RAMAKRISHNA VIVEKANANDA MISSION
MODEL ANSWER FOR ANNUAL EXAM 2020
SUBJECT- MATHEMATICS (ENGLISH MEDIUM)
CLASS – IX

Q.1.

(B) lies between 2 and 3

i) The number $\sqrt{7}$ lies between

$$\begin{array}{l|l} 7.\overline{00}\,\overline{00} & 2.6 \\ 4 & \\ \hline 46 & 300 \\ & 276 \\ \hline & 24 \end{array}$$

ii) (d) 4^{th}

ii) 2^{nd} -,+	+,+ 1^{st}
3^{rd} -,-1	+,- 4^{th}

iii) (a) 5

iii) Polynomial $x^5+2x^3+3x^2+x$

Maximum power = 5

degree = 5

iv) (d) 4

iv) The value of log_2^{16}

$=log_2^{2^4}$

$= 4 . log_2^2$

$=4.1$

$=4$

v) (d) None of these

v) $(\sqrt[5]{8})^{\frac{5}{2}} \times (16)^{\frac{-3}{2}}$

$=8^{\frac{1}{5}\times\frac{5}{2}} \times 4^{2\times\frac{3}{2}} = 2^{\frac{3}{2}} \times 2^{-6} = 2^{\frac{3}{2}-6} = 2^{\frac{3-12}{2}}$

vi) (a) Rs. 360

vi) Rebate (Rs)	Total bill (Rs)
15	100
54	?

Direct relation.

Total bill = $\frac{\cancel{54}^{18} \times \cancel{100}^{20}}{\cancel{15}_{3}}$ = 360

vii) m = 3

vii) mx – 3y – 1 = 0
(4 - m) x – y + 1=0
Can not have any solution,
Means,

$$\frac{m}{4-m} = \frac{-3}{-1}$$
$$-m = -12 + 3m$$
$$\Rightarrow 12 = 3m + m$$
= 4m = 12
=> m = 3.

viii) $\frac{closs\ frequency}{total\ frequency} \times 100$

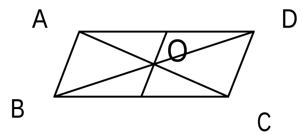
viii) Percentage frequency equal to.
$=\frac{closs\ frequency}{total\ frequency} \times 100\ (by\ formula)$

ix) (d) 7

ix) 2,2,3,4,5,6,7,8,9 are given data.
Maximum = 9
Minimum = 2
Range = 9 -2
= 7

x) c) 32 cm^2

x)



$\Delta AOB + \Delta COD = 16cm^2$
∴ total ABCD = 2 X 16 = $32cm^2$

xi) Parallel to yaxis.

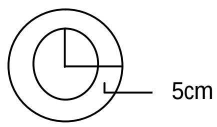
xi) 2x+3=0
2x= -3 equation of y axis is
X= $\frac{-3}{2}$ x=0
∴ It is parallel to yaxis.

xii) (c) (3, 2)

xii) (7, 5) = (x_1y_1)
(-2, 5) = (x_2y_2)
(4, 6) = (x_3y_3)
Coordinate of corboid
$=\frac{1}{3}(7-2+4), \frac{1}{3}(-5+5+6)$
$=\frac{9}{3}, \frac{6}{3}$
=(3, 2)

xiii) (a) 5 cm

xiii) R – r = 5cm



xiv) $\sqrt{3}$ unit

xiv) let side = a unit

$$\frac{\sqrt{3}}{4} \times a^2 = \sqrt{3}$$
$$\therefore a^2 = 4$$
$$a = 2\,unit$$

Height $\frac{\sqrt{3}}{2} \times a = \frac{\sqrt{3}}{\cancel{2}} \times \cancel{2}$unit

Q.2.

2.i) $\frac{1}{5}$, $\frac{1}{4}$

$=\frac{4}{20}$, $\frac{5}{20}$ (same denominator 1)

$= \frac{8}{40}$, $\frac{10}{40}$ (same denominator 2)

$=\frac{12}{60}$, $\frac{15}{60}$ (same denominator 3)

Two rational number between these two –

$\frac{13}{60}$, $\frac{14}{60}$ (answer)

2.ii) Cost price = Rs (480 + $\frac{48\cancel{0} \times 2\cancel{0}}{1\cancel{0}\cancel{0}}$)

= Rs (480 + 96)

= Rs 576

Answer:- Required C.P is Rs.576.

2.iii) $\left\{(125)^{-2} \times (16)^{\frac{-3}{2}}\right\}^{\frac{-1}{6}}$

$=\left\{(5^3)^{-2} \times (2^4)^{\frac{-3}{2}}\right\}^{\frac{-1}{6}}$

$=\left\{5^{-6} \times 2^{2\times(-3)}\right\}^{\frac{-1}{6}}$

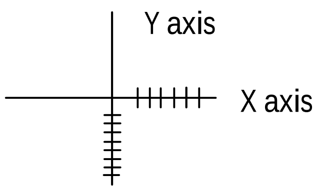
$=\{5^{-6} \times 2^{-6}\}^{\frac{-1}{6}}$

$=(5 \times 2)^{-\cancel{6}\times\left(\frac{-1}{\cancel{6}}\right)}$

$= 10^1$

= 10 Answer:- Required simplified value is 10.

2.iv)



(6, -8)

Answer :- From X axis 8unit

From Y axis 6unit

2.v) $f(x)=x^3-6x^2+13x+60$

$F(1)=(1)^3-6(1)^2+13(1)+60$

$= 1-6+13+60$

$= 74 - 6$

$= 68$ answer:- Required remainder is 68.

2.vi) Let $A = (2, 2)$

$B = (-2, -2)$

$C = (-2\sqrt{3}, 2\sqrt{3})$

$AB^2=[(2 + 2)^2 + (2 + 2)^2] = 16 + 16 = 32$

$BC^2=\left[(-2 + 2\sqrt{3})^2 + (-2 - 2\sqrt{3})^2\right]$

$= 4 - \cancel{8\sqrt{3}} + 4 \times 3 + 4 + \cancel{8\sqrt{3}} + 4 \times 3$

$= 8 + 24$

$= 32$

$AC^2= (2+2\sqrt{3})^2 + (2-2\sqrt{3})^2$

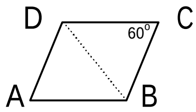
$= 2 (2 + 4.3)$

$= 32$

$AB=BC=AC$

Given three points are the vertical of an equilateral triangle. (answer) <u>proved</u>

2.vii



$\therefore \angle C = 60^o$ given

$\therefore \angle B = 180^o - 60^o = 120^o$

BD direct it

$\therefore \angle DBC = 60^{o}$

and $\angle BDC = 60^{o}$

ABCD is a Rhombus

$\therefore$ All sides are equal BCD is an equilateral triangle. All sides are equal.

$\therefore$ BD = 4cm

2.viii Let length = X cm

Breadth = Y cm

ATP Z(X+Y)=34

X + Y = 17-----------(i)

XY = 60----------(ii)

Y = $\frac{60}{x}$

$\therefore\ x + \frac{60}{x} = 17$

Or, $\frac{x^2+60}{x} = 17$

Or, $x^2 - 17x + 60 = 0$

Or, $x^2 - 12x - 5x + 60 = 0$

Or, $x(x - 12) - 5(x - 12) = 0$

Or, $(x - 12)(x - 5) = 0$

Either, $x - 12 = 0$	Or,	$x - 5 = 0$
$x = 12$		$x = 5$

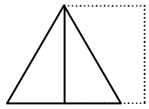
Length is greater than breadth

$\therefore$ len = 12cm

Breadth = $\frac{\cancel{60}^{5}}{\cancel{12}}$ = 5cm

Diagonal = $\sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169}$ = 13cm (answer).

2)ix) Let side of equilateral triangle is a cm.



Height = $\frac{\sqrt{3}}{2}a\ cm.$

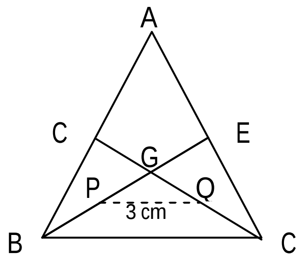
Area of triangle = $\frac{\sqrt{3}}{4}a^2\ \ sq\ cm.$

Area of square = $\left(\frac{\sqrt{3}}{2}a\right)^2\ \ sq\ cm.$ = $\frac{3a^2}{4}\ sq\ cm.$

Ratio of their area,

$\frac{\sqrt{3}}{4}a^2 : \frac{3a^2}{4}$ = $\sqrt{3}$: 3 = 1 : $\sqrt{3}$ (answer)

2)x)



From fig a small triangle is formed name BGC midpoint of BG is P and midpoint of CG is Q. By midpoint theorem we know PQ = ½ BC

∴ BC = 6cm (answer)

2)xi) Let lower limit = l ATP

Upper limit = u $\frac{u+l}{2} = 42 - - - - - (i)$

$$u - l = 10 - - - - - - (ii)$$

$u + l = 84$

$u + l = 10$

$2u = 94$

$u = \frac{\cancel{94}^{47}}{2}$ Again, $u - l = 10$

⇨ $47 - l = 10$

⇨ $l = 47 - 10$

⇨ $l = 37$

Answer :- upper limit 47

Lower limit 37

2)xii)Remainder theorem:-

F(n) is a polynomial of degree n($n\geq 1$) and a is any real number. If f(n) is divided by (n-a), then the remainder will be f(a).

2)xiii)Answer:-

Close limit	Close boundary
60-69	59.5-69.5
70-79	69.5-79.5
80-89	79.5-89.5
90-99	89.5-99.5

Q.3.

Let cost price of table is Rs X

cost price of chair is Rs Y

ATP, X+Y = 3000 ------------(i)

Table add 15% profit

∴ Amount of profit = $\frac{15x}{100}$

chair sold 10% loss

∴ amount of loss = $\frac{10y}{100}$

total profit is $8\frac{1}{3}\% = \frac{25}{3}\%$

Amount of total profit = Rs $\frac{25}{\cancel{3}} \times \frac{\cancel{3000}^{10}}{\cancel{100}}$ = Rs. 250

$\frac{15x}{100} - \frac{10y}{100} = 250 - - - - - (ii)$

$or, \frac{15x-10y}{100} = 250$

Or, 15x – 10y = 250 X 100

Or, 3x – 2y = 5000

(i) X 2 ----------→ 2x +$\cancel{2y}$ = 6000

(ii) --------------→ 3x – $\cancel{2y}$ = 5000

5x = 11000

X = 2200

∴ Y = 3000 – 2200 = 800

$answer \to$ cost price of table is Rs. 2200
Cost price of chair is Rs. 800.

<u>Or,</u>

$\sqrt{11}$ →←

```
 ←→  →  →  →
11.00 00 00 00 | 3.3166
  9
-------------------
63   | 200
     | 189
-------------------
661  | 1100
     |  661
-------------------
6626 | 43900
     | 39756
-------------------
66326 | 414400
      | 399956
-------------------
```

∴ $\sqrt{11}$ = 3.317 (approx)
And it is an irrational number.

Q.4. f(n)=$\frac{a(n-b)}{a-b}$ + $\frac{b(n-a)}{b-a}$

∴ f (a) = $\frac{a(\cancel{a-b})}{(\cancel{a-b})}$ + $\frac{b(\cancel{a-a})}{(b-a)}$

=a.1 +b.0 = a ----------(i)

And f(b) = $\frac{a(\cancel{b-b})}{a-b}$ + $\frac{b(\cancel{b-a})}{(\cancel{b-a})} = a.0 + b = b ------(ii)$

Now, f(a+b) = $\frac{a(a+\cancel{b}-\cancel{b})}{(a-b)}$ + $\frac{b(\cancel{a}+b-\cancel{a})}{(b+a)}$

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

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

=$\frac{(a+b)\cancel{(a-b)}}{\cancel{(a-b)}}$ = a+b

= f(a)+f(b)

∴ f(a) + f(b) = f(a+b) (proved)

<u>We solve into factors (any one):</u>

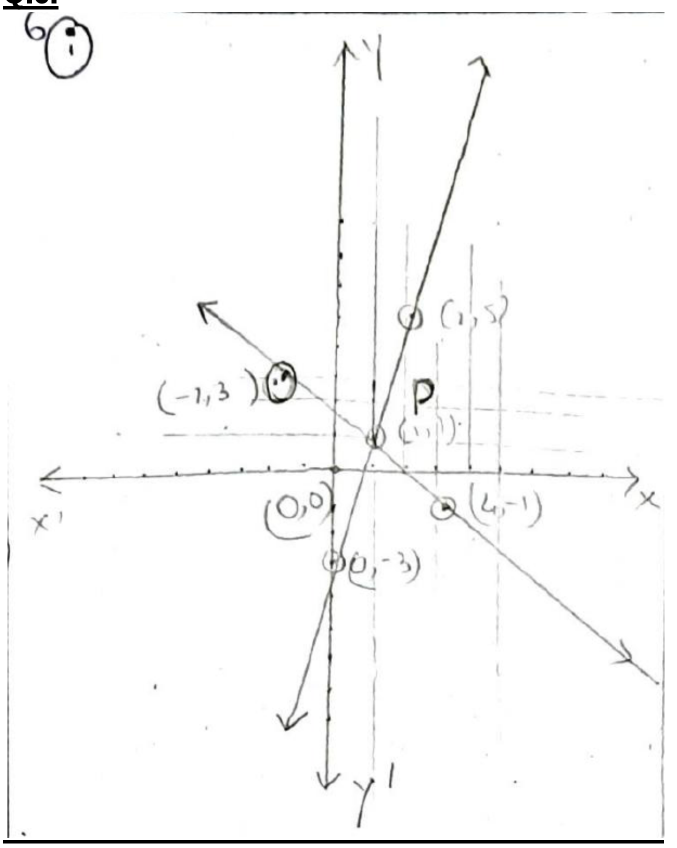
<u>Q.5.</u>

i. $1 + 8x^3 + 18xy - 27y^3$
$= (1)^3 + (2x)^3 + (-3y)^3 - 3(1)(2x)(-3y)$
$= (1+2x-3y)\{(1)^2+(2x)^2+(-3y)^2-1(2x)-1(-3y)-(2x)(-3y)\}$
$= (1 + 2x - 3y)(1 + 4x^2 + 9y^2 - 2x + 3y + 6xy)$
Answer:- $(1 + 2x - 3y)(1 + 4x^2 + 9y^2 - 2x + 6xy + 3y)$

ii. $2\left(a^2 + \frac{1}{a^2}\right) - \left(a - \frac{1}{a}\right) - 7$
$=2\left[\left(a - \frac{1}{a}\right)^2 + 2.\cancel{a}.\frac{1}{\cancel{a}}\right] - \left(a - \frac{1}{a}\right) - 7$
$=2\left(a - \frac{1}{a}\right)^2 + 4 - \left(a - \frac{1}{a}\right) - 7$
$=2\left(a - \frac{1}{a}\right)^2 - \left(a - \frac{1}{a}\right) - 3$ $\quad [let\ a - \frac{1}{a} = x]$

$= 2x^2 - x - 3$
$= 2x - 3x + 2x - 3$
$= x(2x - 3) + 1(2x - 3)$
$= (2x - 3)(x - 1)$
Putting the value $\left(2a - \frac{2}{a} - 3\right)\left(a - \frac{1}{a} + 1\right)$
Answer:- $\left(2a - \frac{2}{a} - 3\right)\left(a - \frac{1}{a} + 1\right)$

Q.6.



I. $4x - y = 3 - - - - - (i)$
$= 4x = 3 + y$
$= x = \frac{3+y}{4}$

X	1	2	0
Y	1	5	-3

(1, 1), (2, 5), (0, -3)

$2x + 3y = 5$
$2x = 5 - 3y$
$x = \frac{5-3y}{2}$

X	1	-2	4
Y	1	3	-1

(1, 1), (-2, 3), (4, -1)

XOX^1 and YOY^1 are two axes
One small square is the unit
0(0, 0) is the origin. P is point of intersection from graph P(1, 1)
Required solve $x = 1$
$y = 1$

Or,

Let my present age is X years
and uncle's age is Y years.
ATP Y = X + 16 -----------(i)

After 8 years I will be (X + 8) years
Uncle will be (Y + 8) years.
Then, y + 8 = 2 (x + 8)
y = 2x + 16 – 8
y = 2x + 8 -----------(ii)
By compression,
2x + 8 = x + 16

Or, 2x – x = 16 – 8

Or, x = 8

My present age = 8 years.

Uncle's present age = 8 + 16

= 24 years

Answer:- The age of me and my uncle are 8 years and 24 years.

Q.7.

(i) $\frac{6}{x} + \frac{2}{y} = 5 - - - - (i)$ $\quad \frac{8}{x} - \frac{3}{y} = 1 - - - - - - (ii)$

$1 \times 3 - - - - - - \rightarrow \frac{18}{x} + \cancel{\frac{6}{y}} = 15$

$2 \times 2 - - - - - - \rightarrow \frac{16}{x} - \cancel{\frac{6}{y}} = 2$

(+)

$\frac{18}{x} + \frac{16}{x} = 15 + 2$

$or, \frac{18+16}{x} = 17$

$or, 17x = 34$

$or, x = \frac{\cancel{34}^2}{\cancel{17}} = 2$

Putting $x = 2$ in equation (i) $\frac{\cancel{6}^3}{\cancel{2}} + \frac{2}{y} = 5$

⇨ $\frac{2}{y} = 5 - 3$

⇨ $2 = 2y$

⇨ $y = \frac{\cancel{2}}{\cancel{2}} = 1$ answer:- x = 2, y = 1.

Or,

$x + y = a + b - - - - (i)$ $\quad ax - by = a^2 - b^2 - - - - - - (ii)$

$1 \times b - - - - - \rightarrow bx + \cancel{by} = ab + b^2$

$2 - - - - - - - \rightarrow ax - \cancel{by} = a^2 - b^2$

(+)

$bx + ax = ab + a^2$

$=> x(a + b) = a(a + b)$

$\therefore x = a$

Putting $x = a$ $in\ equation - - - - -$ (i) we get

$\cancel{a} + y = \cancel{a} + b$

$\therefore y = b$

Answer :- $x = a, y = b.$

Q.8.

$2^{5x+4} + 2^9 = 2^{10}$

$=> 2^{5x}.2^4 = 2^{10} - 2^9$

$=> 2^{5x}.16 = 2^9(2 - 1)$

$=> 2^{5x} = \frac{2^9}{16}$

$=> 2^{5x} = 2^{9-4}$ [16=2^4]

$=> 2^{5x} = 2^5$

$\therefore 5x = 5$

$x = \frac{5}{5} = 1$

Answer:- $x = 1$

Q.9

$$\frac{logx}{y-z} = \frac{logy}{z-x} = \frac{logz}{x-y} = k \quad (let)$$

$$logx = k(y-z)$$

$$xlogx = xk(y-z)$$

$$=> logx^x = k(xy-xz) - - - - - (i)$$

Similarly, $logy^y = k(yz-xy) - - - - - (ii)$

And $logz^z = k(xz-yz) - - - - - -(iii)$

(1) + (2) + (3)

$logx^x + logy^y + logz^z = \cancel{K}(\cancel{xy} - \cancel{xz} + \cancel{yz} - \cancel{xy} - \cancel{xz} - yz)$

$=> \log(x^x.y^y.z^z) = k \times 0$

$=> \log(x^x y^y z^z) = log1 \quad [we\ know\ log1 = 0]$

$\therefore x^x.y^y.z^z = 1 \ \ proved.$

Q.10

$a^3 + b^3 + c^3 - 3abc$

$=>\frac{1}{2}(a+b+c)\{(a-b)^2 + (b-c)^2 + (c-a)^2\} \quad (by\ formula)$

$=>\frac{1}{2}(999 + 998 + 997)\{(999 - 998)^2 + (998 - 997)^2 + (997 - 999)^2\}$

$=>\frac{1}{2}(2994)\{1^2 + 1^2 + (-2)^2\}$

$=>\frac{1}{2}(2994)(1 + 1 + 4)$

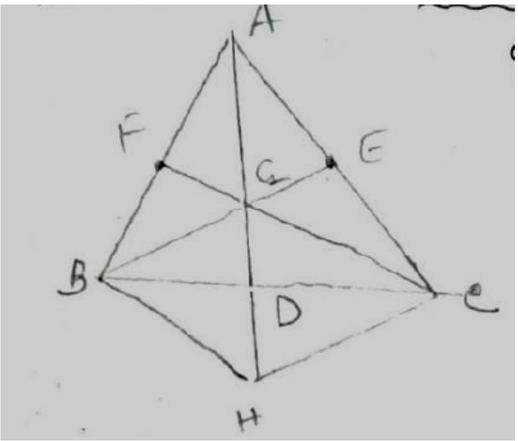
$=>\frac{1}{\cancel{2}}(2994)(\cancel{6})^3$

=> 8982 answer:- 8982 is required value.

Q.11.

Class	Frequency	Number of students
0-10	17	
10-20	5	
20-30	7	
30-40	8	
40-50	13	
50-60	10	
	$\mathcal{E}fi = 60$	

Q.12. Theorem:- Three medians are concurred



Given Let ABC is a triangle, BE and CF are two medians intersect at G. Join A, G and produce to it. AG meets BC at D.

RTQ Medians of triangle are concurred that means AD is a median or D is the midpoint of BC.

Construction AD is produced up to H such a way that AG=GH

Proof In ΔABH, F is the midpoint of AB and G is the midpoint of AH. ∴ FG//BH or GC//BH

Again, In ΔACH, E is the midpoint AC and G is the midpoint of AH. ∴GE//HC opr GB//HC

Thus BHCG is a parallelogram, opposite sides are parallel to each other. BC and GH are two diagonals. We know diagonals of parallelogram bisect each other.

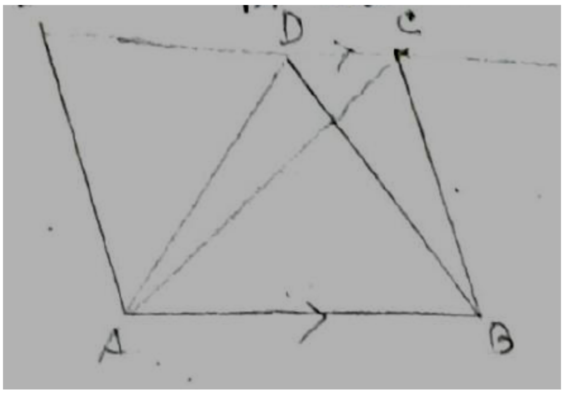
∴D is the midpoint of BC.

∴ Three medians of a triangle are concurred. (proved)

Or,

Theorem

Prove that triangular fields being on the same base and between same parallels is equal.



Given

Δ ABC and ΔADC are on same base AB and between same paralled AB and DC.

RTP ΔABC = ΔADC.

Construction Draw a parallelogram ABCE for AB as a ride and BC another ride as AB//EC and BC// to AE.

Proof ΔABC and ▱ABCE are of on same base and between same parallel lines ∴ ΔABC = ½ ▱ABCE

Again Δ ADC and ▱ ABCE are of on same base unit between same parallel line

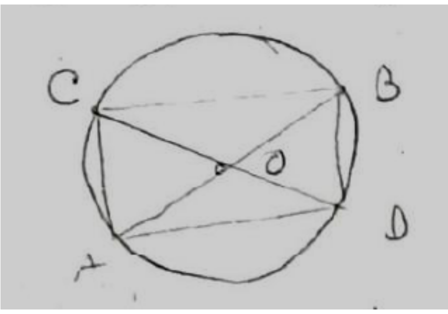
ΔADC = ½ ▱ABCE

Thus ΔABC = ΔADC (proved)

Q.13

Application

AB and CD are two diameters of any circle with centre O proved that ACBD is a rectangle.



Given AB and CD are two diameters of the circle with centre O.

RTP ACBD is rectangle.

Proof AO = OB , CO = OD (all are radii).

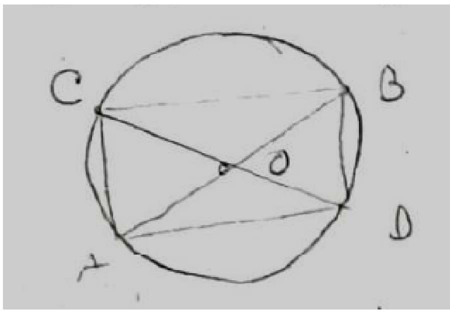
∴ diagonals are bisect each other.

∴ ACBD is a parallelogram.

In ΔADB and ΔADC AB = CD (both are diameter)

AC = BD (opposite side of parallelogram)

AD is common.



By S – S – S rule

ΔABD ≅ ΔACD

$\angle CAD = \angle ADB$ (by C.P.C.T)

AC//DB

∴ ∠CAD + ∠ADB = 180^o

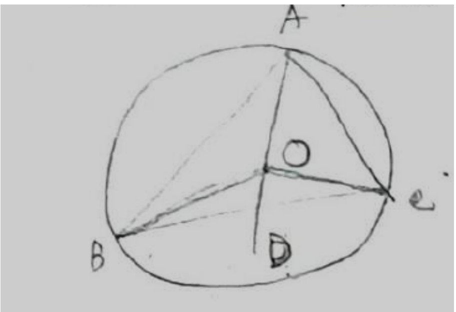
Both are equal ∴ ∠ADB = $\frac{\cancel{180}^{90}}{\cancel{2}}$ = 90^o

We know anyone angle of parallelogram if 90^o then it runs to rectangle. (proved)

Or,

Circum centre of ΔABC is O.

Prove then ∠BOC = ∠BAC



Given ABC is a triangle O is the circum centre.

RTP ∠BOC = 2∠BAC

Construction join A, O it is extended up to D.

Proof In ΔAOB AO = OB (radii)

∠OAB = ∠OBA (opposite angle)

∠BOD is an exterior angle

∴ ∠BOD = ∠OAB + ∠OBB (sum of two opposite interior angles)

∴ ∠BOD = 2∠OAB-----------(i)

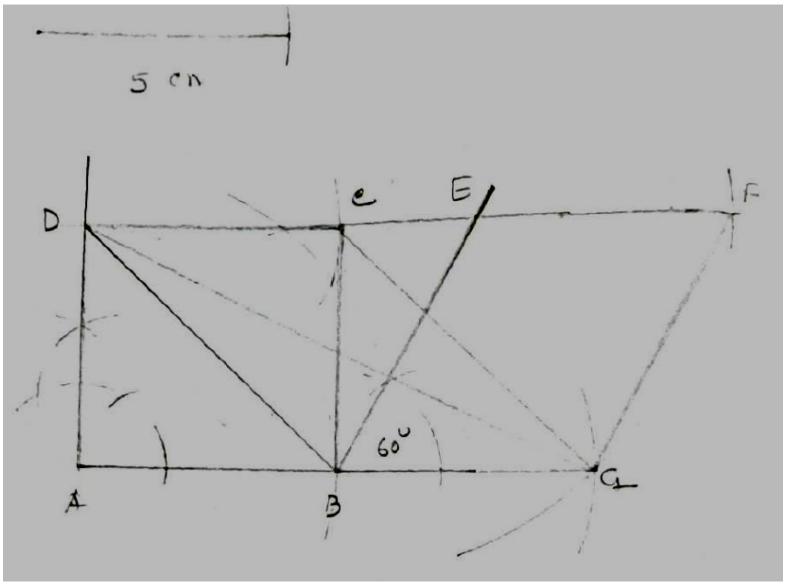
Similarly from ΔAOC ∠COD = 2∠OAC ---------(ii)

(1) + (2)

∠BOD + ∠COD = 2 (∠OAB + ∠OAC)

∠BOC = 2∠BAC (proved)

Q.14



ABCD is given square

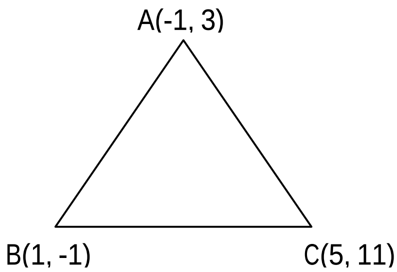
Δ ADG = ▱ ABCD

▱ BEFG = Δ ADG

▱ BEFG is required parallelogram where $\angle EBG = 60^0$

Q.15

Coordinate of D midpoint of BC is



$\left(\frac{1+5}{2}, \frac{-1+1}{2}\right)$

$=\left(\frac{6}{2}, \frac{0}{2}\right)$ A= (-1, 3)

= (3, 0) D= (3, 0)

AD = $\sqrt{(3+1)^2 + (0-3)^2}$

$= \sqrt{4^2 + 3^2} = \sqrt{16+9} = \sqrt{25} = 5\, unit$

Or,

(a, 0)

(0, b) are collinear

(1, 1)

$\therefore$ a(b-1) + 0 (1 – 0) + 1 (0 – b) = 0 [by condition]

=>ab – a + 0 – b = 0

=> ab = a + b

$=> 1 = \frac{\cancel{a}}{\cancel{a}b} + \frac{\cancel{b}}{a\cancel{b}}$

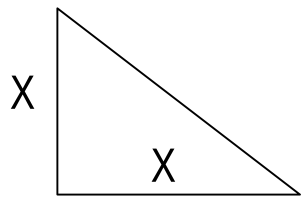
$\therefore \frac{1}{a} + \frac{1}{b} = 1$ (proved)

Q.16

(i) Let sides are X cm and X cm as base and perpendicular of that right angled isosceles triangle.

$\therefore$ Hypotenuse $=\sqrt{x^2 + x^2}$

$= x\sqrt{2}\ cm$



Perimeter = $(X + X + x\sqrt{2})cm$

$= 2X + x\sqrt{2}$

$= X.\sqrt{2}\,(\sqrt{2} + 1)cm$

ATP $\quad X.\sqrt{2} = \cancel{(\sqrt{2} + 1)} = \cancel{(\sqrt{2} + 1)}$

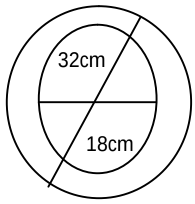
Or, $x = \frac{1}{\sqrt{2}}$

$\therefore hypotenuse = \cancel{\sqrt{2}} \times \frac{1}{\cancel{\sqrt{2}}} = 1\ cm$

Area = ½ × $x^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} sq\ cm.$

Answer:- 1) hypotenuse is 1 cm, 2) area is ¼ sq cm.

16. ii) Length of inner diameter = 18cm



Length of inner radius = 9 cm

Length of outer diameter = 32 cm

Length of outer radius = 16 cm

$\therefore$ Area of iron sheet is $\frac{22}{7}(16^2 - 9^2) sq\ cm.$

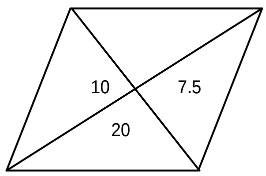
$= \frac{22}{7}(16 + 9)(16 - 9)$

$= \frac{22}{\cancel{7}} \times 25 \times \cancel{7}$

$=550\ sq\ cm.$

Answer:- Required area of circle is 550 sq cm.

16. iii) Let side = a or height = hm



Shorter diagonal = 15m

half of it = 7.5m

larger diagonal = 20m

half of it = 10m

from fig $\quad a^2 = 10^2 + (7.5)^2$ [diagonal bisect perpendicularly]

$a^2 = 100 + 56.25$

=> $a^2 = 156.25$

=> $a = \sqrt{\frac{15625}{100}}$

=> $a = \frac{125}{10}$

=> side = 12.5m

area,

$\frac{1}{2} \times d_1 \times d_2\ sqm$

$\frac{1}{\cancel{2}} \times 15 \times \cancel{20}^{10}\ sqm$

= 150 sqm.

$\therefore 12.5 \times h = 150$

$h = \frac{\cancel{150}^{6} \times \cancel{10}^{2}}{\cancel{125}_{5}}$ = 12m

Perimeter = 4 X 12.5m= 50m.

Answer:- side = 12.5m, perimeter = 50m, Area= 150 sqm, height= 12m.