Basic Mathematics (241)
Marking Scheme
2023-24

Section A

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

SECTION B

21) $3x+2y = 8$

$6x- 4y = 9$

a_1=3, a_2=6 , $C_{1=8}$

b_1=2, b_2=-4, C_2=9 1

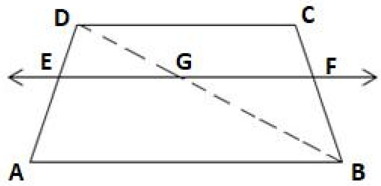
$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2}$ $\frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2}$ $\frac{c_1}{c_2} = \frac{8}{9}$ 1/2

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

The given pair of lines is consistent. 1/2

22) Given:-AB II CD II EF

To prove:- $\frac{AB}{ED} = \frac{BF}{FC}$



Constant:- Join BD which 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)

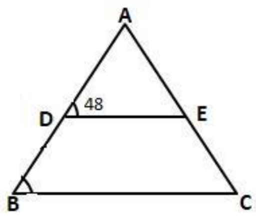
$\frac{AE}{ED} = \frac{BF}{FC}$ 1/2

OR

Given AD=6cm, DB=9cm

AE=8cm, EC=12cm, ∠ADE=48

To find:- ∠ABC=?



Proof:

In ΔABC

Consider, $\frac{AD}{DB} = \frac{AE}{EC}$

$\frac{6}{9} = \frac{8}{12}$

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

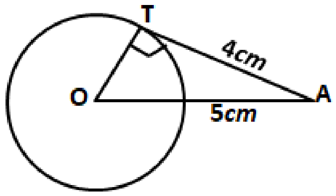
$\frac{AD}{DB} = \frac{AE}{EC}$

DEIIBC (Converse of BPT)

∠ADE=∠ABC (Corresponding angles)∠ABC=48˚ 1

23) In Δ OTA, $\angle$OTA = 90°

By Pythagoras theorem



$OA^2 = OT^2 + AT^2$ 1/2

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

$25-16= OT^2$

$9 = OT^2$ 1/2

OT=3cm

radius of circle = 3cm. 1

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24) $Sin^2 60^\circ + 2 \tan 45^\circ - \cos^2 30^\circ$

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

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

$R^2 = 1600 + 81$

$R^2 = 1681$

$R = 41 \ cm.$ 1/2

$Diameter \ of \ given \ circle = 41x2 = 82cm$ 1/2

OR

r of circle = 10cm $\theta = 90^\circ$

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

$= \frac{\theta}{360^\circ} x \, \pi \, r^2 - \frac{1}{2} x \, b \, x \, h$ 1/2

$= \frac{90^\circ}{360^\circ} x3.14 \, x \, 10 \, x \, 10 - \frac{1}{2} \, x \, 10 \, x \, 10$ 1/2

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

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

A of segment = $28.5 \ cm^2$ 1/2

Section C

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

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

squaring on both the sides

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

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

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

let a=3cfor any integer c.

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

ac^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- primes.

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

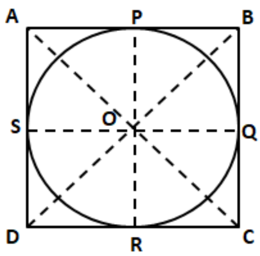
$1 = 1$

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
$Substiture\ value\ of\ y\ in\ (2)$	
$[3x + 2(2050 - 4x) = 1600]$	
3x + 4100 – 8x =1600	
-5x $= -2500$	
$x = 500$	1/2
$Substiture\ value\ of\ x\ in\ (1)$	
$4x + 1y = 2050$	
$4(500) + y = 2050$	
$2000 + y = 2050$	
$y = 50$	1/2
Hence	
Cost of one bat=Rs 500	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	1/2
ATQ	
$x + 4y = 27$---------------(1)	
$x + 2y = 21$ --------------(2)	1/2
Subtract eq^n (2) from (1)	
$x + 4y = 27$	
$x + 2y = 21$	
$2y = 6$	
$y = 3$	1
Substitute value of y in (2)	
$x + 2y = 21$	
$x + 2(3) = 21$	
$x = 21 - 6$	
$x = 15$	1
Fixed charge= RS 15	
Additional charge = Rs 3	
29) Given circle touching sides of ABCD at P,Q,R and S	
To prove- AB+CD=AD+DA	
Proof- 	1
AP=AS-------(1) tangents from same point	
PB=BQ-------(2) to a circle are equal in length	
DR=DS-------(3)	
CR=CQ-------(4)	1
Adding eq^n (1),(2),(3) & (4)	
AP+BP+DR+CR=AS+DS+BQ+CQ	
AB+DC=AD+BC	1

30) $(cosec\theta - \cot\theta) = \frac{1-cos\theta}{1+cos\theta}$	
LHS=$(cosec\theta - cot\theta)^2$	
$= \left(\frac{1}{sin\theta} - \frac{\cos\theta}{sin\theta}\right)^2$	1/2
$= \left(\frac{1-\cos\theta}{sin\theta}\right)^2$	1/2
$= \frac{(1-\cos\theta)^2}{sin^2\theta}$	
$= \frac{(1-\cos\theta)^2}{1-cos^2\theta}$	1
$= \frac{(1-\cos\theta)^2}{(1-cos\theta)(1+cos\theta)}$	
$= \frac{1-cos\theta}{1-cos\theta}$	1
$\text{LHS} = \text{RHS}$	
OR	
SecA $(1 - sinA)(\sec A + tanA)$=*1*	
LHS=$\frac{1}{cosA}(1 - sinA)\left(\frac{1}{cosA} - \frac{sinA}{cosA}\right)$	1
= $\frac{(1-\sin A)}{\cos A}\frac{(1+\sin A)}{\cos A}$	
= $\frac{(1-\sin A)\,(1+\sin A)}{cos^2 A}$	
= $\frac{1-sin^2 A}{cos^2 A}$ (1-$sin^2 A = cos^2 A$)	1
= $\frac{cos^2 A}{cos^2 A}$	
= 1	1
LHS=RHS	
31) Red color balls= 6	
Black color balls= 4	
Total ball=10	1/2
P(S)=$\frac{fawourable\ out\ comes}{total\ no\ of\ out\ comes}$	1/2
P(Red)= $\frac{6}{10} = \frac{3}{5}$	1
P(Not Red) = 1-$\frac{3}{5}$= $\frac{5-3}{5}$ = $\frac{2}{5}$	1
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

$x+45=0$ $\quad\quad$ $x-40=0$

$x=-45$ $\quad\quad$ $x=40$

Speed cannot be negative

Speed of train =40km/hr 1

OR

Let the speed of the stream=xkm/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)=$\frac{24}{(18-x)}$

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

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

$x-6=0$ $\quad\quad$ $x+54=0$

$x = 6$ $\qquad$ $x = -54$

Speed cannot be negative 1

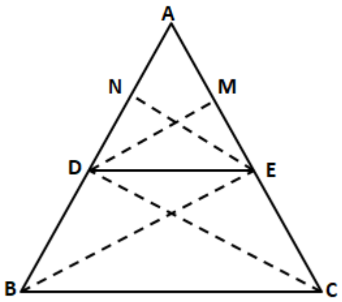
Speed of stream=$6km/hr$

33) Given $\Delta\ ABC$ =DE||BC

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

Construction: join BE and CD 1/2

Draw DM ⊥ AC and EN ⊥ CD



Proof: $or\ \ \Delta ABC = \frac{1}{2}$ x b x h

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

Or $\Delta ABC = \frac{1}{2}$x DB x EN--------(2)

Divide eq^n (1) by (2)

$\frac{\text{Or } \Delta ABC}{\text{Or } \Delta BDE} = \frac{\frac{1}{2} X\ AD\ X\ EN}{\frac{1}{2} X\ DB\ X\ EN} = \frac{AD}{DB}$-----------(A) 1

Or $\Delta ABC = \frac{1}{2}$ x AE x DM -------(3)

Or $\Delta DEC = \frac{1}{2}$ x EC x DM -------(4)

Divide eq^n (3) by (4)

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

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

$-\ or\ (BDE) = or\ (\ DEC)$

$hence$

$\frac{ar\ \Delta ADE}{ar\ \Delta BDE} = \frac{ar\ \Delta ADE}{ar\ \Delta DEC}$

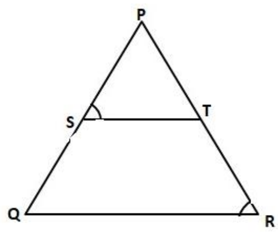
$\frac{AD}{DB} = \frac{AE}{EC}$ (from (A) and (B)) 1/2

$Given$

$\frac{PS}{PQ} = \frac{PT}{TR}$

∠PST = ∠PRQ

To prove :- PQR is an isosceles Δ^{le}



Proof :- $\frac{PS}{PQ} = \frac{PT}{TR}$

∠PST = ∠PQR (Corresponding angles) 1

But ∠PST = ∠PRQ

∠PQR = ∠PRQ

PR = PQ (sides opposite to equal angles are equal

- ΔPQR is isosceles Δ^{le}. 1

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

Total weight = 14mm

Height of cylinder = 14 - 5 = 9mm 1

CSA of cylinder = $2\pi rh$

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

$= \frac{990}{7}$ mm^2 1

CSA of hemispheres = $2\pi r^2$

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

$= \frac{275}{7}$ mm^2 1

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

$= \frac{550}{7}$ mm^2 1

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

$= \frac{1540}{7}$

= 220 mm^2 1

OR

Diameter of cylinder = 2.8 cm

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

r of cylinder = r 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

$= \pi r^2 h + 2 \times \frac{2}{3} \pi r^2$ 1

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

$= 13.55 + 11.50$

$= 25.05\ cm^3$ 1

$volume\ of\ us\ gulab\ jamun = 45 \times 25.05$

$syrup\ jin\ 45\ jamun = 30\% \times 45 \times 25.05$

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

$= 338.185\ cm^3$

$= 338\ cm^3$ 1

35)

Life time (in hours)	Number of lamps	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 + $\frac{64000}{400}$ 1

= 3250 + 160

= 3410

Average life of lamp is 3410 hr 1

Section E

36) a_6 =16000 a_9 = 22600

a+5d=16000-------(1)

a=16000-5d

a+8d=22600 --------(2)

substitute in (2)

16000-sd + 8d = 22600

3d = 22600-16000

3d=6600

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

a = 16000-5(2200)

a = 16000-11000

a = 5000

(i) a_n = 29200 a = 5000   d = 2200

a_n = a + (n-1)d

29200 = 5000 + (n – 1)2200 1/2

29200-5000 = 2200n-2200

24200+2200=2200n

26400=2200n

n= $\frac{264}{22}$

n=12 1/2

in 12th year the production was Rs 29200

(ii) n=8, a=5000,   b=2200

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

= 5000+(8-1)2200 1/2

= 5000+7 x 2200

= 5000+15400 1/2

= 20400

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

OR

n = 3, a = 5000, b = 2200

$s_n = \frac{n}{2}$ [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 = 7400 1/2

37) coordinates of A (2,3)- Alia is house

coordinates of B (2,1)- Shagun is 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

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

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

$Alia's\ house\ from\ shagun's\ house\ is\ 2\ unit$

(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

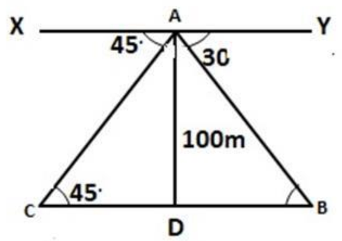
$AC^2 + BC^2 = 2^2 + 2^2 = 4 + 4 = 8$ ½

Therefore A,B and C form a right triangle.

38) (i) XY ‖CD and AC is transversal.

∠ACD = ∠CAX (alt.int ∠S) 1/2

∠ACD=30˚ 1/2



(ii) ∠YAB = 30˚

∠ABD = 30˚ 1/2

Because XY || CD and AB is a transversal

so alternate interior angles are equal

∠YAB=∠ABD 1/2

(iii) CD=?

In $\Delta\, ADC\ \theta = 45^\circ$

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

$\tan 45^\circ = \frac{100}{B}$

$1 = \frac{100}{B}$ 1/2

B=100m

CD = 100m 1

OR

BD=?

In $\Delta ABD \quad \theta = 30^\circ$

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

$\tan 30 = \frac{100}{BD}$

$\frac{1}{\sqrt{3}} = \frac{100}{BD}$ 1/2

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