STUDENT NAME | TOTAL MARKS
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SINDHI HIGH SCHOOL BENGALURU

I-PRE BOARD EXAMINATION - 2023

MATHEMATICS STANDARD-041

CLASS : 10

MAX. MARKS : 80

DATE : 11.12.2023

DURATION : 3 hr 15 mins

SET-2

KEY ANSWER

SECTION - A

1. b) 1 — 1
2. a) 0 — 1
3. d) No value of k — 1
4. c) $b^2 - 4ac$, a perfect square — 1
5. d) 3 — 1
6. d) 1 : 1 — 1
7. c) 4 units — 1
8. b) 3 units — 1
9. d) 30° — 1
10. c) 7 cm — 1
11. b) 2 — 1
12. c) -1 — 1
13. d) $\frac{150}{\sqrt{2}}$ m — 1
14. a) 2 : 1 — 1
15. c) One-eighth of area of the circle — 1
16. c) $\frac{5}{9}$ — 1
17. b) $\frac{4}{21}$ — 1
18. d) 80-90 — 1
19. a) Both true and R is the correct explanation. — 1
20. a) same reasons. — 1

SECTION - B

21. Let $\sqrt{5}$ be an irrational

Say $\sqrt{5} = p/q$ where p & q are integers (+ve) — $\frac{1}{2}$

$q \neq 0$. HCF $(p, q) = 1$

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Sq. On b.s

$5 = \frac{p^2}{q^2}$

$q^2 = \frac{p^2}{5}$ — (1)

$\Rightarrow$ 5 divides p^2, as p prime, 5 divides p also. $\frac{1}{2}$

Hence $\frac{p}{5} = c$ for some tive c

$p = 5c$

sub in $q^2 = \frac{25c^2}{5} = 5c^2$ $\frac{1}{2}$

$\Rightarrow$ 5 divides q^2, as ~~q~~ prime 5 divides q also.

Hence p & q has atleast one divisor 5 $\frac{1}{2}$

which contradicts HCF (p, q) = 1

$\therefore \sqrt{5}$ is is irrational. $\boxed{2}$

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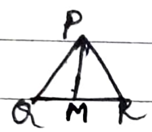
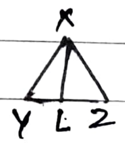
22. 



$\frac{PQ}{XY} = \frac{QR}{YZ}$ (as $PQR \sim \Delta XYZ$)

$\frac{PQ}{XY} = \frac{2QM}{2YL}$ (PM & XL Medians) $\frac{1}{2}$

In PQM & XYL $\frac{PQ}{XY} = \frac{QM}{YZ}$ & $\angle Q = \angle Y$

$\therefore \Delta PQM \sim \Delta XYZ$ (AA) $\frac{1}{2}$

$\therefore \frac{PQ}{XY} = \frac{PM}{XL} \Rightarrow \frac{9}{7} = \frac{15}{XL}$ 1

$XL = \frac{105}{9} = 11.6$ cm. $\boxed{2}$

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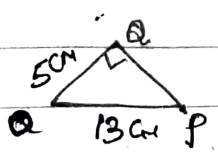
23. 

$\angle Q = 90°$ [radius ⊥ tgt thr' pt of contact]

$PQ = \sqrt{13^2 - 5^2} = 12$ cm. $\frac{1}{2}$

$\Delta OQP \cong \Delta ORP$ (SSS)

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(2)

$\therefore ar(OQP) = ar(ORP)$

$\therefore$ area $PQOR = 2(OQP)$ $\frac{1}{2}$

$= 2 \times \frac{1}{2} \times 5 \times 12$ 1

$= 60 cm^2$ $\boxed{2}$

24. $2(2)^2 + x\left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{4}\left(\frac{1}{\sqrt{3}}\right)^2 = 0$ 1

$\frac{3x}{4} = \frac{1}{4} - 8 = \frac{-31}{4}$ $\frac{1}{2}$

$x = \frac{-31}{3}.$ $\frac{1}{2}$ $\boxed{2}$

OR.

$A + B + C = 180°$ ③ (angles of Δ sum upto $180°$) $\frac{1}{2}$

$A + B - C = 90°$ ①
$B + C - A = 60$ ② $\frac{1}{2}$

add, $2B = 150$ $\frac{1}{2}$

$B = 75°$

from ③ $A + C = 180 - 75° = 105°$ $\frac{1}{2}$

from ① $A - C = 90 - 75° = 15°$ not required

$2A = 120$ $A = 60°$, $C = 105° - 60° = 45°$ $\boxed{2}$

25. No. of sectors $= 7$.

$\theta = 15°$. $r = 24 cm$

arc length of 7 sectors $= 7 \times \frac{\theta}{360°} \times 2\pi r$

$= 7 \times \frac{15}{360} \times 2 \times \frac{22}{7} \times 24$ 1

$= 44 cm$

length of lace required $= 44 + 2r$

$= 44 + 2(24)$

$= 92 cm$ 1

$\boxed{2}$

OR.

r_1 r_2 Let the radii be r_1 & r_2
$r_1 + r_2 = 14$ cm. 1

$\therefore 2\pi r_1 + 2\pi r_2 = 2\pi(r_1 + r_2)$
$= 2 \times \frac{22}{7} \times 14$
$= 88$ cm. 1

SECTION C $\boxed{2}$

26. treadmills $= 63$, elliptical machine $= 108$.

HCF $= (63, 108) = 9$ [Any method] $1\frac{1}{2}$
greatest number of branches in the city $= 9$. $\frac{1}{2}$

No. of treadmills $= \frac{63}{9} = 7$ $\frac{1}{2}$

No of elliptical $= \frac{108}{9} = 12$ $\frac{1}{2}$ $\boxed{3}$

27. $2x^2 - 5x - 3 = 0$ $\boxed{3}$
$2x^2 - 6x + 1x - 3 = 0$
$2x(x-3) + 1(x-3) = 0$
$(x-3)(2x+1) = 0$
$x = 3$ or $x = -\frac{1}{2}$ $\frac{1}{2}+\frac{1}{2}$

Zeros of $x^2 + px + q$ are $\alpha = \frac{1}{3} \times 3 = 1$ $\frac{1}{2}$
& $\beta = \frac{1}{3} \times -\frac{1}{2} = -\frac{1}{6}$. $\frac{1}{2}$

$\alpha + \beta = -p$

$1 + (-\frac{1}{6}) = -p$

$p = -\frac{5}{6}$ $\frac{1}{2}$

$\alpha\beta = q$
$1 \times -\frac{1}{6} = q$

$q = -\frac{1}{6}$ $\frac{1}{2}$ $\boxed{3}$

28. $37x + 43y = 123$

$43x + 37y = 117.$

add $80x + 80y = 240$

$x + y = 3$ ① 1

subtract

$-6x + 6y = 6$

$-x + y = 1$ ② 1

① + ②

$2y = 4$

$y = 4$ $\frac{1}{2}$

$x + y = 3$

$x + 4 = 3$

$\underline{x = -1}$ $\frac{1}{2}$ $\boxed{3}$

OR.

Let the number of rows be 'x'

no of children in each row y. $\frac{1}{2}$

Total children $= xy$.

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

$xy - 2x + y - 2 = xy$

$-2x + y - 2 = 0$ ① 1

$(x-1)(y+3) = xy$

$xy + 3x - y - 3 = xy$

$3x - y - 3 = 0$ ② $\frac{1}{2}$

① + ②

$x - 5 = 0 \Rightarrow \underline{x = 5}$

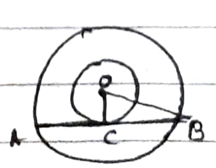
$-2(5) + y - 2 = 0$ $\frac{1}{2}$

$y = 2 + 10 = \underline{12}$

Total no of children $= xy = 5 \times 12 = 60$ $\frac{1}{2}$ $\boxed{3}$

29. $r_1 = \frac{d_1}{2}$ $r_2 = \frac{d_2}{2}$ $\frac{1}{2}$

$OC = \frac{d_1}{2}, OB = \frac{d_2}{2}$



OC ⊥ AB & it bisects AB.

$\therefore OC = \frac{c}{2}$ $\frac{1}{2}$

In rt Δ OBC

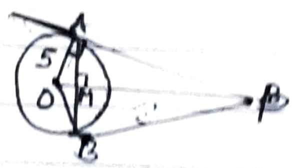
$$OB^2 = OC^2 + CB^2$$

$$\frac{d_2^2}{4} = \frac{d_1^2}{4} + \left(\frac{c}{2}\right)^2$$ 2

$$\frac{d_2^2}{4} = \frac{d_1^2}{4} + \frac{c^2}{4}$$

$$d_2^2 = d_1^2 + c^2$$ [3]

OR



$\frac{1}{2}$

$\angle OAP = 90°$ (tgt & radius at point of contact are ⊥)

$\Delta OAP \cong \Delta OBP$ (SSS)

By CPCT of the congruence $\Delta OMA \cong OMB$

Hence $\angle AMO = \angle BMO = 90°$. $\frac{1}{2}$

Now $\Delta AOM \sim POA$ (AA) $\left[\begin{array}{l}\angle O = \angle O \text{ (common)} \\ \angle A = \angle M = 90°\end{array}\right]$ 1

$\therefore \frac{AO}{OP} = \frac{OM}{OA} = \frac{AM}{AP}$ — (i)

$AM = \frac{1}{2} AB = 4$ cm [as OM bisects AB].

In Δ AMO, $OM = \sqrt{5^2 - 4^2} = 3$ cm.

Sub in (i) $\frac{3}{5} = \frac{4}{AP}$ $\frac{1}{2}$

$AP = \frac{20}{3}$ cm [6.66 cm $\frac{1}{2}$ [3]

30 $1 + \sin^2\theta = 3\sin\theta\cos\theta$
$- \cos^2\theta$

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

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

$1+2\tan^2\theta = 3\tan\theta$ $[1+\tan^2\theta = \sec^2\theta]$

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

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

$2\tan\theta(\tan\theta - 1) - 1(\tan\theta - 1) = 0$

$(\tan\theta - 1)(2\tan\theta - 1) = 0$ 2

$\tan\theta = 1$ or $\tan\theta = \frac{1}{2}$.

[3]

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Class	freq	cf
0-6	4	4
6-12	x	$4+x$
12-18	5	$9+x$
18-24	y	$9+x+y$
24-30	1	$10+x+y$

$\frac{1}{2}$

Median class 12-18

$f = 5$ $cf = 4+x$, $h = 6$. $\frac{1}{2}$

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

$\frac{1}{2}$

$$14.4 = 12 + \left(\frac{10-4-x}{5}\right) \times 6$$

$$2.4 = \left(\frac{6-x}{5}\right) \times 6$$

$12 = 36 - 6x$ 1

$6x = 24$

$x = 4$

$\Sigma f_i = 10+x+y$

$20 = 10+x+y$

$10-4 = y$ $\frac{1}{2}$

$y = 6$

[3]

32. Distance to be covered 1500 km

Let the usual speed be x km/hr — $\frac{1}{2}$

Time taken to cover 1500 km @ x km/hr

$$= \left(\frac{1500}{x}\right) \text{ hr}$$ — $\frac{1}{2}$

Time taken to cover 1500 km @ $x+250$ km/hr

$$= \frac{1500}{x+250}$$ — $\frac{1}{2}$

$$\frac{1500}{x} - \frac{1500}{x+250} = \frac{30}{60} = \frac{1}{2}$$ — $\frac{1}{2}+\frac{1}{2}$

$$1500\left[\frac{1}{x} - \frac{1}{x+250}\right] = \frac{1}{2}$$

$$\frac{\cancel{x}+250-\cancel{x}}{x^2+250x} = \frac{1}{3000}$$

$$x^2+250x-750000=0$$ — 1

$$x^2+1000x-750x-750000=0$$

$$x(x+1000)-750(x+1000)=0$$

$$(x+1000)(x-750)=0$$

$x=750$ or $x=-1000$ rejected as speed can't be $-ve$

$\therefore$ Usual speed of aeroplane is 750 km/hr. — $\frac{1}{2}$ — 5

OR

33. Speed of boat in still water 8 km/hr.

Distance upstream = 15 km. Distance downstream = 22 km

Let speed of stream be x km/hr. — $\frac{1}{2}$

Speed upstream = $(8-x)$ km/hr

Speed downstream = $(8+x)$ km/hr.

time taken for 15 km upstream at $(8-x)$ km/hr $= \frac{15}{8-x}$ — $\frac{1}{2}$

time taken for 22 km downstream at $(8+x)$ km/hr

$$= \frac{22}{8+x}.$$ — $\frac{1}{2}$

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$\frac{15}{8-x} + \frac{22}{8+x} = 5$ 1

$15(8+x) + 22(8-x) = 5(64-x^2)$

$120 + 15x + 176 - 22x = 320 - 5x^2$

$5x^2 - 7x - 24 = 0$

$5x^2 - 15x + 8x - 24 = 0$ 2

$5x(x-3) + 8(x-3) = 0$

$(x-3)(5x+8) = 0$

$x = 3$ or $x = -\frac{8}{5}$ rejected as speed can't be -ve.

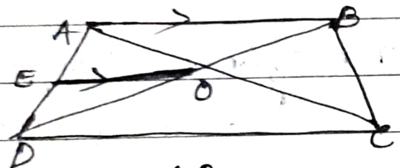
$\therefore$ sp of stream 3km/hr $\frac{1}{2}$ $\boxed{5}$

33. figure $\frac{1}{2}$

given & to prove } $\frac{1}{2}$

Construction }

proof 2



given $\frac{OB}{OD} = \frac{AO}{CO}$ (1) fig $\frac{1}{2}$

OE ∥ AB.

In Δ ADB

$\frac{AE}{ED} = \frac{OB}{OD}$ (2) (BPT) $\frac{1}{2}$

from (1) & (2) $\frac{AE}{ED} = \frac{AO}{OC}$ $\frac{1}{2}$

$\Rightarrow$ EO ∥ DC [Converse BPT in ADC]

EO ∥ DC & EO ∥ AB $\frac{1}{2}$

$\Rightarrow$ AB ∥ CD

$\Rightarrow$ ABCD trapezium

$\boxed{5}$

34 Let ht of water in orientation I be h. } $\frac{1}{2}$

$\therefore$ ht of water in orientation II is $\frac{h}{2}$ }

ht of cuboid in orientation I is (h+4)cm = } 1

length of cuboid in orientation II. }

Volume of water = 480 cm³ }

$8 \times (h+4) \times \frac{h}{2} = 480$ 96 } $\frac{1}{2}$ $(1\frac{1}{2})$

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$h^2+4h-192=0$

$h^2+16h-12h-192=0$

$h(h+16)-12[h+16]=0$ 1

$(h+16)(h-12)=0$

$h=-16$ or $h=12.$

rejected.

Height of water in orientation I $=12M$ $\frac{1}{2}$

Height of water in orientation II $=\frac{12}{2}=6m.$ $\frac{1}{2}$

$\boxed{5}$

OR

Cuboid:

$l=15cm$

$b=10cm$

$h=5cm$

Cylinder

$2r=7\Rightarrow 3.5cm=r.$ $\frac{1}{2}$

$h=5cm$

SA of remaining block = TSA cuboid + CSA cylinder − 2(area of circle) 1

$2(lb+hl+bh)+2\pi rh-2\pi r^2$

$2(15\times10+10\times5+5\times15)+2\pi r[h-r]$

$2(275)+2\times\frac{22}{7}\times\frac{7}{2}\left[5-\frac{7}{2}\right]$ $1\frac{1}{2}$

Refer last page:

$550+1\cancel{0}33=583cm^2$ +2 (Last page)

$\boxed{5}$

35

Ar. of land (ha)	No. of families	x_i	$u_i=\frac{x_i-a}{h}$	f_iu_i	cf
1-3	20	2	-3	-60	20
3-5	45 f_0	4	-2	-90	65
5-7	80 f_1	6	-1	-80	145
7-9	55 f_2	8	0	0	200
9-11	40	10	1	40	240
11-13	12 → 252	12	2	24	252
				-166	

Till f_iu_i ($1\frac{1}{2}$)

$\bar{u}=\frac{-166}{252}=\frac{-83}{126}$

$\bar{x}=a+\bar{u}h=8+\frac{-83}{126}\times2$ $\frac{1}{2}$

$=8-\frac{83}{63}=\frac{504-83}{63}=\frac{421.00}{63}$

$=6.68$ $\frac{1}{2}$

$\frac{n}{2} = \frac{252}{2} = 126$ Median class 5-7

$l = 5, h = 2, f = 80, cf = 65$

Median $= l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$ cf's ½

1

$= 5 + \left(\frac{126 - 65}{\cancel{80}\ 40}\right) \times \cancel{2}$

$= 5 + \frac{61}{40} = \frac{261}{40}$

$= \underline{6.52}$ ha

Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) h$

$= 5 + \left(\frac{80 - 45}{160 - 45 - 55}\right) 2$ 1

$= 5 + \frac{35}{60} \times 2$

$= 5 + \cancel{0.156}$ Mode : 1 M

$= \cancel{6.16}$ ha Median : 1½

Mean : 2½ $\boxed{5}$

36. No. of people can be accomodated = 150.

$d = 10$

(i) $a = 30$

$a_{10} = a + 9d = 30 + 9(10) = 120 \rightarrow$ seats in 10th row 1

(ii) $S_n = \frac{n}{2}[2a + (n-1)d]$ 1

$1500 = \frac{n}{2}[2 \times 30 + (n-1)10]$

$3000 = n[60 + 10n - 10]$

$3000 = n[50 + 10n]$

$10n^2 + 50n - 3000 = 0$

$n^2 + 5n - 300 = 0$

1

$(n + 20)(n - 15) = 0$

$\underline{n = 15}$ No of rows should be 15. 1

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OR

Tot. No. of seats up 10th row

$S_{10} = \frac{10}{2}[30+120]$ 1

$= 5 \times 150 = 750$

$1500 - 750 = 750$

No of stall required to put $= 750$. $\frac{1}{2}+\frac{1}{2}$

$\boxed{2}$

(iii) When there are 17 rows

middle most row is $\frac{17+1}{2} = 9^{th}$ row $\frac{1}{2}$

$a_9 = a + 8d = 30 + 8(10)$

$= 110$ seats are there on the middle most row. $\frac{1}{2}$

$\boxed{1}$

37 (i) $B = (1, 2)$ $F = (-2, 9)$ $\frac{1}{2}$

$BF = \sqrt{3^2 + 7^2}$

$= \sqrt{58}$ u $\frac{1}{2}$ $\boxed{1}$

(ii) $W = (-6, 2)$ $X = (-1, 0)$ $O = (5, 9)$ $R = (3, 11)$ $\frac{1}{2}$

Diagonals of rectangle bisect each other

$\therefore$ point of intersection is

midpt of any one diagonal (WO)

$= \left(\frac{-6+5}{2}, \frac{2+9}{2}\right)$

$= \left(-\frac{1}{2}, \frac{11}{2}\right)$ $\frac{1}{2}$

$\boxed{1}$

(iii) $A = (-2, 2)$ $G = (-4, 7)$

Let point be $K(0, y)$ $\frac{1}{2}$

$AK = KG$

$\sqrt{(-2)^2 + (y-2)^2} = \sqrt{4^2 + (y-7)^2}$ 1

sq.

$4 + (y-2)^2 = 16 + (y-7)^2$

$4 + y^2 - 4y + 4 = 16 + y^2 - 14y + 49$

$8 - 65 = -10y$

$y = \frac{57}{10}$. $\frac{1}{2}$

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D

OR

~~Base~~ = A

11's $AF = 70,\ GH = 30,$ 1

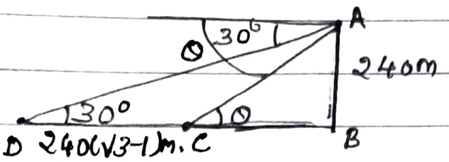
$h = 20.$

$Ar(\text{trapezium } AFGH) = \frac{1}{2} \times 2\,[3+7]$ 1

[2]

$= \underline{10\,\text{unit}^2}$

33 (i)



1

(ii) $\tan 30^\circ = \frac{240}{BD}$ (ΔABD)

$\frac{1}{\sqrt{3}} = \frac{240}{BD}$ 1

$BD = 240\sqrt{3}$ m = Dist from tower.

(iii)   In ΔABD,

$\sin 30^\circ = \frac{AB}{AD} \Rightarrow \frac{1}{2} = \frac{240}{AD}$ 1

$\underline{AD = 480\text{M}}$ $\frac{1}{2}$ [2]

Distance betn the Boat & top of tower = 480m. $\frac{1}{2}$

OR

Let θ be angle of depression

$BC = BD - DC = 240\sqrt{3} - 240(\sqrt{3}-1)$ 1

$= \underline{240\text{M}}$

$AB = BC = 240\text{M}$

$\therefore \underline{\theta = 45^\circ}$ 1

[2]

34. Vol = Vol. cuboid − Vol. cylinder

$= lbh - \pi r^2 h$

$= 15 \times 10 \times 5 - \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 5$ 2

$= 750 - 192.5 = 557.5\,\text{cm}^2$

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