~~18~~ 18c

WITH GRAPH PAPER

केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सैकण्डरी स्कूल परीक्षा (कक्षा दसवीं)
परीक्षार्थी प्रवेश–पत्र के अनुसार भरें

विषय Subject : Mathematics Basic

विषय कोड Subject Code : 241

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : Thursday, 12/03/2020

उत्तर देने का माध्यम
Medium of answering the paper : English

प्रश्न पत्र के ऊपर लिखे कोड को दर्शाएँ : Write code No. as written on the top of the question paper :	Code Number	Set Number
	430/4/1	● ② ③ ④

अतिरिक्त उत्तर–पुस्तिका (ओं) की संख्या No. of supplementary answer-book(s) used	Nil
बेंचमार्क विकलांग व्यक्ति : हाँ / नहीं Person with Benchmark Disabilities : Yes / No	No
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Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

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CBSE 2020

SECTION - A

Ans. 1.
(A) 156

Ans. 2.
(D) 16 : 81

Ans. 3.
(B) $\sqrt{37}$ units

Ans. 4. (Choice - I)
(A) −8

Ans. 5.
(C) 1

Ans. 6.
(B) $\frac{1}{2}$

Rough

2 | 156, 78
2 | 78, 39
39

$\sqrt{(5+1)^2 + (-2+3)^2}$
$\sqrt{36+1}$
$\sqrt{37}$

2 | 156, 78
2 | 78, 39
3 | 39, 39
13 | 13, 13
1, 1

$\sqrt{b^2 - 4ac}$
$\sqrt{16 - 24}$

39 × 4 = 156

$D = b^2 - 4ac$
$= 16 - 24$
$= -8$

$\sqrt{(5+1)^2 + (-2+3)^2}$

1 − odd
2
3 − odd
4
5 − odd
6

36 + 1
$= \sqrt{37}$

16 − 24
−8

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Ans. 7.
(D) −2

Ans. 8.
(D) 45°

Ans. 9.
(C) 44

Ans. 10.
~~(C) $4\pi r^2$~~ (A) $3\pi r^2$

Ans. 11.
D = 0 (discriminant is zero)
or $b^2 - 4ac = 0$ {here a = 1}
$b^2 = 4c$

Ans. 12. (−3, 0)

Rough
$\frac{3}{26}$
k = 2.
a = 47
d = −3
$a_2 = a + d$
= 47 − 3
= 44
$m_1 = 1$, m_2
$\frac{-3-3}{2}$, $\frac{3}{2}$
$\frac{-3-3}{2}$, $\frac{3-3}{2}$
$\frac{-6}{2}$, $\frac{0}{2}$
$\frac{-6}{2}$, $\frac{0}{2}$
−3, 0
$\frac{-3-3}{2}$, $\frac{-3+3}{2}$
$\frac{-6}{2}$ −3, 0.

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Ans. 13.

equal.

Ans. 14.

58

Ans. 15.

$\alpha + \beta = \frac{-b}{a} = \frac{0}{1} = 0$

Ans. 16.

$a_{26} = ?$ $n = 26$, $a = 7$, $d = a_2 - a_1 = 4 - 7 = -3$

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

$a_{26} = 7 + (26-1)(-3)$

~~$a_{26} = 7 +$ $a_{26} =$~~

$a_{26} = 7 - 75$

$\boxed{a_{26} = -68}$

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$m_1 = 1$, $m_2 = 2$
$x_1 = 2$, $x_2 = 5$
$y_1 = 3$, $y_2 = -6$

Let the point be P and its coordinates be (x,y)

$$(x,y) = \left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$$

$$(x,y) = \left(\frac{1(5)+2(2)}{1+2}, \frac{1(-6)+2(3)}{1+2}\right)$$

$$(x,y) = \left(\frac{5+4}{3}, \frac{-6+6}{3}\right)$$

$$(x,y) = \left(\frac{9}{3}, \frac{0}{3}\right)$$

$$\boxed{(x,y) = (3,0)}$$

Since the point is on x-axis, therefore ~~t~~ the point on y-axis will be '0'.

Ans. 18. (Choice - II)

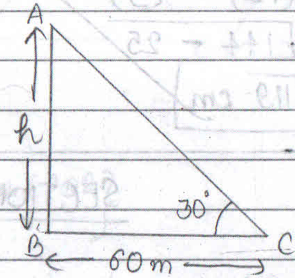
$\sin 42° - \cos 48°$

$= \sin 42° - \sin(90-48)°$ $\{\because \cos\theta = \sin(90-\theta)\}$

$= \sin 42° - \sin 42°$

$= \boxed{0}$

Ans. 19.



Let the height of the tower be h m

In $\triangle ABC$

$\angle ABC = 90°$ (Tower stands vertical on the ground)

$\therefore \tan 30° = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{h}{60}$

$h = \frac{60}{\sqrt{3}} \Rightarrow h = \frac{20 \times \cancel{3}^{\sqrt{3}}}{\cancel{\sqrt{3}}} \Rightarrow \boxed{h = 20\sqrt{3}\ m}$

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Ans. 20.

In $\triangle$ OQP

$\angle OQP = 90^\circ$ (radius is $\perp$ to tangent)

By Pythagoras theorem,

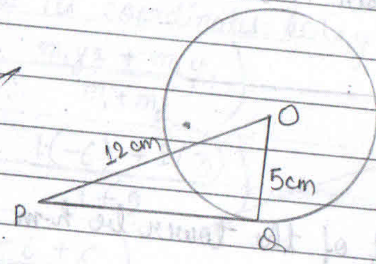
$OP^2 = OQ^2 + PQ^2$

$PQ^2 = OP^2 - OQ^2$

$PQ^2 = (12)^2 - (5)^2$

$PQ = \sqrt{144 - 25}$

$\boxed{PQ = \sqrt{119}\text{ cm}}$



SECTION - B

Ans. 21.

Cylinder

$h = 32$ cm $\quad \pi = \frac{22}{7}$

$r = 14$ cm

Volume of sand = vol. of cylinder

$= \pi r^2 h$

P.T.O.

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$$= \left(\frac{22}{\cancel{7}} \times \cancel{14}^{2} \times 14 \times 32\right) cm^3$$

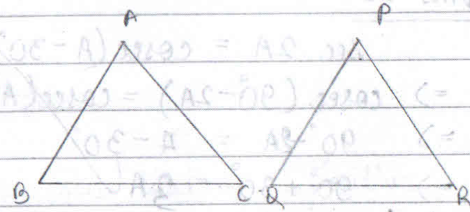
$$= \boxed{19712\ cm^3}$$

Ans. 22. (Choice II)

Given

$\triangle ABC \sim \triangle PQR$

$ar(ABC) = ar(PQR)$



To prove: $\triangle ABC \cong \triangle PQR$

Proof:

$$\frac{ar(ABC)}{ar(PQR)} = 1 \qquad \{\because ar(ABC) = ar(PQR)\}$$

$$\frac{ar(ABC)}{ar(PQR)} = \left(\frac{AB}{PQ}\right)^2 \qquad \{\because \text{the ratio of areas of two similar } \Delta s \text{ is equal to the square of ratio of their sides}\}$$

$$\frac{AB}{PQ} = 1^2$$

$$AB = PQ \quad \text{—— (1)}$$

Similarly $\frac{BC}{QR} = 1^2 \Rightarrow BC = QR$ (2), $\frac{AC}{PR} = 1^2 \Rightarrow AC = PR$ —— (3)

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From (1.), (2.) and (3.)

$\triangle ABC \cong \triangle PQR$ (SSS congruency)

$\therefore$ Proved

Ans. 23.

$\sec 2A = \operatorname{cosec}(A-30^\circ)$

$\Rightarrow \operatorname{cosec}(90^\circ-2A) = \operatorname{cosec}(A-30^\circ)$ $\{\because \sec\theta = \operatorname{cosec}(90^\circ-\theta)\}$

$\Rightarrow 90^\circ-2A = A-30^\circ$

$\Rightarrow 90^\circ+30^\circ = 3A$

$\Rightarrow 120^\circ = 3A$

$\Rightarrow$ ~~$\boxed{A = 60^\circ}$~~ $\Rightarrow \boxed{A = \left(\frac{120}{3}\right)^\circ = 40^\circ}$

Ans. 24.

Let a be any positive integer. Let it be divided by 2 giving 'q' as quotient, 'r' as remainder.

$a = 2q + r$

According to Euclid's divison algorithm.

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$0 \leq r < b \Rightarrow 0 \leq r < 2$

r can either be 0 or 1

When $r = 0$

$a = 2q + 0 \Rightarrow a = 2q$ (Here a is even) — (1.)

When $r = 1$

$a = 2q + 1$ (Here a is odd) — (2.)

Thus, from (1.) and (2.) it can be said that every even positive integer is of the form $2q$ and every positive odd integer is of the form $2q+1$.

Ans. 25. (Choice – II)

$d = 5$, $n = 10$, $S_{10} = 75$

$a = ?$

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

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$$S_{10} = \frac{10}{2}[2a + (10-1)5]$$

$$S_{10} = \frac{10}{2}[2a + 45]$$

$$75 \times 2 = 20a + 450$$

$$150 - 450 = 20a$$

$$-300 = 20a$$

$$a = \frac{-30\cancel{0}}{2\cancel{0}}$$

$$\boxed{a = -15}$$

Ans. 26.

C.I.	f
5-15	60
15-25	110
25-35	210 — f_0
35-45	230 — f_1

Rough

45 - 55	150
55 - 65	50

f_2

$f_1 = 230$, $f_2 = 150$, $f_0 = 210$

$l = 35$, $h = 10$

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 35 + \left[\frac{230 - 210}{460 - 210 - 150}\right] \times 10$$

$$= 35 + \left[\frac{\cancel{20}^{2}}{\cancel{100}} \times 1\cancel{0}\right]$$

$$= 35 + 2$$

$$= \boxed{37}$$

~~SEC~~

23
2
460
360
150
210
150
360

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SECTION-C

Ans. 27.

(i.) Coordinates of A = (2, 2)

Coordinates of B = (5, 4)

Coordinates of C = (7, 6)

(ii.) If the points are collinear then,

$$AB + BC = AC$$

$$AB = \sqrt{(5-2)^2 + (4-2)^2} \quad \left\{ \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} \right\}$$

$$AB = \sqrt{9 + 4}$$

$$AB = \sqrt{13} \text{ unit}$$

$$BC = \sqrt{(7-5)^2 + (6-4)^2}$$

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$BC = \sqrt{4+4}$

$BC = \sqrt{8}$ unit

$AC = \sqrt{(7-2)^2 + (6-2)^2}$

$AC = \sqrt{25 + 16}$

$AC = \sqrt{41}$

25
+16
$\sqrt{41}$

$\because \sqrt{13} + \sqrt{8} \neq \sqrt{41}$

$\therefore$ The points are not collinear.

Ans. 28. (Choice – I)

$AB = 10$ cm, $AQ = 7$ cm, $CQ = 5$ cm

$BC = ?$

$AR = AQ$ (equal tangents from point A) {tangents from a point outside the circle are equal in length}

$AR = 7$ cm

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$BC = \sqrt{4 + 4}$

$BC = \sqrt{8}$ unit

$AC = \sqrt{(7-2)^2 + (6-2)^2}$

$AC = \sqrt{25 + 16}$

$AC = \sqrt{41}$

$$\begin{array}{r} 25 \\ +16 \\ \hline 41 \end{array}$$

$\because \sqrt{13} + \sqrt{8} \neq \sqrt{41}$

$\therefore$ The points are not collinear.

Ans. 28. (Choice - I)

AB = 10 cm, AQ = 7 cm, CQ = 5 cm

BC = ?

AR = AQ (equal tangents from point A) {tangents from a point outside the circle are equal in length}

AR = 7cm

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$AB = AR + BR$

$BR = AB - AR$

$BR = 10 - 7$

$BR = 3$ cm

$BR = BP = 3$ cm (equal tangents from B) — 1.

$CQ = 5$cm $= CP$ {equal tangents from C} — 2.

$BC = BP + CP$ {from 1. & 2.}

$BC = 3 + 5$

$\boxed{BC = 8\text{cm}}$

Ans. 29.

Let us assume that $\sqrt{2}$ is rational

Then, $\frac{a}{b}$ is its simplest where 'a' and 'b' are

P.T.O.

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co-prime integers, $b \neq 0$

$$\sqrt{2} = \frac{a}{b}$$

squaring both the sides we get

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

$$2b^2 = a^2 \quad \text{—— (1)}$$

Thus, 2 divides a^2 {∵ it divides b^2}

$\Rightarrow$ 2 divides a {∵ 2 is prime & divides a^2} —— (2)

Let $a = 2c$ for some integer c

$$a^2 = 4c^2$$

$$2b^2 = 4c^2 \quad [\text{from (1)}]$$

$$b^2 = 2c^2$$

Thus, 2 divides b^2 {∵ 2 divides c^2}

$\Rightarrow$ 2 divides b {∵ 2 is prime & divides b^2} —— (3)

from (2) and (3) we get 2 as a common factor of a and b

P.T.O.

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But this contradicts the fact that a and b are co-primes.
This contradiction has arisen due to our wrong assumption
Therefore, $\sqrt{2}$ is irrational number.

Ans. 30.

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

From L.H.S.

$$(\text{cosec}\,\theta - \cot.\theta)^2$$

$$= \text{cosec}^2\theta + \cot^2\theta - 2\,\text{cosec}\,\theta\cot\theta \qquad \{(a-b)^2 = a^2+b^2-2ab\}$$

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

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

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

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$$= \frac{(1-\cos\theta)^2}{1-\cos^2\theta} \qquad \left\{ \begin{array}{l} \because a^2+b^2-2ab=(a-b)^2 \\ \because \sin^2\theta + \cos^2\theta = 1 \end{array} \right\}$$

$$= \frac{\cancel{(1-\cos\theta)}(1-\cos\theta)}{\cancel{(1-\cos\theta)}(1+\cos\theta)} \qquad \{\because a^2-b^2=(a+b)(a-b)\}$$

$$= \frac{1-\cos\theta}{1+\cos\theta}$$

$= R.H.S.$

Therefore, Proved.

Ans. 31 (Choice - I)

Let the cost of 1 pencil be ₹ x and cost of 1 pen be ₹ y.

Then, ~~as~~ ATQ,

$$5x + 7y = 250 \quad \text{—— (1)}$$

$$7x + 5y = 302 \quad \text{—— (2)}$$

Multiplying (1) by 7 and (2) by 5 and subtracting (1) from (2)

$$35x + 49y = 1750$$
$$35x + 25y = 1510$$
$$- \quad - \quad -$$
$$24y = 240$$
$$y = \frac{240}{24}$$
$$y = ₹\ 10$$

Substituting $y = 10$ in (1), we get,

$$5x + 7(10) = 250$$
$$5x = 250 - 70$$
$$x = \frac{180}{5}$$
$$x = ₹\ 36$$

Cost of one pencil = ₹ 36
Cost of one pen = ₹ 10

$\begin{array}{r} 35 \\ \times 5 \\ \hline 175 \end{array}$ $\begin{array}{r} 302 \\ \times 5 \\ \hline 1510 \end{array}$ $\begin{array}{r} 250 \\ -70 \\ \hline 180 \end{array}$ $\begin{array}{r} 36 \\ \times 5 \\ \hline 180 \end{array}$ $\begin{array}{r} 180 \\ +70 \\ \hline 250 \end{array}$ $\begin{array}{r} 302 \\ \times 5 \\ \hline 1510 \end{array}$

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Ans. 32. (Choice - I)

(i.) Total no. of red king = 2
Total no. of cards = 52

P(getting a king of red colour) = $\frac{\text{favourable outcome}}{\text{Total no. of outcomes}}$

$= \frac{2}{52}$

$= \frac{1}{26}$

(ii.) Diamond suit has 1 queen
P(getting the queen of diamonds) = $\frac{1}{52}$

(iii.) There are total 4 ace (one in each suit)
P(getting an ace) = $\frac{4}{52} = \frac{1}{13}$

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SECTION - D

Ans. 39.

C.I (lower limits)	c.f.
More than 40 (or equal to)	100
More than 44 (or equal to)	(100-4) = 96
More than 48 (or equal to)	96-10 = 86
More than 52 (or equal to)	86-30 = 56
More than 56 (or equal to)	56-24 = 32
More than 60 (or equal to)	32-18 = 14
More than 64 (or equal to)	14-12 = 2

Coordinates → (40, 100)
(44, 96)
(48, 86)
(52, 56)
(56, 32)
(60, 14)
(64, 2)

4
10
30
24
18
12
2
0

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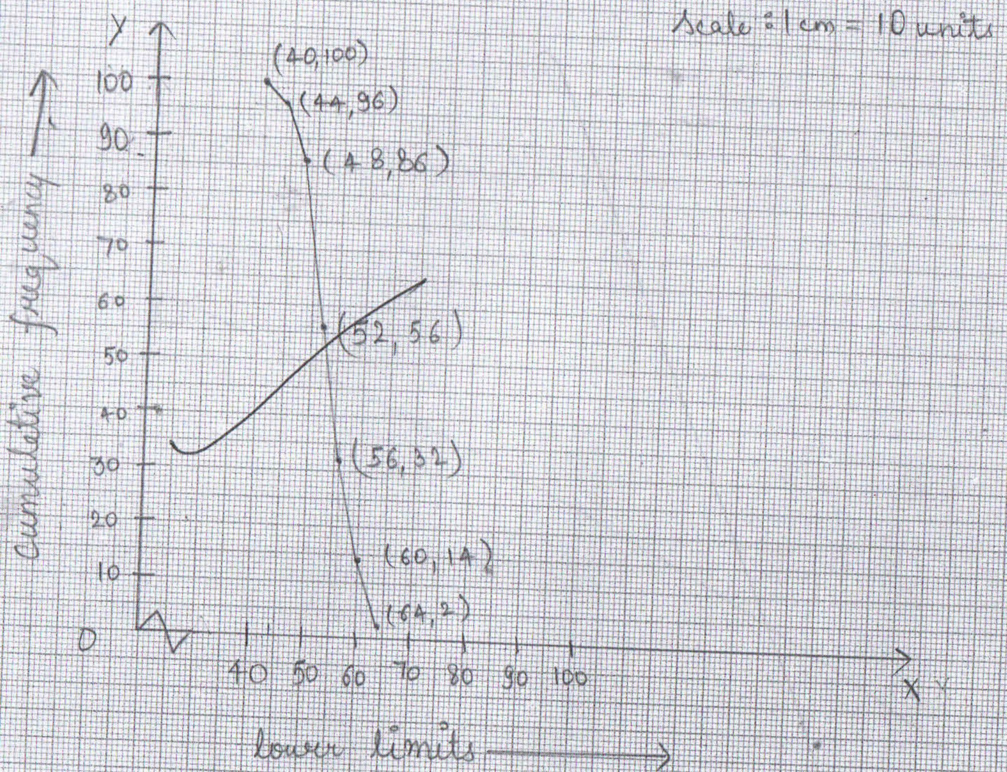
Ans. 39.



Scale : 1 cm = 10 units
Y
Cumulative frequency
100
90
80
70
60
50
40
30
20
10
O
(40,100)
(44,96)
(48,86)
(52,56)
(56,32)
(60,14)
(64,2)
40
50
60
70
80
90
100
X
lower limits

Ans. 33.

Area of the square $= (\text{side})^2$

$= (14)^2$

$= 196 \text{ cm}^2$

Area of 4 quadrants $= 4 \times \left[\dfrac{\theta}{360^\circ} \times \pi r^2\right]$

$= 4 \times \left[\dfrac{90^\circ}{\cancel{360^\circ}_{4}} \times \dfrac{22}{\cancel{7}} \times \cancel{3.5}^{0.5} \times 3.5\right]$

$= \left(\cancel{4} \times \dfrac{1}{\cancel{4}} \times 22 \times 0.5 \times 3.5\right)$

$= 38.5 \text{ cm}^2$

Area of circle $= \pi r^2$

$= \cancel{\dfrac{22}{7} \times 16}\ \dfrac{22}{7} \times (4)^2$

$= \dfrac{352}{7} = 50.29 \text{ cm}^2$ (approx.)

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SECTION - D

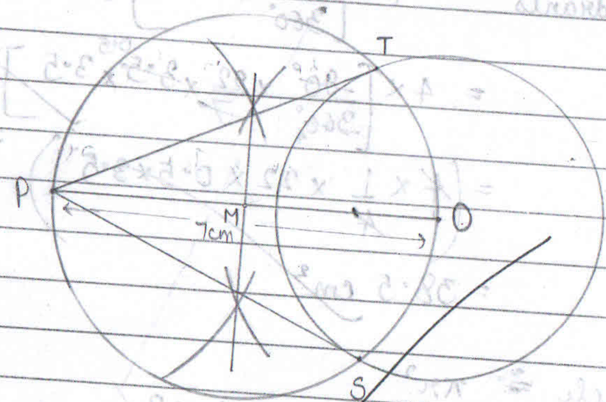
Area of shaded region = Area of square − (Area of 4 q... Area of circl...)

= 196 − (38·5 + 50·29)

= (196 − 88·79)

= $\underline{\underline{107·21\ cm^2}}$ (approx)

Ans. 34.



PT and PS are the required tangents.

P.T.O.

Steps of construction:

1. Draw a circle with radius 3 cm
2. Take a point P outside the ~~a~~ circle which is 7cm away from the centre of the circle.
3. Join OP.
4. Draw the perpendicular bisector of OP which intersects it at M.
5. Taking M as centre and radius equal to PM draw another circle.
6. ~~L~~ Mark the points of intersection of bigger circle and smaller circle as T and S
7. Join PT and PS.

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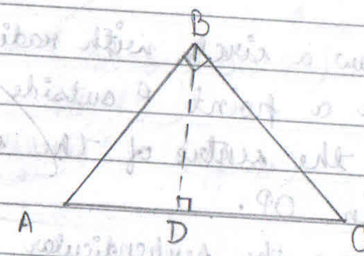
SECTION-D

Ans. 35.



ABC is a right-angled $\triangle$

$\angle B = 90°$

AC → hypotenuse

To prove: $AC^2 = AB^2 + BC^2$

Const.: Draw $AD \perp$ ~~AD~~ AC

Proof:

In $\triangle$ ADB and $\triangle$ ABC

$\angle ADB = \angle ABC = 90°$

$\angle DAB = \angle BAC$ (common)

$\therefore \triangle ADB \sim \triangle ABC$ (AA-similarity criterion)

$\Rightarrow \frac{AD}{AB} = \frac{AB}{AC}$

$\Rightarrow AB^2 = AD \times AC$ —— (1.)

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In $\triangle BDC$ and $\triangle ABC$

$\angle BDC = \angle ABC = 90^\circ$

$\angle BCD = \angle ACB$ (common)

$\therefore \triangle BDC \sim \triangle ABC$ (AA- similarity criterion)

$\Rightarrow \frac{\cancel{BD}\ BC}{AC} = \frac{DC}{BC}$

$\Rightarrow BC^2 = AC \times DC$ —— (2.)

Adding (1.) & (2.) we get,

$AB^2 + BC^2 = AD \times AC + AC \times DC$

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

$AB^2 + BC^2 = AC \times AC$

$\boxed{AB^2 + BC^2 = AC^2}$

$\therefore$ Proved

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Ans. 36. (Choice-I)

$$\begin{array}{r|l} & -x+4 \\ \hline x^2+x-1 & -x^3+3x^2-3x+5 \\ & -x^3-x^2+x \\ & +\quad +\quad - \\ \hline & 4x^2-4x+5 \\ & 4x^2+4x-4 \\ & -\quad -\quad + \\ \hline & -8x+9 \end{array}$$

Divisor $= x^2+x-1$

Dividend $= -x^3+3x^2-3x+5$

Remainder $= -8x+9$

Quotient $= -x+4$

According to the division algorithm

Dividend = Divisor × Quotient + Remainder

$\cancel{-x^3+3x^2-3x+5 = (-x+4)(-x+4)+(-8x+9)}$

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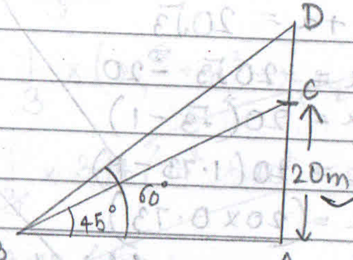
~~$-x^3+3x^2-3x+5 = x^2-4x-4x+16-8x+9$~~

$$-x^3+3x^2-3x+5 = (x^2+x-1)\times(-x+4) + (-8x+9)$$
$$= -x^3+4x^2-x^2+4x+x-4-8x+9$$
$$= -x^3+3x^2-3x+5$$
$$= \text{L.H.S.}$$

$\therefore$ Proved.

Ans. 37.

AC → height of building = 20m
CD → height of transmission tower
CD = x m.
AB → distance of the point from the foot of the building = y m



In $\triangle$ ABC

$\angle CAB = 90^\circ$ [building stands vertical on the ground]

$\therefore \tan 45^\circ = \frac{AC}{AB} \Rightarrow 1 = \frac{AC}{y} \Rightarrow y = 20\text{ m}$ — (1)

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In $\triangle ADB$

$\angle DAB = 90^\circ$ (building stands vertical on the ground)

$\therefore \tan 60^\circ = \frac{AD}{AB}$

$\Rightarrow \sqrt{3} = \frac{20+x}{y}$

$\Rightarrow \sqrt{3} = \frac{20+x}{20}$ {from (1.)}

$20 + x = 20\sqrt{3}$

$x = 20\sqrt{3} - 20$

$x = 20(\sqrt{3} - 1)$

$x = 20(1.73 - 1)$

$x = (20 \times 0.73)$

$x = 14.60$ m. (height of tower)

20
.73
60
140
14.6

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Ans. 38. (Choice I)

$h = 30$ cm

$r_1 = 10$ cm

$r_2 = 20$ cm

Capacity = Volume

Volume of frustum of a cone $= \frac{1}{3} \times \pi \times h ($

$= \frac{1}{3}\pi(r_1^2 + r_2^2 + r_1 r_2) \times h$

$= \frac{1}{\cancel{3}} \times 3.14 (10^2 + 20^2 + 200) \times \cancel{30}^{10}$

$= 3.14 (100 + 400 + 200) \times 10$

$= 3.14 \times 700 \times 10$

$= 2198 \times 10$

$= \underline{21980 \text{ cm}^3}$

$\begin{array}{r} 3.14 \\ \times 700 \\ \hline 000 \\ 000\times \\ 2198\times\times \\ \hline 2198.00 \end{array}$

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Ans. 39. In front of graph paper

Ans. 40. Choice (II)

Let the sides of the two squares be x m and y m resp.

~~ATQ~~, Perimeter of square $= 4 \times$ side

ATQ, $4x - 4y = 24$

$4(x-y) = 24$

$x - y = 6$ — (1.)

$x = 6 + y$ — (1.)

Area of square $= (\text{side})^2$

ATQ,

$x^2 + y^2 = 468$

$\cancel{x^2 +} (6+y)^2 + y^2 = 468$ (from (1.))

$36 + y^2 + 12y + y^2 = 468$

$2y^2 + 12y + 36 - 468 = 0$

$2y^2 + 12y - 432 = 0$

$2(y^2 + 6y - 216) = 0$

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$y^2 + 6y - 216 = 0$

$y^2 + 18y - 12y - 216 = 0$

$y(y+18) - 12(y+18) = 0$

$(y+18)(y-12) = 0$

$y = -18$ E

$y = 12$

We consider $y = 12$ m because distance cannot be negative

$x = 12 + 6$

$= 18$ m

Sides of two squares are 18 m and 12 m.

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