

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

विषय Subject : **Mathematics**

041

विषय का कोड Subject Code :
परीक्षा का दिन एवं तिथि
Day & Date of the Examination : **19.3.16 (Saturday)**

उत्तर देने का माध्यम
Medium of answering the paper : **English**

प्रश्न पत्र के ऊपर लिखें
कोड को दर्शाएँ
Write code No. as written on
the top of the question paper : **30/2**

Set Number
① ● ③ ④

NIL

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

हाँ / नहीं
Yes / No

विकलांग व्यक्ति
Person with Disabilities :

किसी शारीरिक अक्षमता 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 = हिस्सेदारित्व, A = ऑटिस्टिक
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क्या लेखन -- लिपिक उपलब्ध कराया गया :
Whether writer provided :

यदि दृष्टिहीन है तो उपयोग में लाए गए
सॉफ्टवेयर का नाम :
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*नाम 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.

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कार्यालय उपयोग के लिए
Space for office use

Section D

21)

We have-

Radius of cylindrical and conical base = 2.8 m.

Height of cylinder = 3.5 m.

Height of conical part = 2.1 m

Slant height of conical part = $\sqrt{h^2 + r^2}$

$$= \sqrt{(2.8)^2 + (2.1)^2} \Rightarrow \sqrt{7.84 + 4.41}$$

$$l = \sqrt{12.25} \Rightarrow l = 3.5 \text{ m}$$

Total canvas required = C.S.A of cylinder + C.S.A of cone to make 1 tent

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

$$= \pi r (2h + l) \Rightarrow \frac{22 \times 2.8 (2 \times 3.5 + 3.5)}{7} \text{ m}^2$$

$$= \frac{(22 \times 2.8 (7 + 3.5))}{7} = \frac{22 \times 2.8 \times 10.5}{7} \text{ m}^2$$

Canvas required to make 1500 such tent

$$= 1500 \times 92.4 \text{ m}^2$$

$$= 138600 \text{ m}^2$$

Total cost of making tent @ ₹120/m²

$$\Rightarrow ₹120 \times 138600$$

Amount shared by each ^{school} std, when there are 50 schools

$$120 \times 138600$$

50

$$₹12 \times 27720$$

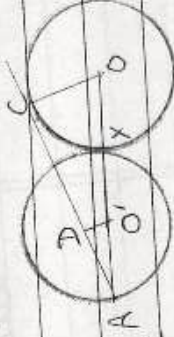
$$= ₹332640$$

Value - "Help the needy"

22) We have -

Two equal circles, O & O', touching each other at X and O'D ⊥ AC.

$$\text{To find} = \frac{DO'}{CO}$$



Let radius of each circle = r

In ΔADO' & ΔACO -

$$\angle A = \angle A \quad (\text{common})$$

$$\angle ADO' = \angle ACO \quad (\text{each } 90^\circ)$$

⇒ ΔADO' ~ ΔACO by AA similarity

By c.p.d. $\frac{AO'}{AO} = \frac{O'D}{OC} = \frac{AD}{AC}$

($AO' = 2$ & $AO = 3$)

$\Rightarrow \frac{2}{3} = \frac{O'D}{OC} \Rightarrow \frac{1}{3} = \frac{DO'}{CO}$

Ans: $\frac{DO'}{CO} = \frac{1}{3}$

we have -

Total possible outcome = 1, 2, 3, 4 & 1, 4, 9, 16 = 16

	1	2	3	4
1	1	2	3	4
4	4	8	12	16
9	9	18	27	36
16	16	32	48	64

Total favourable event, having product less than 16
 = 9 + 1, 2, 3, 4, 4, 8, 12 = 7 + 1 = 8

Probability = $\frac{\text{Favourable event}}{\text{Total event}}$

$P\{E\} = \frac{7+1}{16} = \frac{8}{16} = \frac{1}{2}$

Ans: $\frac{1}{2}$

24)

The vertices of $\triangle ABC$ are -
 $A(4,6)$, $B(1,5)$, $C(7,2)$

Area of $\triangle ABC$ (by cross method)



$$\Rightarrow \frac{1}{2} [(x_2 y_1 + x_3 y_2 + x_1 y_3) - (x_1 y_2 + x_2 y_3 + x_3 y_1)]$$



$$\text{Area of } \triangle ABC = \frac{1}{2} [(6 + 35 + 8) - (20 + 2 + 42)]$$

$$\Rightarrow \frac{1}{2} [49 - (64)] = \frac{1}{2} |-15| = \frac{15 \text{ unit}^2}{2}$$

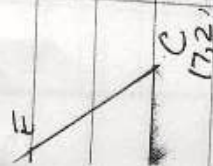
We have - $\frac{AD}{AB} = \frac{1}{3} \Rightarrow \frac{AD}{AD+DB} = \frac{1}{3}$

$$\Rightarrow 3AD = AD + DB$$

$$2AD = DB \Rightarrow \frac{AD}{DB} = \frac{1}{2}$$

$$AD : DB = 1 : 2, \text{ similarly } AE : EC = 1 : 2$$

(4,6)



By section formula. — $\frac{mx_2 + nx_1}{m+n}$ & $\frac{my_2 + ny_1}{m+n}$

$$D(x, y) \Rightarrow x = \frac{1 + 2 \times 4}{3} \quad \& \quad y = \frac{1 \times 5 + 2 \times 6}{3}$$

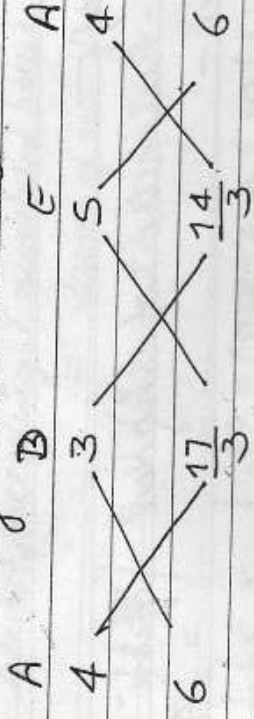
$$x = \frac{9 + 8}{3} \quad y = \frac{17}{3}$$

$$E(x_1, y_1) = x_1 = \frac{1 \times 7 + 2 \times 4}{3} \quad \& \quad y_1 = \frac{1 \times 2 + 2 \times 6}{3}$$

$$x_1 = \frac{7 + 8}{3} \quad \& \quad y_1 = \frac{2 + 12}{3}$$

$$x_1 = 5 \quad \& \quad y_1 = \frac{14}{3}$$

Area of $\triangle ADE$ by cross method —



Area

$$= \frac{1}{2} \left[\left(18 + \frac{85}{3} + 56 \right) - \left(\frac{68}{3} + 14 + 30 \right) \right]$$

$$= \frac{1}{2} \left[\left(\frac{54 + 85 + 56}{3} \right) - \left(\frac{68 + 42 + 90}{3} \right) \right]$$

$$\frac{1}{2} \left[\left(\frac{195}{3} - \frac{200}{3} \right) \right] \Rightarrow \frac{1}{2} \left| \frac{-5}{3} \right| \quad \text{2. } \frac{1 \times 5}{2 \times 3} = \frac{5 \text{ units}^2}{6}$$

$$\begin{aligned} \text{Area of } \triangle ADE &= \frac{\frac{1}{2} \times \frac{5}{3}}{\frac{1}{2} \times 15} \Rightarrow \frac{5}{3 \times 15} \Rightarrow \frac{1}{9} \\ \text{Area of } \triangle ABC &= \end{aligned}$$

$$\boxed{\text{Ar}(\triangle ADE) = \frac{1}{9}(\text{Ar} \triangle ABC)}$$

25) Given - OAP is sector of circle with centre O, $\angle POA = \theta$ and $OA \perp AB$

To prove -

$$\text{Perimeter of shaded region} = r \left[\tan \theta + \sec \theta + \frac{\pi \theta}{180} - 1 \right]$$

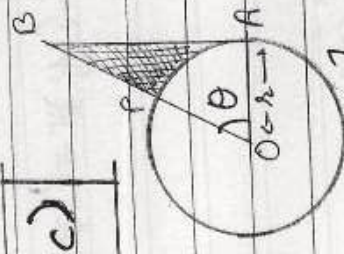
Proof - (IV)

$$\text{Perimeter of shaded region} = BP + AB + \widehat{AP} \quad \text{--- (1)}$$

Now - $\tan \theta = \frac{AB}{r} \Rightarrow r \tan \theta = AB$

$$\sec \theta = \frac{OB}{r} \Rightarrow r \sec \theta = OB \quad \checkmark$$

$$OB - OP = BP \Rightarrow r \sec \theta - r = BP \quad \text{--- (2)}$$



$\frac{S_{\text{und}}}{6}$

Length of arc AP = $\frac{0 \times 2\pi r}{360} = \frac{0 \times 2\pi r}{360} = \frac{0\pi r}{180}$ — (3)

Putting value from eq ①, ②, ③ in eq IV
 $\Rightarrow$ Perimetre of shaded region

$= r \tan 0 + r \sec 0 - r + \frac{0\pi r}{180}$

$= r \left[\tan 0 + \sec 0 + \frac{0\pi - 1}{180} \right]$

Hence proved.

26)

The houses are numbered consecutively from 1 to 49
 1 2 3 $x-1$, x , $x+1$ 49

Sum of no. of house preceding x numbered house

$=$ sum of no. following x
 $\Rightarrow \frac{x-1}{2} [1 + (x-1)] = \left[1 + \dots + 49 \right] - \left[1 + 2 + \dots + x \right]$

$\Rightarrow \frac{x-1}{2} [1 + x - 1] = \left[\frac{49 \times (1+49)}{2} - \left[\frac{x \times (1+x)}{2} \right] \right]$

$\therefore \frac{(x-1)x}{2} = \frac{49 \times 50}{2} - \frac{x(x+1)}{2}$

— (IV)

$$\frac{x(x-1)}{2} + \frac{(x+1)x}{2} = 49 \times 25$$

$$\frac{x^2 - x + x^2 + x}{2} = 49 \times 25$$

$$\frac{2x^2}{2} = 49 \times 25 \Rightarrow x^2 = 7 \times 7 \times 5 \times 5$$

$$x = 35$$

35, being whole no, proved that, given statement is true for $x = 35$

27)

Let speed of stream = x

speed of boat = 24 km/h.

WTO-

Q10, -

$$\frac{32}{24-x} + \frac{32}{24+x} = 1$$

$$\frac{32 - 32}{24-x} = 1$$

"Sorry Sir/Mam"

$$\Rightarrow 32 \left[\frac{1}{24-x} + \frac{1}{24+x} \right] = 1$$

$$32 \left[\frac{1}{24-x} - \frac{1}{24+x} \right] = 1$$

$$\Rightarrow \frac{24+x+(24-x)}{576-x^2} = \frac{1}{32}$$

$$32 \left[\frac{24+x-24+x}{576-x^2} \right] = 1$$

1

29) Given - A circle (O, OP) and tangent at P .

To prove - $OP \perp PO$

Constⁿ - Extend OR to Q , at AB

Proof - we have -

$$OP = OR \text{ (radius)}$$

$$OQ = OR + RQ$$

$$\therefore \text{Clearly } OQ > OR$$

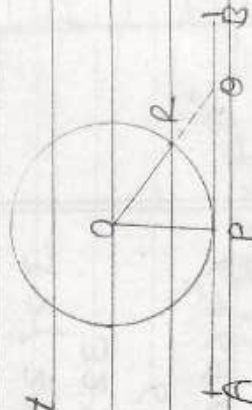
$$OQ > OP$$

The shortest line joining a point to any point on given line is $\perp$ to that line

$$\Rightarrow OP \perp AB$$

$$\text{or } [OP \perp PQ]$$

Hence proved

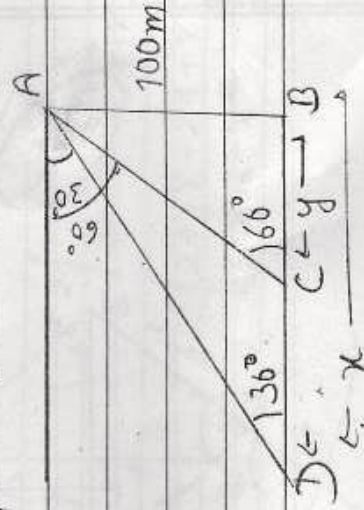


30)

In $\triangle ABC$, $\angle ACB = 60^\circ$

$$\tan 60^\circ = \frac{\sqrt{3}}{1}$$

$$\Rightarrow \frac{100}{BC} = \sqrt{3}$$



$$\frac{100}{\sqrt{3}} = BC = y$$

In ΔABD , $\angle ADB = 30^\circ$

$$\tan 30^\circ = \frac{1}{\sqrt{3}} \Rightarrow \frac{AB}{BD} = \frac{1}{\sqrt{3}} \Rightarrow \frac{100}{BD} = \frac{1}{\sqrt{3}}$$

$$100\sqrt{3} = BD = y$$

Required distance travelled by ship $= (y - x) = x - y$
 $= 100\sqrt{3} - \frac{100}{\sqrt{3}}$

$$x - y \Rightarrow 100 \left[\sqrt{3} - \frac{1}{\sqrt{3}} \right] = 100 \left[\frac{3-1}{\sqrt{3}} \right] = \frac{100 \times 2}{\sqrt{3}}$$

$$CD = x - y \Rightarrow \frac{100 \times 2 \times \sqrt{3}}{\sqrt{3} \sqrt{3}} = \frac{200\sqrt{3}}{3} \text{ m}$$

$$CD = \frac{200 \times 1.73 \text{ m}}{3} = \frac{346}{3} \text{ m}$$

$$\Rightarrow \boxed{115.33 \text{ m}}$$

n given

31)

Let length of park = x Its breadth = $x-3$ Area = $x(x-3) \text{ m}^2$ Base of isosceles Δ = $x-3$ and altitude = 12 m

$$\text{Its area} = \frac{1 \times (12 \times (x-3)) \text{ m}^2}{2} = 6(x-3) \text{ m}^2$$

SJO $\rightarrow$

$$+x(x-3) = 6(x-3) + 4$$

$$x^2 - 3x = 6x - 18 + 4$$

$$x^2 - 3x = 6x - 14$$

$$x^2 - 3x - 6x + 14 = 0$$

$$x^2 - 9x + 14 = 0$$

$$x^2 - 7x - 2x + 14 = 0$$

$$x(x-7) - 2(x-7) = 0$$

$$x = 2, 7$$

Length of rectangle field = 7 m & breadth = $(7-3) \text{ m} = 4 \text{ m}$

(Length can't be 2, because if then breadth = -1, that isn't possible).

Ans:- 7 m, 4 m respectively

(By Factorisation Method)

Section C-

11) Given - The point $P(x, y)$ is equidistant from point $A(a+b, b-a)$ & $B(a-b, a+b)$

To prove - $bx = ay$

Proof -

$$AP = BP \Rightarrow AP^2 = BP^2$$

By distance formula = $\frac{AP^2}{BP^2} = \frac{[x_2 - x_1]^2 + [y_2 - y_1]^2}{BP^2}$

$$\Rightarrow [x - (a+b)]^2 + [y - (b-a)]^2 = [x - (a-b)]^2 + [y - (a+b)]^2$$

$$\Rightarrow x^2 + (a+b)^2 - 2x(a+b) + y^2 + (b-a)^2 - 2y(b-a)$$

$$= x^2 + (a-b)^2 - 2x(a-b) + y^2 + (a+b)^2 - 2y(a+b)$$

$$(b-a)^2 - 2x(a+b) + 2y(a-b) = (a-b)^2 - 2x(a-b) - 2y(a+b)$$

$$b^2 + a^2 - 2ba - 2ax - 2bx + 2ay - 2by = a^2 + b^2 - 2ab - 2ax + 2bx - 2ay + 2by$$

$$= 4ay = 4bx$$

$$ay = bx$$

Hence proved

mod)

12) Radius & height of conical vessel = 5 cm & 24 cm resp.
 Volume of cone = $\frac{1}{3}\pi r^2 h$

$$\text{Volume of cone} = \frac{1}{3}\pi \times 25 \times 24 \text{ cm}^3$$

Water is emptied of cylindrical vessel of $r = 10$ cm & height = h

Volume of cone = Volume of cylinder

$$\Rightarrow \frac{1}{3}\pi \times 25 \times 24 = \pi \times 10 \times 10 \times h$$

$$\left. \begin{array}{l} \text{Volume of -} \\ \text{Conu} = \frac{1}{3}\pi r^2 h \\ \text{Cylinder} = \pi r^2 h \end{array} \right\}$$

$$= \frac{2500}{100} \text{ cm} = h$$

$$= \boxed{25 \text{ cm} = h}$$



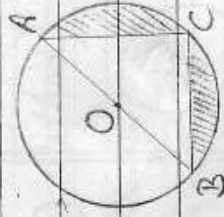
13) Q10 -

Radius of semicircle ACB = 13 cm.

Area of semicircle = $\frac{1}{2}\pi r^2$

$$\text{Its area} = \frac{1}{2} \times 3.14 \times 13 \times 13 \text{ cm}^2$$

$$\frac{3.14 \times 169 \text{ cm}^2}{2} = \frac{530.66 \text{ cm}^2}{2}$$



Semicircle subtend 90° at circle, $\angle ACB = 90^\circ$

In $\triangle ABC$ -

$$AC^2 + BC^2 = AB^2 \Rightarrow 12^2 + BC^2 = 169 \text{ cm}^2$$

$$\Rightarrow BC^2 = (169 - 144) \text{ cm}^2 \quad BC^2 = 25 \text{ cm}$$

$$BC = 5 \text{ cm}$$

$$\text{Area of } \triangle = \frac{1}{2} \times \text{Base} \times \text{Height}$$

$$\text{Area of } \triangle ABC = \frac{1}{2} \times AC \times BC = \frac{1 \times 12 \times 5}{2} = 30 \text{ cm}^2$$

$$\text{Area of shaded region} = \frac{530.66 \text{ cm}^2}{8} - 30 \text{ cm}^2$$

$$\Rightarrow (66.3325 - 30) \text{ cm}^2$$

$$\Rightarrow \underline{\underline{36.3325 \text{ cm}^2}}$$

14) Diameter of sphere = 12 cm

Its radius = 6 cm

$$\text{Volume} = \frac{4\pi \times 6^3}{3} \text{ cm}^3$$

$$\left\{ \begin{array}{l} \text{Volume of sphere} \\ = \frac{4}{3} \pi r^3 \end{array} \right\}$$

It is submerged into water in cylindrical vessel, then
water level rise by $3\frac{5}{9} \text{ cm} = \frac{32}{9} \text{ cm}$

Volume submerged = Volume rise.

Let radius of cylinder be r cm

$$\Rightarrow \frac{4}{3} \pi \times 6^3 = \pi \times r^2 \times \frac{32}{9}$$

$$\frac{27 \times 216 \times 3 \times 4}{32 \times 4} = r^2$$

$$\Rightarrow 4 \times 27 \times 3 = r^2 \Rightarrow 4 \times 81 = r^2$$

$$r = \frac{9}{1} \text{ cm}$$

$$\text{Diameter} = 2r = 2 \times 9 \text{ cm} = 18 \text{ cm}$$

15) Radius of cylinder as well as conical part = $\frac{3}{2}$ m.

Height of cylinder, $h = 2.1$ m

Slant height of cone, $l = 2.8$ m.

Total canvas required = $2\pi rh + \pi r l$

$$\pi r (2h + l)$$

$$\Rightarrow \frac{22}{7} \times \frac{3}{2} [4.2 + 2.8] \text{ m}^2$$

$$\Rightarrow \frac{22 \times 3 \times 7.0}{7} \text{ m}^2 = 33 \text{ m}^2$$

$$\text{Total cost @ ₹500/m}^2 = \frac{₹33 \times 500}{1} = \boxed{₹16,500}$$

16) Radii of two concentric circle = 7cm & 14cm
and $\angle AOC = 40^\circ$

$$\therefore \angle AOC = 360^\circ - 40^\circ = 320^\circ$$

Area of shaded region

$$\frac{\theta}{360} \pi [R^2 - r^2]$$

$$\Rightarrow \frac{320 \times 22}{360} \times \frac{14^2 - 7^2}{7} = \frac{8 \times 22 \times 7 \times 21}{4 \times 3}$$



$$\Rightarrow \frac{8 \times 154 \text{ cm}^2}{3}$$

$$\text{Required area} = \frac{1232 \text{ cm}^2}{3}$$

$$= \boxed{410.67 \text{ cm}^2}$$

17)

Let $AC = h$ be height of hill and $AB = h_m$ In $\triangle BCE$,where $BC = 10\text{ m}$ & $\angle BEC = 30^\circ$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \frac{BC}{BE} = \frac{1}{\sqrt{3}} \Rightarrow \frac{10}{BE} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow 10\sqrt{3}\text{ m} = BE = CD$$

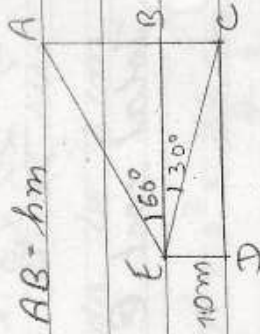
$$\text{Distance of hill from ship} = 10\sqrt{3}\text{ m} = 10 \times 1.732\text{ m} = 17.32\text{ m}$$

In $\triangle ABE$, where $AB = h_m$, $BE = 10\sqrt{3}\text{ m}$ & $\angle AEB = 60^\circ$

$$\tan 60^\circ = \frac{h}{10\sqrt{3}}$$

$$\Rightarrow \frac{h}{10\sqrt{3}} = \frac{1}{\sqrt{3}} \Rightarrow h = \frac{10\sqrt{3} \times \sqrt{3}}{10\sqrt{3}} = 30\text{ m}$$

$$\text{Height of hill} = h + 10\text{ m} = \boxed{40\text{ m}}$$



18) Let three digit of 3-digit no be $a-d, a, a+d$.
 Their sum = 15

$$a-d+a+d = 15 \Rightarrow 3a = 15 \Rightarrow a = 5$$

Required 3-digit no = $100(a-d) + 10a + a+d$

$$100a - 100d + 10a + a + d$$

$$111a - 99d$$

No. obtained by reversing digit = $100(a+d) + 10a + a-d$

$$100a + 100d + 10a + a - d$$

$$111a + 99d$$

1110 -

$$111a + 99d = 1110 - 99d - 594$$

$$\Rightarrow 594 = 111a - 99d - 1110 + 99d$$

$$594 = -198d$$

$$\frac{-594}{198} = d$$

$$d = -3 = d$$

$$\text{The no} = 111a - 99d$$

$$111 \times 5 - 99 \times -3$$

$$555 + 297 = 852$$

$$\text{No.} \Rightarrow \boxed{852 \text{ or } 258}$$

19)

$$(a-b)x^2 + (b-c)x + (c-a) = 0$$

The roots are equal, then $D=0$

Comparing eqⁿ by $ax^2 + bx + c = 0$

$$a = (a-b); b = (b-c); c = c-a$$

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

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

$$\text{Hence, } D = 0$$

$$(b-c)^2 - 4(a-b)(c-a) = 0$$

$$b^2 + c^2 - 2bc - 4(ac - a^2 - bc + ab) = 0$$

$$b^2 + c^2 - 2bc - 4ac + 4a^2 + 4bc - 4ab = 0$$

$$4a^2 + b^2 + c^2 + 2bc - 4ab - 4ac = 0$$

$$\Rightarrow (-2a + b + c)^2 = 0 \quad [a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = (a+b+c)^2]$$

$$-2a + b + c = 0$$

$$b + c = 2a$$

Hence proved

20)

$$\text{Total cards} = 52$$

$$\text{Cards removed} = 6$$

$$\text{Card left} = 52 - 6 = 46$$

Total black king = 2.

$$\text{Probability of drawing black king} = \frac{2}{46} = \frac{1}{23}$$

$$\text{Total red card} = 26 - 6 \\ = 20$$

$$\text{Probability of drawing red colour card} = \frac{20}{46} = \frac{10}{23}$$

$$\text{Total card of black colour} = 26$$

$$\text{Probability of drawing black colour card} = \frac{26}{46} = \frac{13}{23}$$

Section B

5 Given a quadrilateral circumscribing

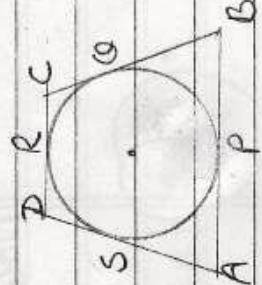
a circle, with centre O, such that

it touches sides AB, BC, CD, AD at P, Q, R, S

$$\text{To prove} = AB + CD = BC + DA$$

Proof- Length of tangent drawn from external point are equal

- | | | |
|---------|----------|---|
| AP = AS | — (at A) | ① |
| BP = BQ | — (at B) | ② |
| DR = DS | — (at C) | ③ |
| CQ = CR | — (at D) | ④ |



Adding eq ①, ②, ③, ④

$$AP + BP + DR + CR = AS + DS + BS + CS$$

$$AB + CD = AD + BC$$

Hence proved.

6)

we have,

$$a_4 = 0$$

$$a + 3d = 0$$

$$3d = -a$$

$$n - 3d = a \quad \text{--- (1)}$$

Now,

$$a_{25} = a + 24d$$

$$= -3d + 24d$$

$$= 21d \quad \text{--- (2)}$$

$$a_{11} = a + 10d$$

$$= -3d + 10d$$

$$= 7d \quad \text{--- (3)}$$

$$(a = -3d)$$

From eq ② & eq ③

$$7a_{25} = 3a_{11}$$

Hence Proved.

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

(Putting value of 'a' from eq ①)

7) Given PT & PS are two tangent drawn from P to circle C (O, r) & OP = 2r

To prove = $\angle OTS = \angle OST = 30^\circ$

Proof -

In $\triangle OPT$,

Let $\angle TOP = \theta$

$$\cos \theta = \frac{OT}{OP} = \frac{r}{2r}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}}$$

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

also $\cos 60^\circ = \frac{1}{2}$, then

$$\theta = 60^\circ$$

Similarly, $\angle SOP = 60^\circ$, and $\angle SOT = 120^\circ$

In $\triangle OST$,

Applying (Pyth) angle sum property of $\triangle$ -

$$\angle OTS + \angle OST + \angle TOS = 180^\circ$$

$$\angle OTS + \angle OST = 180^\circ - \angle TOS$$

$$\angle OTS + \angle OST = 60^\circ$$

Since $OT = OS$ (radius of circle) $\Rightarrow \angle OTS = \angle OST$

$$\Rightarrow \angle OTS = \angle OST = 30^\circ$$

Hence Proved

8) Let $A = (3, 0)$; $B = (6, 4)$ and $C = (-1, 3)$.

Applying distance formula -

$$AB = \sqrt{(6-3)^2 + (4-0)^2} = \sqrt{3^2 + 4^2} = \sqrt{25} = 5 \text{ unit}$$

$$BC = \sqrt{(6+1)^2 + (4-3)^2} = \sqrt{7^2 + 1^2} = \sqrt{49+1} = \sqrt{50} = 5\sqrt{2} \text{ unit}$$

$$AC = \sqrt{(3+1)^2 + (0-3)^2} = \sqrt{2^2 + 9} = \sqrt{13} \text{ unit}$$

Since, $AB = AC = 5 \text{ unit}$

$\triangle ABC$ is isosceles triangle.

$$\text{Also, } AB^2 + AC^2 = BC^2$$

$$\Rightarrow 5^2 + 5^2 = 50$$

$$25 + 25 = 50 = BC^2 = (5\sqrt{2})^2 \Rightarrow AB^2 + AC^2 = BC^2$$

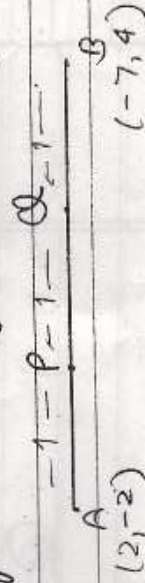
Hence, by converse of Pythagoras Theorem,

$\Rightarrow \triangle ABC$ is right angled triangle.

9) We have -

Line AB, joining points

$A(2, -2)$ and $B(-7, 4)$



P & Q are points of trisection, then,
 P divides AB in ratio 1:2 & Q in ratio 2:1

By section formula -

$$x = \frac{mx_2 + nx_1}{m+n} \quad \& \quad y = \frac{my_2 + ny_1}{m+n}$$

$$P(x, y) = \frac{1 \times -7 + 2 \times 2}{3} \quad \text{and} \quad y = \frac{1 \times 4 + 2 \times -2}{3}$$

$$P(x, y) = \frac{-7+4}{3} \quad \text{and} \quad \frac{4-4}{3}$$

$$P(x, y) = (-1, 0)$$

$$Q(x', y') = \frac{2 \times -7 + 1 \times 2}{3} \quad \text{and} \quad y = \frac{2 \times 4 + 1 \times -2}{3}$$

$$Q(x', y') = \frac{-14+2}{3} \quad \text{and} \quad \frac{8-2}{3}$$

$$Q(x', y') = (-4, 2)$$

$5\sqrt{2}$ and

$\vec{c}$

$(-8, 4)$

$$16) \quad \sqrt{2x+9} + x = 13$$

$$\sqrt{2x+9} = 13-x$$

$$2x+9 = (13-x)^2 \Rightarrow$$

$$2x+9 = 169+x^2-26x \Rightarrow x^2+169-26x-9-2x$$

$$= 169+x^2-2x-26-9$$

$$x^2-2x-26+169-9=0$$

$$x^2-2x-26+160=0$$

$$x^2-2x+134=0$$

$$\text{either } x=8 \text{ or } x=20$$

Section A

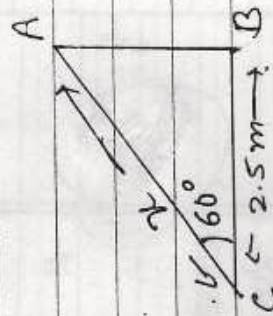
1) In $\triangle ABC$, with $\angle C = 60^\circ$

Let length of ladder = $x = AC$

$$\cos 60^\circ = \frac{1}{2}$$

$$\Rightarrow \frac{2.5}{AC} = \frac{1}{2} = 2 \times 2.5 = AC$$

$$\Rightarrow \underline{5m = AC}$$



2). we have-

Three consecutive terms of AP = $k+9, 2k-1, 2k+7$

Then,

$$(k+9)(2k+7) = 2(2k-1) \quad \{(a+c = 2b)\}$$

$$\Rightarrow k+9+2k+7 = 4k-2$$

$$3k+16 = 4k-2$$

$$16+2 = 4k-3k$$

$$\boxed{18 = k}$$

3) we have-

$$\angle CAB = 30^\circ$$

Since, $OA = OC$ (radius of circle)

$$\angle OAC = \angle OCA = 30^\circ$$

Line joining centre to tangent is perpendicular on tangent

$$\angle OCP = 90^\circ$$

$$\angle PCA = \angle OCP - \angle OCA$$

$$\Rightarrow 90^\circ - 30^\circ$$

$$= \boxed{60^\circ}$$

4)

Total cards = 52

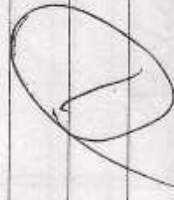
Total red card & queen = 28

Probability of getting neither red card nor queen

$$= 1 - \frac{28}{52} = \frac{52-28}{52}$$

$$= \frac{24}{52} = \frac{12}{26}$$

$$\boxed{\frac{6}{13}}$$

Ans:- $\frac{12}{26}$ or $\frac{6}{13}$ 

009130519



Ninety one

N=100

The collector