sigma fd}{\Sigma f}$ 1/2

a = 3250   1/2

Mean $= 3250 + \dfrac{64000}{400}$	1
$\quad = 3250 + 160$	
$\quad = 3410$	
Average life of lamp is 3410 hr	1

Section E

36) $a_6 = 16000 \quad a_9 = 22600$

$a + 5d = 16000 \text{-------(1)}$

$a + 8d = 22600 \quad \text{--------(2)}$

substitute $a = 1600 - 5d$ from (1)

$16000 - 5d + 8d = 22600$

$3d = 22600 - 16000$

$3d = 6600$

$d = \dfrac{6600}{3} = 2200$

$a = 16000 - 5(2200)$

$a = 16000 - 11000$

$a = 5000$

(i) $a_n = 29200, \ a = 5000, \quad d = 2200$

$\quad a_n = a + (n-1)d$

$\quad 29200 = 5000 + (n-1)2200$ 1/2

$\quad 29200 - 5000 = 2200n - 2200$

$\quad 24200 + 2200 = 2200n$

$\quad 26400 = 2200n$

$\quad n = \dfrac{264}{22}$

$\quad n = 12$ 1/2

in 12th year the production was Rs 29200

(ii) $n = 8, \ a = 5000, \quad d = 2200$

$\quad a_n = a + (n-1)d$ 1/2

$\quad = 5000 + (8-1)2200$ 1/2

$\quad = 5000 + 7 \times 2200$

$\quad = 5000 + 15400$ 1/2

$\quad = 20400$

The production during 8th year is $= 20400$ 1/2

OR

$\quad n = 3, \quad a = 5000, \quad d = 2200$

$\quad s_n = \dfrac{n}{2}[\, 2a + (n-1)d\,]$ 1/2

$= \frac{3}{2}$ [2(5000) + (3-1) 2200]

$S_3 = \frac{3}{2}$ (10000 + 2 x 2200)   1/2

$= \frac{3}{2}$ (10000 + 4400)   1/2

= 3 x 7200

= 21600   1/2

The production during first 3 year is 21600

(iii) a_4 = a+3d

= 5000 + 3 (2200)

= 5000 + 6600

= 11600   1/2

a_7 = a+6d

= 5000 + 6 x 2200

=5000 + 13200

= 18200

a_7 - a_4 = 18200-11600 = 6600   1/2

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37) coordinates of A (2, 3)   Alia's house

coordinates of B (2, 1)   Shagun's house

coordinates of C (4,1)   Library

(i) AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(2 - 2)^2 + (1 - 3)^2}$ 1/2

$= \sqrt{(0^2 + (-2)^2}$

$AB = \sqrt{0 + 4}$ $= \sqrt{4}$ = 2 units   1/2

Alia's house from shagun's house is 2 units

(ii) C(4,1), B (2,1)

CB = $\sqrt{(2 - 4)^2 + (1 - 1)^2}$ 1/2

$= \sqrt{(-2)^2 + 0^2}$

$= \sqrt{4 + 0} = \sqrt{4}$ = 2 unit   1/2

(iii)   0(0,0), B(2,1)

OB = $\sqrt{(2 - 0)^2 + (1 - 0)^2}$

$= \sqrt{2^2 + 1^2}$ $= \sqrt{4 + 1}$ $= \sqrt{5}$ units   1

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units   1/2

OB is greater than AB and CB,   1/2

For shagun, school [O]   is farther than Alia's house [A] and Library [C]

OR

C (4, 1), A(2, 3)

$CA = \sqrt{(2-4)^2 + (3-1)^2}$

$= \sqrt{(-2)^2 + 2^2} +$ $= \sqrt{4+4}$ $= \sqrt{8}$

$= 2\sqrt{2}$ units $AC^2 = 8$ 1

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units   1/2

$AB^2 + BC^2 = 2^2 + 2^2 = 4 + 4 = 8 = AC^2$ ½

Therefore A, B and C form an isosceles right triangle.

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38)

(i) XY ∥ PQ and AP is transversal.

∠APD = ∠PAX (alternative interior angles)   1/2

∠APD=45°   1/2

(ii) Since XY ∥ PQ and AQ is a transversal

so alternate interior angles are equal

hence ∠YAQ = ∠AQD=30°   1/2

(iii)   In $\Delta\,ADP$, $\theta = 45°$

$\tan\theta = \dfrac{P}{B}$

$\tan 45° = \dfrac{100}{PD}$ 1/2

PD=100 m

          1/2

Boat P is 100 m from the light house   1

OR

In ΔADQ, $\theta = 30°$

$\tan\theta = \dfrac{P}{B}$ 1/2

$\tan 30 = \dfrac{100}{DQ}$

$\dfrac{1}{\sqrt{3}} = \dfrac{100}{DQ}$ 1/2

DQ = $100\sqrt{3}$ m   1