18t

WITH GRAPH PAPER

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

विषय Subject : Mathematics

विषय कोड Subject Code : 041

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : Monday, 16·03·15

उत्तर देने का माध्यम
Medium of answering the paper : English

प्रश्न पत्र के ऊपर लिखा कोड नं. लिखें
Write code No. as written on the top of the question paper :

Code Number	Set Number
30/2	① ● ③ ④

अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या
No. of supplementary answer -book(s) used

विकलांग व्यक्ति
Person with Disabilities — हाँ / नहीं Yes / No: NO

यदि शारीरिक असमर्थता से प्रभावित हो तो संबंधित वर्ग में ✓ का निशान लगाएँ।
If physically challenged, tick the category

B	D	H	S	C	A

B = दृष्टिहीन, D = मूक व बधिर, H = शारीरिक रूप से विकलांग, S = स्पास्टिक
C = डिस्लेक्सिक, A = ऑटिस्टिक
B = Visually Impaired, D = Hearing Impaired, H = Physically Challanged
S = Spastic, C = Dyslexic, A = Autistic

क्या लेखन – लिपिक उपलब्ध करवाया गया : हाँ / नहीं
Whether writer provided : Yes / No: NO

यदि दृष्टिहीन हैं तो उपयोग में लाए गये सॉफ्टवेयर का नाम
If visually challenged, name of software used :

*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

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.

कार्यालय उपयोग के लिए
Space for office use

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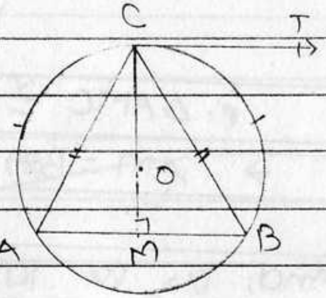
Section-D.



2. Given, In circle with centre O.
C is the mid-point of the arc AB
Now, CT is a tangent to the circle at point C.
Here, AB is a chord.

To prove:- CT ∥ AB

Const:- we join AC and BC
we draw CM ⊥ AB

Proof:- Since, C is the mid-point of arc $\widehat{ACB}$
so, $l(\widehat{AC}) = l(\widehat{BC})$
$\Rightarrow$ AC = BC (chords subtended by equal arcs are equal)

Now, △ACB is Isosceles △.
Now, In right △CMA and △CMB
CM = CM (common)
∠M = ∠M = 90° (by const)
AC = BC (as proved)

$\therefore \triangle AMC \cong \triangle BMC$ (RHS)

$\Rightarrow AM = BM$ (CPCT)

And, as we know that a perpendicular that bisects the chord passes through the centre.

$\therefore$ CM passes through O.

And, we know that a tangent is perpendicular to the radius through the point of contact.

$\therefore \angle OCT = 90^\circ$

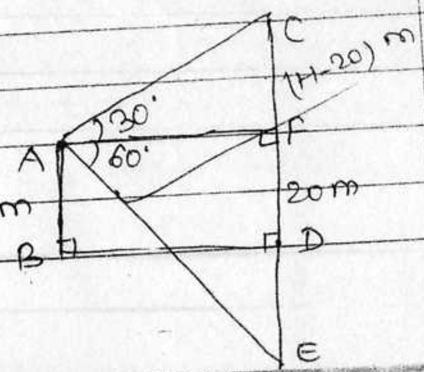
And, $\angle CMA = 90^\circ$

But these are alternate $\angle$s

$\therefore CT \parallel AB$ proved

22 Let A be the required point of observation above the lake.

Let C be the position of cloud & E be



its reflection in the lake.

Here, $AF \perp CD$

Given, $\Rightarrow AB = DF = 20m$

$\angle CAF = 30^\circ$

$\angle FAE = 60^\circ$

Now, let the height of cloud $= (H)\,m$

i.e $CD = DE = (H)\,m$

Then, $CF = CD - DF = (H-20)\,m$

And; $EF = ED + DF$

$= (H+20)\,m$

Now, in right ΔAFC,

$\tan 30^\circ = \frac{CF}{AF} \Rightarrow \frac{1}{\sqrt{3}} = \frac{H-20}{AF}$

$\Rightarrow AF = \sqrt{3}(H-20)$ - (i)

Similarly in right ΔAFE,

$\tan 60^\circ = \frac{EF}{AF} \Rightarrow \sqrt{3} = \frac{H+20}{AF}$

$\Rightarrow AF = \frac{H+20}{\sqrt{3}}$ - (ii)

From (I) & (II), we get

or, $\sqrt{3}(H-20) = \frac{H+20}{\sqrt{3}}$

or, $3(H-20) = H+20$

or, $3H-60 = H+20$

or, $3H-H = 20+60$

or, $2H = 80$

or, $H = 40$ m

Now, $CF = (H-20)$m

$= (40-20)$ m $= 20$ m

Then, in right ΔAFC,

$\sin 30^\circ = \frac{CF}{AC} \Rightarrow \frac{1}{2} = \frac{20}{AC}$

$\Rightarrow AC = 40$m

$\therefore$ Dist of cloud from point $A = 40$ m

23. Total no. of cards in a deck $= 52$

(i) Let E_1 be the event of getting a card of spade or an ace.

No. of favourable events $= 13+3 = 16$

Now, $P(\text{a spade or an ace}) = P(E_1) = \frac{16}{52} = \frac{4}{13}$

(ii) Let E_2 be the event of getting a black king.

No. of black kings $= 2$

$\therefore P(\text{black king}) = P(E_2) = \frac{2}{52} = \frac{1}{26}$

(iii) Let E_3 be the event of getting either a jack or a king.

No. of favourable events $= 4+4 = 8$

Now, $P(\text{either jack or king}) = P(E_3) = \frac{8}{52} = \frac{2}{13}$

Hen, $P(\text{neither jack nor king}) = P(\bar{E_3}) = 1 - P(E_3)$

$= 1 - \frac{2}{13} = \frac{13-2}{13} = \frac{11}{13}$

(iv) Let E_4 be the event of getting either a king or a queen.

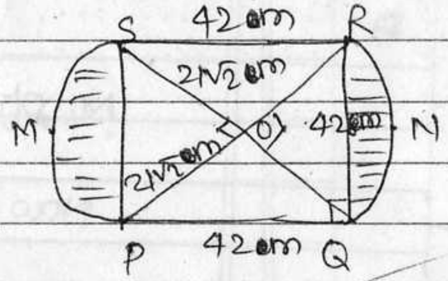
No. of favourable events $= 8$

$\therefore P(\text{either king or queen}) = P(E_4) = \frac{8}{52} = \frac{2}{13}$

8

24. Given, PQRS is a square lawn of side, $PQ = 42$ cm

Here, Two circular flower beds are drawn on sides PS and QR with O as centre.



Diagonals of sq. bisect each other at O.

Now, In right ΔRQP, By pythagoras theorem

$$PR = \sqrt{(RQ)^2 + (PQ)^2} = \sqrt{(42)^2 + (42)^2}$$
$$= \sqrt{2(42)^2}$$
$$= 42\sqrt{2} \text{ cm}$$

And, as we know that diagonals of a square bisect each other at $90°$

$$\therefore OS = OP = \frac{42\sqrt{2}}{2} = 21\sqrt{2} \text{ cm}$$

And, $\angle POS = \angle ROQ = 90°$

Now, Req. shaded area = Area of 2 segments with $r = 21\sqrt{2}$ cm & $\theta = 90°$

2015

$$= 2 \times \frac{r^2}{2}\left[\frac{\pi\theta}{180} - \sin\theta\right]$$

$$= r^2\left[\frac{\pi \times 90}{180} - \sin 90\right]$$

$$= (21\sqrt{2})^2\left[\frac{22}{14} - 1\right]$$

$$= 441 \times 2\left[\frac{22-14}{14}\right] = 441 \times 2\left[\frac{8}{14}\right]$$

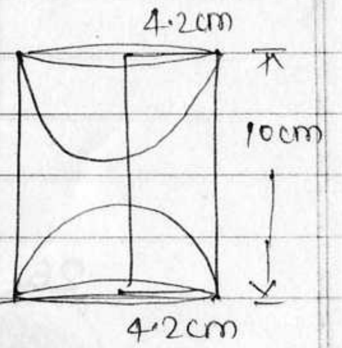
$$= 63 \times 8$$

$$= 504 \text{ m}^2$$

25. Here, Height of cylinder $(H) = 10$ cm

Base radius $= 4.2$ cm

Now, Hemispheres of radius (r) 4.2 cm are scooped out from each end.



Now, Volm of remaining solid $= \pi r^2 H - 2 \times \frac{2}{3}\pi r^3$

$$= \pi r^2 \times 10 - \frac{4}{3}\pi r^3$$

$$= \pi r^2\left[10 - \frac{4r}{3}\right]$$

$$= \pi r^2\left[\frac{30-4r}{3}\right] = \frac{22}{7}\times\frac{42}{10}\times 4.2\left[\frac{30-4(4.2)}{3}\right]$$

$$= \frac{22\times 4.2\times(30-16.8)}{5}$$

$$= \frac{22\times 42\times 13.2}{5\times 10\times 10} = \frac{924\times 13.2}{5\times 100}\ cm^3$$

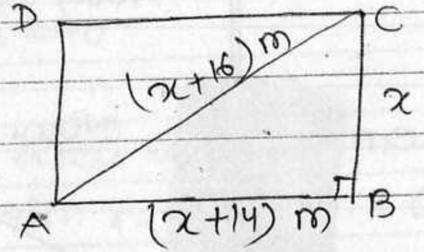
Now, the remaining solid is melted to form a wire of thickness 1.4 cm

Now, radius of wire $= \frac{1.4}{2}$ cm $= 0.7$ cm

Now, length of wire $= \frac{924\times 13.2\times 7\times 100}{5\times 100\times 22\times 0.7\times 0.7}$

$$= \frac{792}{5} = 158.4 \text{ cm Ans}$$

26. Let ABCD be a rectangle.



Let the shorter side, $BC = x$ cm

Then, $AC = (x+16)$ cm

And, $AB = (x+14)$ cm

Now, In right $\triangle ABC$, By pythagoras theorem

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

or, $(x+16)^2 = (x+14)^2 + x^2$

or, $x^2 + 256 + 32x = x^2 + 196 + 28x + x^2$

or, $2x^2 + 28x + 196 - x^2 - 32x - 256 = 0$

or, $x^2 - 4x - 60 = 0$, which is a Quad. eqn

or, $x^2 - 10x + 6x - 60 = 0$

or, $x(x-10) + 6(x-10) = 0$

or, $(x-10)(x+6) = 0$

or, $x - 10 = 0$ | or, $x + 6 = 0$

or, $x = 10$ | or, $x = -6$ (Invalid)

Now, $BC = x = 10$ m

$AB = x+14 = (10+14)$ m $= 24$ m

27. Given, A.P is 8, 10, 12 - - -

Here, $a = 8$, $d = 10 - 8 = 2$

Now, $a_{60} = a + (60-1)d$

$= 8 + (59 \times 2)$

$= 8 + 118 = 126$

Now, sum of the last 10 terms = sum of terms from 51st to 60th

i.e $a_{51} + a_{52} - - - - + a_{60}$

Now, $n = 10$

or, $a_{51} = 8 + (51-1)2$

$= 8 + (50 \times 2) = 100 + 8 = 108 =$ (first term)

$a_{60} = l = 126$

Now,

sum of last 10 term $= S_{10}$

$= \frac{10}{2}[a_{51} + a_{60}]$

$= 5[108 + 126]$

$= 5[234] = 1170$ Ans

28\. Let the avg. speed for a dist. of 75 km $= x$ km/hr

Then, time taken to cover 75 km $= \left[\frac{75}{x}\right]$ hrs

Now, speed for the next 90 km $= (x+10)$ km/hr

Time taken to cover 90 km $= \left[\frac{90}{x+10}\right]$ hrs.

A/Q

$$\frac{75}{x} + \frac{90}{x+10} = 3$$

or, $15\left[\frac{5}{x} + \frac{6}{x+10}\right] = 3$

or, $\frac{5(x+10)+6x}{x^2+10x} = \frac{1}{5}$

or, $5x+50+6x = \frac{x^2+10x}{5}$

or, $(11x+50)5 = x^2+10x$

or, $x^2+10x-55x-250=0$

or, $x^2-45x-250=0$, which is a Quad. eqn

or, $x^2-50x+5x-250=0$

or, $x(x-50)+5(x-50)=0$

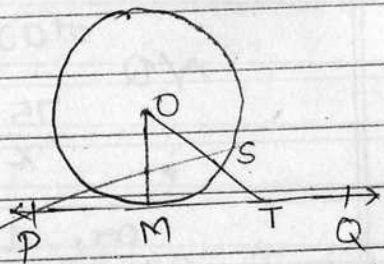
or, $(x-50)(x+5)=0$

or, $x-50=0$ | or, $x+5=0$

or, $x=50$ | or, $x=-5$ (invalid)

$\therefore$ first speed ~~for~~ $= x = 50$ km/hr

29. Given circle $C(O, r)$
PQ is a tangent to the circle at M.



To prove:- $OM \perp PQ$

Const:- we take another point on PQ i.e T and joined it with O.
The line intersects the circle at S.

Proof:- Here, $OM = OS = r$

$\Rightarrow OT > OM$ (~~A~~ whole is greater than a part)

or, $OM < OT$

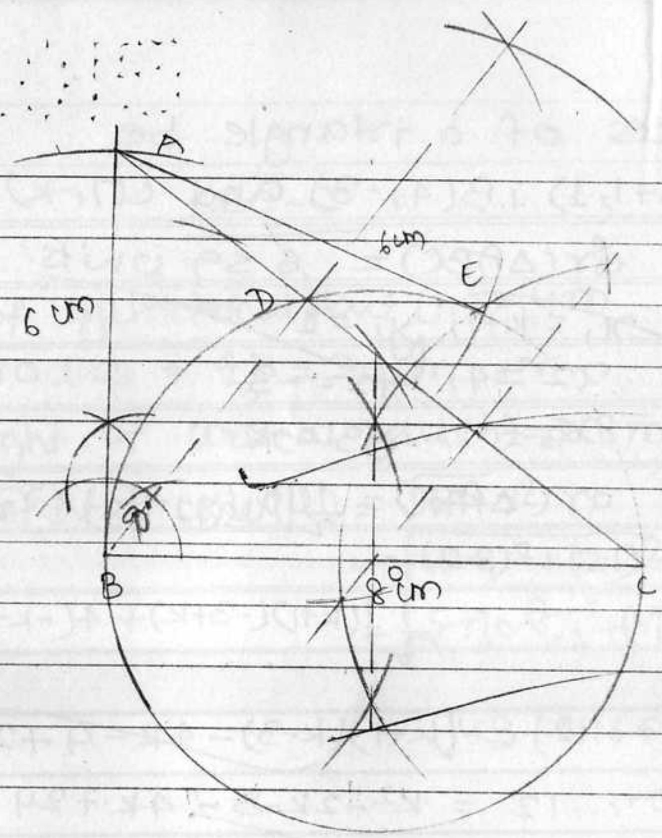
$\therefore$ OM is the shortest dist.

And, as we know that the shortest dist from a point to a line is the perpendicular dist

$\therefore OM \perp PQ$

So, A tangent is perpendicular to the radius through the point of contact.

30.



Steps:-

1. we draw $\triangle ABC$ with the given dimensions.
2. we draw a perpendicular to AC at D from B.
3. we draw a circle passing through B, C & D.
4. we draw tangent to the circle from A at B & E.

∴ AB & AE ~~are~~ required tangents.

31. Given, Let vertices of a triangle be
$A(K+1, 1)$, $B(4, -3)$ and $C(7, -K)$
Given, $ar(\Delta ABC) = 6$ sq. units.
Here, $x_1 = K+1$, $y_1 = 1$
$x_2 = 4$, $y_2 = -3$
$x_3 = 7$, $y_3 = -K$
Now, $ar(\Delta ABC) = \frac{1}{2}|x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)|$

or, $6 = \frac{1}{2}|(K+1)(-3+K) + 4(-K-1) + 7(1+3)|$

or, $12 = (K+1)(K-3) - 4K - 4 + 28$
or, $12 = K^2 - 2K - 3 - 4K + 24$
or, $K^2 - 6K + 21 - 12 = 0$
or, $K^2 - 6K + 9 = 0$, which is a Quad. eqn.
or, $K^2 - 3K - 3K + 9 = 0$
or, $K(K-3) - 3(K-3) = 0$
or, $(K-3)(K-3) = 0$

or, $K-3=0$	or, $K-3=0$
or, $K=3$	or, $K=3$

$\therefore K = 3$

SEC-C

11. Here, Height of cylindrical part $(H) = 4m$

Base radius $= \frac{4.2}{2} = 2.1\ m = r$

Now, Height of conical part $(h) = 2.8\ m$

Now, slant height of cone $(l) = \sqrt{h^2 + r^2}$

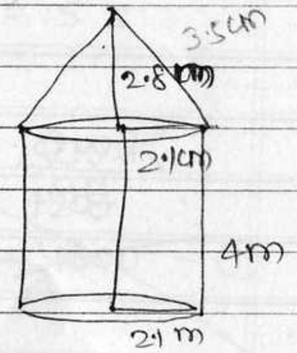
$= \sqrt{(2.8)^2 + (2.1)^2}$

$= \sqrt{\{7(0.4)\}^2 + \{7(0.3)\}^2}$

$= \sqrt{49(0.16 + 0.09)} = 7\sqrt{0.25}$

$= 7 \times 0.5$

$= 3.5\ m$



Req. area of canvas for making 1 tent

$= C.S.A$ of cone $+ C.S.A$ of cylinder

$= \pi r l + 2\pi r H$

$= \pi r[l + 2H] = \pi \times 2.1[3.5 + 2 \times 4]$

$= \frac{\cancel{22}^{11}}{\cancel{7}} \times \frac{\cancel{21}^{3}}{\cancel{10}_{5}}[3.5 + 8]$

$= \frac{33}{\cancel{5}} \times \frac{\cancel{115}^{23}}{10}$

$= \frac{33}{5}[11.5]\ m^2 = \frac{33 \times 23}{10}\ m^2$

Req. area of ~~tent~~ canvas for making 110 tents $= \cancel{110}^{22} \times \frac{33}{\cancel{5}} \times \frac{23}{\cancel{10}}$

$= \frac{\cancel{110}^{10} \times 33 \times 23}{10} = (33 \times 230)\,m^2 \quad \cancel{= (66 \times 43)\,m^2}$

$\therefore$ Rate of canvas $=$ ₹ $110 / m^2$

$\therefore$ cost " " $=$ ₹ $110 \times \cancel{66 \times 43}\; 33 \times 230$

$=$ ₹ $\cancel{6610 \times 43} =$ ₹ $\cancel{283800}$

$=$ ₹ (3300×230)

Since, the welfare association will contribute 50%.

$\therefore$ Its contribution $=$ ₹ $\frac{50}{100} \times \cancel{283800}\; 3300 \times 230$

$=$ ₹ $\cancel{141900}\; 16500 \times 23$

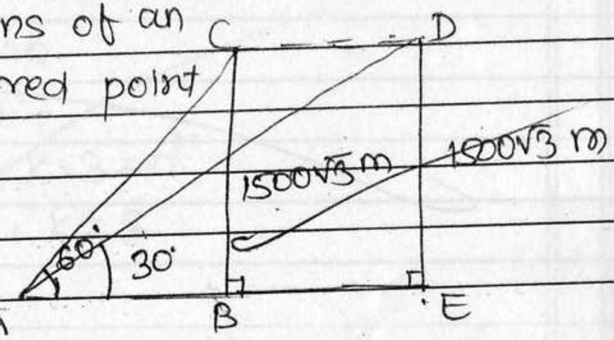
$=$ ₹ 379500

The associations are very social, helpful, generous & kind.

12\. Let C & D be the two positions of an aeroplane & A be the required point on the ground.

Here, $CB \perp AE$ & $DE \perp AE$

Given, $\angle CAB = 60^\circ$, $\angle DAE = 30^\circ$



$BC = DE = 1500\sqrt{3}$ m

Now, Time taken to reach D from C = 15 s

Now, In right $\triangle DEA$,

$$\tan 30^\circ = \frac{DE}{AE} \Rightarrow \frac{1}{\sqrt{3}} = \frac{1500\sqrt{3}}{AE}$$

$$\Rightarrow AE = 4500 \quad \text{--- (i)}$$

Similarly, In right $\triangle ABC$,

$$\tan 60^\circ = \frac{BC}{AB} \Rightarrow \sqrt{3} = \frac{1500\sqrt{3}}{AB}$$

$$\Rightarrow AB = 1500 \quad \text{--- (ii)}$$

Subtracting (ii) from (i), we get

or, $AE - AB = 4500 - 1500 = 3000$

or, $BE = 3000$ m

so, $CD = 3000$ m $= 3$ km

$\therefore$ Time taken to cover $CD = 15\,s = \frac{15}{3600}$ hrs $= \frac{1}{240}$ hrs

$\therefore$ Speed of aeroplane $= \frac{3 \times 240}{1}$ km/hr

$= 720$ km/hr

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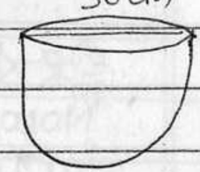
13. Here, internal diameter of a hemispherical bowl $= 36$ cm



$\Rightarrow$ radius $= R = 18$ cm

A/Q

The liquid of the bowl is filled into 72 cylindrical bottles of diameter 6 cm i.e of radius 3 cm

Also, 10% liquid is wasted.

Now, vol^{m} of the bowl $= \frac{2}{3} \times \pi \times (18)^3 = \frac{2 \times \pi \times \overset{6}{\cancel{18}} \times 18 \times 18}{\cancel{3}}$

$= (12 \times 324 \pi)$ cm^3

Liquid wasted $= \frac{\cancel{10}}{\cancel{100}_{5}} \times \cancel{12} \times 3\overset{6}{\cancel{24}}\, \pi = \left(\frac{1944}{5} \pi\right)$ cm^3

Now, liquid used to fill the bottles $= \left(3888\pi - \frac{1944\pi}{5}\right)$ cm^3

$= \left(\frac{19440\pi - 1944\pi}{5}\right)$ cm^3

$= \frac{17496\pi}{5}$ cm^3

Now, Height of ~~to~~ each bottle $= \dfrac{\cancel{\cancel{\cancel{17496}}}^{\cancel{1944}\ \cancel{243}\ 27}\ \cancel{\pi}}{5 \times \cancel{\pi} \times \cancel{3} \times \cancel{3} \times \cancel{72}_{9}}$

$= \dfrac{27}{5}$ cm

$= 5.4$ cm

14. No. of orange balls in a jar $= 10$

Let the no. of red balls $= x$

" " " blue " $= y$

Total no. of balls $= 10 + x + y$

Now,

Let E be the event of getting a red ball.

$P(\text{red}) = \dfrac{1}{4} \Rightarrow \dfrac{x}{x+y+10} = \dfrac{1}{4}$

$\Rightarrow 4x = x + y + 10$

or, $3x - y - 10 = 0$ — (I)

Again, $P(\text{blue}) = \dfrac{1}{3} \Rightarrow \dfrac{y}{x+y+10} = \dfrac{1}{3}$

$\Rightarrow 3y = x + y + 10$

$\Rightarrow 2y - x - 10 = 0$ — (II)

Subtracting (ii) from (i), we get

or, $3x-y-10=0$

or, $-x+2y-10=0$
$\quad (+) \quad (-) \quad (+)$

$4x-3y=0$

or, $4x=3y$

or, $x=\frac{3y}{4}$ — (iii)

Putting the value of x in (i) we get

or, $3\left(\frac{3y}{4}\right)-y=10$

or, $9y-4y=40$

or, $5y=40 \Rightarrow y=8$

Putting $y=8$ in (iii), we get

$x=\frac{3\times \cancel{8}^2}{\cancel{4}}=6$

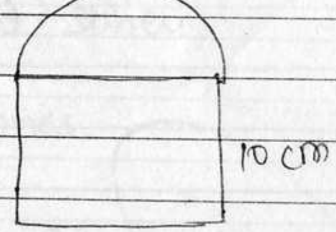
∴ Total no. of balls $= 6+8+10$
$= 24$

15. Here, side of a cubical block $= a = 10$ cm

A hemisphere surmounts the cube.

$\therefore$ Diameter (largest) of hemisphere $= 10$ cm

$\Rightarrow$ radius $(r) = 5$ cm



Now, T.S.A of solid = (T.S.A of cube − area of base of hemisphere) + C.S.A of hemisphere

$= 6a^2 - \pi r^2 + 2\pi r^2$

$= 6a^2 + \pi r^2 = 6(10)^2 + \pi(5)^2$

$= 600 + 25 \times 3.14$

$= 600 + \frac{\cancel{25} \times \cancel{314}^{157}}{\cancel{100}_{\cancel{4}\,2}}$

$= \frac{1200 + 157}{2} = \frac{1357}{2}\ cm^2$

Now, Rate of painting = Rs $5/100\ cm^2$

$\therefore$ cost " " $= Rs\ \frac{\cancel{5}}{\cancel{100}_{20}} \times \frac{1357}{2}$

33.925

$= Rs\ \frac{1357}{4 \times 100} = Rs\ 33.925$

$= Rs\ 33.93$

16. Here, coordinates of points A & B are $A(-2,-2)$ and $B(2,-4)$

Here, P divides AB such that

$$\frac{AP}{AB} = \frac{3}{7} \Rightarrow \frac{AB}{AP} = \frac{7}{3}$$

$$\Rightarrow \frac{AB-AP}{AP} = \frac{7-3}{3}$$

$$\text{or, } \frac{BP}{AP} = 4/3$$

$$\Rightarrow AP : BP = 3:4$$

$\therefore$ Point P divides AB in the ratio 3 : 4

Now, Coordinates of P are

$$P\left[\frac{3\times2+4(-2)}{3+4}, \frac{3(-4)+4(-2)}{3+4}\right]$$

$$= P\left[\frac{6-8}{7}, \frac{-12-8}{7}\right] = P\left(\frac{-2}{7}, \frac{-20}{7}\right)$$

Ans

(17) Diameter of a cone $= 3.5$ cm

$\Rightarrow$ radius$(R) = 3.5/2$ cm

Height of cone $= H = 3$ cm

Here, 504 cones are melted to form a sphere.

Let the radius of sphere $= R$

Now, Vol^m of sphere $=$ Vol^m of 504 cones

or, $\frac{4}{3}\pi R^3 = 504 \times \frac{1}{3} \times \pi \times 3 \times \frac{3.5}{2} \times \frac{3.5}{2 \times 10}$

or, $R^3 = \frac{126 \times 3 \times 35 \times 35}{4 \times 100} = \frac{7 \times 7 \times 7 \times 18 \times 3}{16}$

or, $R = \sqrt[3]{\frac{7 \times 7 \times 7 \times 3 \times 3 \times 3}{2 \times 2 \times 2}} = \frac{7 \times 3}{2} = \frac{21}{2}$ cm

$\therefore$ Diameter $= 2R = 2 \times \frac{21}{2} = 21$ cm

S.A of hemisphere $= 4\pi R^2$

$= 4\pi \times \frac{21}{2} \times \frac{21}{2} = \frac{22}{7} \times 21 \times 21$

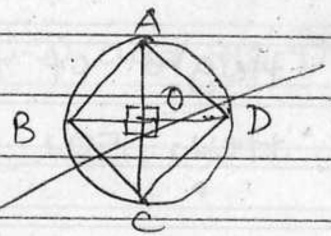
$= 66 \times 21$

$= 1386$ cm^2

66
21
66
132
1386

18. In circle with centre O.

ABCD is a rhombus.



As we know that diagonals of a rhombus are perpendicular to each other.

So, AC and BD intersect each other at O.

Now, $ar\,C(O,r) = 1256\ cm^2$

or, $\pi r^2 = 1256$

or, $3.14 \times r^2 = 1256 \Rightarrow r^2 = \frac{\overset{4}{\cancel{1256}} \times 100}{\cancel{314}}$

$\Rightarrow r = 2 \times 10$

$= 20\ cm$

Now, diagonals of rhombus $= (2 \times 20)\ cm$

$= 40\ cm$

$\therefore$ area of rhombus $ABCD = \frac{1}{\cancel{2}} \times \overset{20}{\cancel{40}} \times 40$

$= 800\ cm^2$

19. $2x^2+6\sqrt{3}x-60=0$

or, $x^2+3\sqrt{3}x-30=0$

or, Here, $a=1$, $b=3\sqrt{3}$, $c=-30$

Now, $D=b^2-4ac$

$=(3\sqrt{3})^2-4\times1(-30)$

$=27+120=147$

$D>0$ so, roots are real and distinct

Now, $x=\frac{-b\pm\sqrt{D}}{2a}=\frac{-3\sqrt{3}\pm\sqrt{147}}{2}$

$\alpha=\frac{-3\sqrt{3}+\sqrt{147}}{2}=\frac{-3\sqrt{3}+7\sqrt{3}}{2}=\frac{\sqrt{3}(7-3)}{2}=\frac{4\sqrt{3}}{2}=2\sqrt{3}$

$\beta=\frac{-3\sqrt{3}-\sqrt{147}}{2}=\frac{-3\sqrt{3}-7\sqrt{3}}{2}=\frac{-\sqrt{3}(7+3)}{2}=\frac{10(-\sqrt{3})}{2}$

$=-5\sqrt{3}$

20. Let a be the first term and d be the common diff of the given A.P.

Then, $a_{16}=5\times a_3$

or, $a+15d=5(a+2d)$

or, $a+15d=5a+10d$

or, $4a-5d=0 \Rightarrow 4a=5d$ —(i)

$\Rightarrow a=\frac{5d}{4}$ —(1)

Given, $a_{10} = 41$

or, $a + 9d = 41$

or, $\frac{5d}{4} + 9d = 41$

or, $36d + 5d = \cancel{176}\ 164$

or, $41d = \cancel{176}\ 164$

or, $d = \frac{\cancel{176}}{\cancel{41}}\ \frac{164}{41} = 4$

Now, Putting $d = 4$ in (1), we get

or, $a = \frac{5 \times 4}{4} = 5$

Now, $S_{15} = \frac{15}{2}[2\times5 + 14\times4]$

$= 15[5+28] = 15\times33$

$= 495$ Ans

Sec-B.

5. Given, points $A(x, y)$, $B(-5,7)$ and $C(-4,5)$ are collinear.

Now, $x_1 = x$, $y_1 = y$, $x_2 = -5$, $y_2 = 7$, $x_3 = -4$, $y_3 = 5$

or, $ar(\Delta ABC) = 0$

or, $\frac{1}{2}|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)| = 0$

or, $x(7-5)+(-5)(5-y)+(-4)(y-7) = 0$

or, $2x - 25 + 5y - 4y + 28 = 0$

or, $2x + y + 3 = 0$, which is the required relation between x & y.

6. Let a be the first term and d be the common diff of the given A.P.

Then, Given, $S_5 + S_7 = 167$

$S_{10} = 235$

or, $\frac{\cancel{10}^{\,5}}{\cancel{2}}[2a+9d] = \cancel{235}^{\,47}$

or, $2a + 9d = 47$ — (1)

Also, $S_5 + S_7 = 167$

or, $\frac{5}{2}[2a+4d] + \frac{7}{2}[2a+6d] = 167$

or, $5[a+2d] + 7[a+3d] = 167$

or, $12a + 31d = 167$ — (ii)

sub. (i) from (ii), we get

or, $12a + 31d = 167$

$-\ 2a + 9d = 47$

$\quad\ \ -\ \quad\ -\quad\ \ -$

$10a + 22d = 120$

or, $10a + 22d = 120$

or, $5a + 11d = 60 \Rightarrow a = \frac{60-11d}{5}$ —(iii)

Putting $a = \frac{60-11d}{5}$ in (ii), we get

or, $\frac{12(60-11d)}{5} + 31d = 167$

or, $720 - 132d + 155d = 835$

or, $23d = 835 - 720$

$= 115$

or, $d = 5$

Putting $d = 5$ in (iii), we get

or, $a = \frac{60 - 11\times5}{5}$

$= \frac{60-55}{5} = 5/5 = 1$

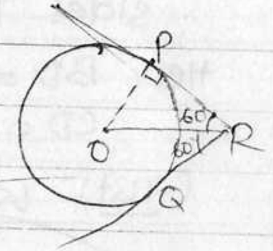
$\therefore$ Req. A.P is $a, a+d, a+2d$ ---

$1, 1+5, 1+2\times5$ ---

~~0, 5, 10~~ ---

1, 6, 11 ---

7\. Given, RQ and RP are tangents to the circle C(O,r) at R & R respectively.



$\angle PRQ = 120°$

To prove:- $OR = PR + RQ$

Const:- We draw $OP \perp PR$

Proof:- As we know that tangents subtend equal ∠s to the line segment joining the point and the centre of the circle.

$\therefore \angle ORP = 60°$

Now, In right $\triangle OPR$,

$\cos 60° = \frac{PR}{OR} \Rightarrow \frac{1}{2} = \frac{PR}{OR}$

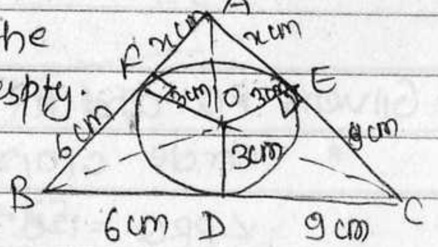
$\Rightarrow 2PR = OR$

$\Rightarrow PR + RQ = OR$

$(\because PR = RQ$ tangents from R)

Proved

8\. Given, Circle with centre O touches the sides BC, AC & AB at D, E & F respty.



Here $BD = 06$ cm

$CD = 9$ cm, $ar(\triangle ABC) = 54\ cm^2$

Const: We draw $OE \perp AC$ & $OF \perp AB$

We join OA, OB & OC

To find: AB & AC

Sol:-

Here, $BF = BD = 6$ cm (tangents from B)

$CD = CE = 9$ cm (tangents from C).

Let $AE = AF = x$ cm (tangents from A)

Now, ~~ar~~ $AB = (x+6)$ cm, $BC = 15$ cm

$AC = (9+x)$ cm

or, $ar(\triangle ABC) = ar(\triangle AOB) + ar(\triangle BOC) + ar(\triangle AOC)$

or, $54 = \frac{1}{2} \times OD \times (x+6) + \frac{1}{2} \times OD + 15 + \frac{1}{2} \times OD \times (x+9)$

or, $\overset{18}{\cancel{54}} = \frac{\cancel{3}}{2}[x+6+15+x+9]$

or, $36 = 30 + 2x$

or, $2x = 6$

or, $x = 3$

$\therefore \quad AB = (x+6)\ cm = (3+6)\ cm = 9\ cm$

$AC = (x+9)\ cm = (3+9)\ cm = 12\ cm$

9. $4x^2 + 4bx - (a^2 - b^2) = 0$

Here, $a = 4, \quad b = 4b, \quad c = -(a^2 - b^2)$

$D = b^2 - 4ac$

$= (4b)^2 + 4 \times 4(a^2 - b^2)$

$= 16b^2 + 16a^2 - 16b^2 = 16a^2 = (4a)^2$

$\therefore D > 0$. So, roots are real & distinct.

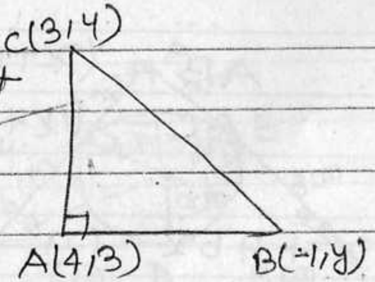
[redacted]

Now, $x = \dfrac{-b \pm \sqrt{D}}{2a} = \dfrac{-4b \pm \sqrt{(4a)^2}}{2 \times 4} = \dfrac{-4b \pm \sqrt{(4a)^2}}{8}$

$\alpha = \dfrac{-4b + 4a}{8} = \dfrac{4(a-b)}{8\,2} = \dfrac{a-b}{2}$

$\beta = \dfrac{-4b - 4a}{8} = \dfrac{4(-a-b)}{8\,2} = -\dfrac{(a+b)}{2}$

10. Let $A(4,3)$, $B(-1,y)$ and $C(3,4)$ be the vertices of a right ΔABC right-angled at A.



Now, By pythagoras theorem,

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

or, $(-1-3)^2 + (y-4)^2 = (4+1)^2 + (3-y)^2 + (4-3)^2 + (3-4)^2$

or, $(-4)^2 + (y-4)^2 = (5)^2 + (3-y)^2 + 1 + 1$

or, $16 + y^2 + 16 - 8y = 25 + 9 + y^2 - 6y + 2$

or, $32 - 2y = 36$

or, $2y = -4$

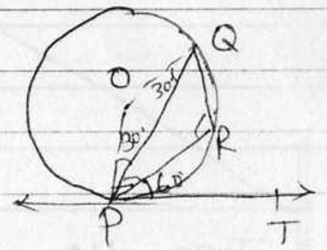
or, $y = -2$ Ans

SEC-A

~~1.~~ $12\cancel{0}^\circ$

~~2.~~

1. Given, $\angle QPT = 60^\circ$



Then, $\angle OPQ = 30^\circ$

$\therefore \angle POQ = 120^\circ$

So, ~~ref~~ $\angle POQ = 240^\circ$

$\therefore \angle PRQ = 120^\circ$ Ar

$\angle PRQ = 120^\circ$

2. $D = 0$ (for equal roots)

$\Rightarrow (-2\sqrt{5}p)^2 - 4p \times 15 = 0$

or, $4 \times 5p^2 - 60p = 0$

or, $20p^2 - 60p = 0$

or, $20p(p-3) = 0$

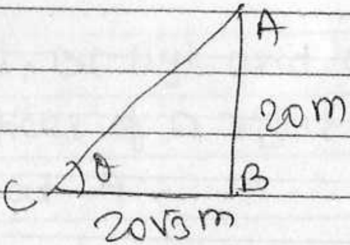
or, $20p = 0$ | or, $p = 3$

or, $p = 0$

(Invalid)

$\therefore p = 3$

3.



$\therefore \tan\theta = \frac{20}{20\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30^\circ$

$\therefore \theta = 30^\circ$

So, Sun's altitude = 30°

4. Two dice are tossed together.

All possible outcomes are (1,1), (1,2) ---- (6,6)

Total no. of " = 36

Let E be the event of getting the product of 2 no.s on top is 6

Then, favourable outcomes = (1,6), (2,3), (3,2), (6,1)

No. of " " = 4

$P(E) = \frac{4}{36} = \frac{1}{9}$