Chapter 5
Geometry

Ex 5.1

Question 1.
Fill in the blanks with the correct term from the given list.
(in proportion, similar, corresponding, congruent, shape, area, equal)
(i) Corresponding sides of similar triangles are _____ .
Answer:
in proportion

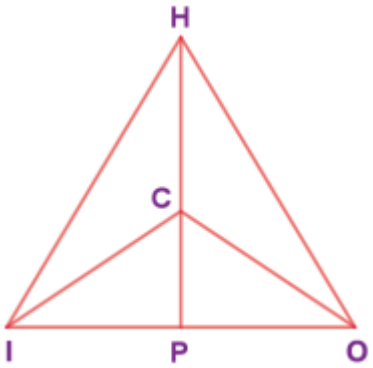
(ii) Similar triangles have the same _____ but not necessarily the same size.
Answer:
Shape

(iii) In any triangle _____ sides are opposite to equal angles.
Answer:
equal

(iv) The symbol is used to represent _____ triangles.
Answer:
congruent

(v) The symbol ~ is used to represent _____ triangles.
Answer:
similar

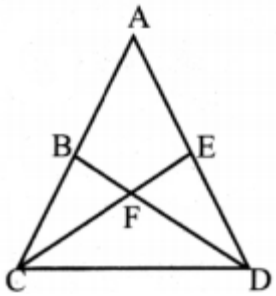
Question 2.
In the figure, ∠CIP ≡ ∠COP and ∠HIP ≡ ∠HOP. Prove that IP ≡ OP.



Answer:

Statements	Reasons
1. CI = CO	∵ CIP ≡ COP, by CPCTC
2. IP = OP	By CPCTC
3. CP = CP	By CPCTC
4. Also HI = HO	CPCTC ΔHIP ≡ HOP given
5. IP = OP	By CPCTC and (4)
6. ∴ IP ≡ OP	By (2) and (4)

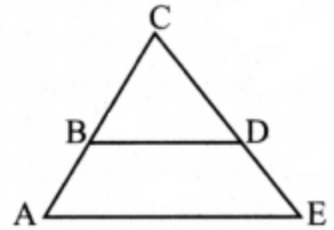
Question 3.
In the given figure, AC ≡ AD and ∠CBD ≡ ∠DEC. Prove that Δ BCF ≡ Δ EDF.



Answer:

Statements	Reasons
1. ∠BCF = ∠EFD	Vertically opposite angles
2. ∠CBD = ∠DEC	Angles on the same base given
3. ∠BCF = ∠EDF	Remaining angles of ΔBCF and ΔEDF
4. ΔBCF ≡ ΔEDF	By (1) and (2) AAA criteria

Question 4.
In the given figure, △ BCD is isosceles with base BD and ∠BAE ≡∠DEA. Prove that AB ≡ ED.



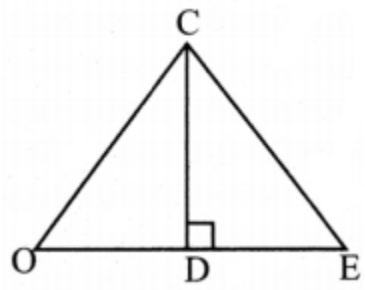
Answer:

Statements	Reasons
1. ∠BAE ≡ ∠DEA	Given
2. AC = EC	By (1) sides opposite to equal angles are equal
3. BC = DC	Given BCD is isosceles with base BD

4. AC – BC = EC – DC	2 – 3
5. AB ≡ ED	By 4

Midpoint Calculator is a free online tool that displays the midpoint of the line segment.

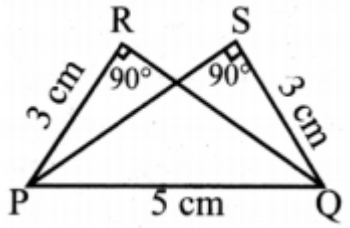
Question 5.
In the given figure, D is the midpoint of OE and ∠CDE = 90°. Prove that △ODC ≡ △EDC



Answer:

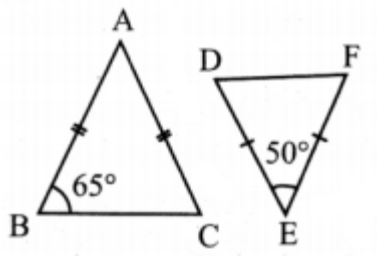
Statements	Reasons
1. OD = ED	D is the midpoint OE (given)
2. DC = DC	Common side
3. ∠CDE = ∠CDO = 90°	Linear pair and given ∠CDE = 90°
4. △ODC ≡ △EDC	By RHS criteria

Question 6.
Is △PRQ ≡ △QSP? Why?



Answer:
In △PRQ and △PSQ
∠PRQ = ∠PSQ = 90° given
PR = QS = 3 cm given
PQ = PQ = 5 cm common
It satisfies RHS criteria
∴ △PRQ congruent to △QSP.

Question 7.
From the given figure, prove that △ABC ~ △EDF



Answer:

From the △ABC, AB = AC

It is an isosceles triangle

Angles opposite to equal sides are equal

∴ ∠B = ∠C = 65°

∴ ∠B + ∠C = 65° + 65°

= 130°

We know that sum of three angles is a triangle = 180°

∠A + ∠B + ∠C = 180°

∠A + 130° = 180°

∠A = 180° – 130°

∠A = 50°

From △EDF, ∠E = 50°

∴ Sum of Remaining angles = 180° – 50° = 130°

DE = FD

∴ ∠D = ∠F

From △ABC and △EDF ∴ $\triangle D = \frac{130}{2} = 65°$

∠A = ∠E = 50°

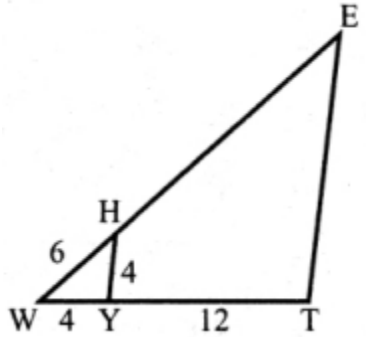
∠B = ∠D = 65°

∠C = ∠F = 65°

∴ By AAA criteria △EDF ~ △ABC

Question 8.

In the given figure YH || TE. Prove that △WHY ~ △WET and also find HE and TE.



Answer:

Statements	Reasons
1. ∠EWT = ∠HWY	Common angle

2. ∠ETW = ∠HYW	Since YH || TE, corresponding angles
3. ∠WET = ∠WHY	Since YH || TE corresponding angles
4. △WHY ~ △WET	By AAA criteria

Also △ WHY ~ △WET
∴ Corresponding sides are proportionated

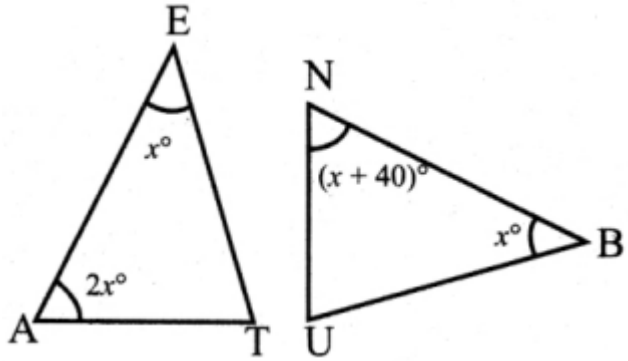
$$\frac{WH}{WE} = \frac{HY}{ET} = \frac{WY}{WT}$$

$$\frac{6}{6+HE} = \frac{4}{ET} = \frac{4}{16}$$

$$\frac{6}{6+HE} = \frac{4}{16}$$

$\Rightarrow 6+HE = \frac{6}{4} \times 16$
$\Rightarrow 6 + HE = 24$
$\therefore HE = 24 - 6$
$HE = 18$
Again $\frac{4}{ET} = \frac{4}{16}$
$ET = \frac{4}{4}$
$ET = 16$

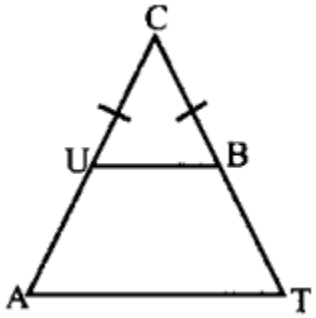
Question 9.
In the given figure, if △EAT ~ △BUN, find the measure of all angles.



Answer:
Given △EAT ≡ △BUN
∴ Corresponding angles are equal
∴ ∠E = ∠B …… (1)
∠A = ∠U …… (2)
∠T = ∠N ……. (3)
∠E = x°
∠A = 2x°
Sum of three angles of a triangle = 180°
In △ EAT, x + 2x + ∠T = 180°

$\angle T = 180° - (x° + 2x°)$
$\angle T = 180° - 3x°$
Also in $\triangle BUN$
$(x + 40)° + x° + \angle U = 180°$
$x + 40° + x + \angle U = 180°$
$2x° + 40° + \angle U = 180°$
$\angle U = 180° - 2x - 40° = 140° - 2x°$
Now by (2)
$\angle A = \angle U$
$2x = 140° - 2x°$
$2x + 2x = 140°$
$4x = 140°$
$x = \frac{140}{4} = 35°$
$\angle A = 2x° = 2 \times 35° = 70°$
$\angle N = x + 40° = 35° + 40° = 75°$
$\therefore \angle T = \angle N = 75°$
$\angle E = \angle 8 = 35°$
$\angle A = \angle U = 70°$

Question 10.
In the given figure, UB || AT and CU ≡ CB Prove that $\triangle CUB \sim \triangle CAT$ and hence $\triangle CAT$ is isosceles.



Answer:

Statements	Reasons
1. $\angle CUB = \angle CBU$	∵ In $\triangle CUB$, CU = CB
2. $\angle CUB = \angle CAB$	∵ UB || AT, Corresponding angle if CA is the transversal.
3. $\angle CBU = \angle CTA$	CT is transversal UB || AT, Corresponding angle commom angle.
4. $\angle UCB = \angle ACT$	Common angle
5. $\triangle CUB \sim \triangle CAT$	By AAA criteria
6. CA = CT	∵ $\angle CAT = \angle CTA$

7. Also △CAT is isoceles	By 1, 2 and 3 and sides opposite to equal angles are equal.

Objective Type Questions

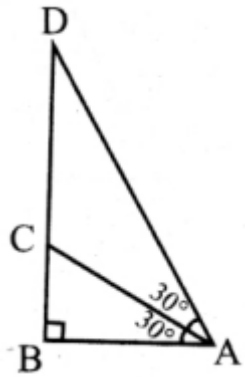
Question 11.
Two similar triangles will always have _____ angles
(A) acute
(B) obtuse
(C) right
(D) matching
Answer:
(D) matching

Question 12.
If in triangles PQR and XYZ, $\frac{PQ}{XY}=\frac{QR}{ZX}$ then they will be similar if
(A) ∠Q = ∠Y
(B) ∠P = ∠X
(C) ∠Q = ∠X
(D) ∠P ≡∠Z
Ans:
(C) ∠Q = ∠X

Question 13.
A flag pole 15 m high casts a shadow of 3m at 10 a.m. The shadow cast by a building at the same time is 18.6m. The height of the building is
(A) 90 m
(B) 91 m
(C) 92 m
(D) 93 m
Answer:
(D) 93 m

Question 14.
If ΔABC – ΔPQR in which ∠A = 53° and ∠Q = 77°, then ∠R is
(A) 50°
(B) 60°
(C) 70°
(D) 80°
Answer:
(A) 50°

Question 15.
In the figure, which of the following statements is true?



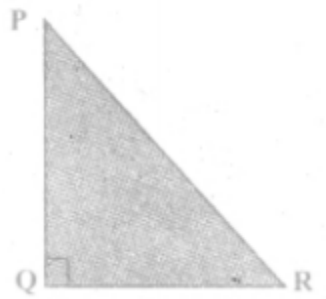
(A) AB = BD
(B) BD < CD
(C) AC = CD
(D) BC = CD

Answer:

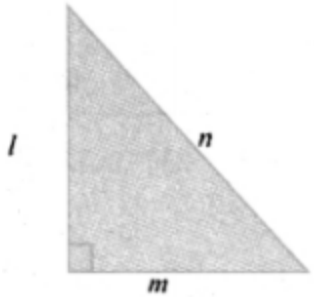
(C) AC = CD

Ex 5.2

Question 1.
Fill in the blanks:
(i) If in a Δ PQR, $PR^2 = PQ^2 + QR^2$, then the right angle of Δ PQR is at the vertex _____ .
Answer:
Q
Hint:



(ii) If 'l' and 'm' are the legs and 'n' is the hypotenuse of a right angled triangle then, l^2 = _____ .
Answer:
$n^2 - m^2$
Hint:



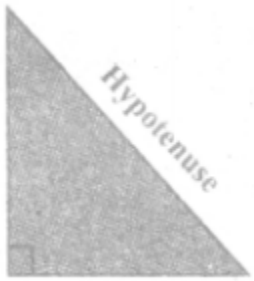
(iii) If the sides of a triangle are in the ratio 5:12:13 then, it is _____ .
Answer:
a right angled triangle
Hint:
$13^2 = 169$
$5^2 = 25$
$12^2 = 144$
$169 = 25 + 144$
$\therefore 13^2 = 5^2 + 12^2$

(iv) The medians of a triangle cross each other at _____ .
Answer:
Centroid

(v) The centroid of a triangle divides each medians in the ratio _____ .
Answer:
2 : 1

Question 2.
Say True or False.
(i) 8, 15, 17 is a Pythagorean triplet.
Answer:
True
Hint:
$17^2 = 289$
$15^2 = 225$
$8^2 = 64$
$64 + 225 = 289 \Rightarrow 17^2 = 15^2 + 8^2$

(ii) In a right angled triangle, the hypotenuse is the greatest side.
Answer:
True
Hint:



(iii) In any triangle the centroid and the incentre are located inside the triangle.
Answer:
True

(iv) The centroid, orthocentre, and incentre of a triangle are collinear.
Answer:
True

(v) The incentre is equidistant from all the vertices of a triangle.
Answer:
False

Question 3.
Check whether given sides are the sides of right-angled triangles, using Pythagoras theorem.
(i) 8, 15, 17
Answer:
Take a = 8 b = 15 and c = 17

Now $a^2 + b^2 = 8^2 + 15^2 = 64 + 225 = 289$
$172 = 289 = c^2$
$\therefore a^2 + b^2 = c^2$
By the converse of Pythagoras theorem, the triangle with given measures is a right angled triangle.
∴ Ans: yes

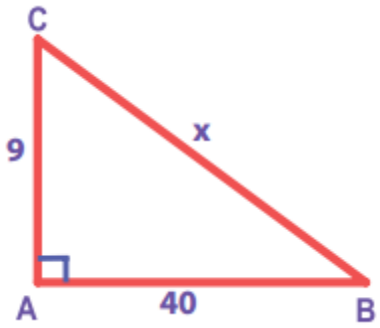
(ii) 12, 13, 15
Answer:
(ii) 12, 13. 15
Take $a = 12, b = 13$ and $c = 15$
Now $a^2 + b^2 = 12^2 + 13^2 = 144 + 169 = 313$
$15^2 = 225 \neq 313$
By the converse of Pythagoras theorem, the triangle with given measures is not a right angled triangle.
∴ Ans: No.

(iii) 30, 40, 50
Answer:
Take $a = 30$, $b = 40$ and $c = 50$
Now $a^2 + b^2 = 30^2 + 40^2 = 900 + 1600 = 2500$
$C^2 = 50^2 = 2500$
$\therefore a^2 + b^2 = c^2$
By the converse of Pythagoras theorem, the triangle with given measures is a right angled triangle.
∴ Ans: yes

(iv) 9, 40, 41
Answer:
Take $a = 9$, $b = 40$ and $c = 41$
Now $a^2 + b^2 = 9^2 + 40^2 = 81 + 1600 = 1681$
$c^2 = 41^2 = 1681$
$\therefore a^2 + b^2 = c^2$
By the converse of Pythagoras theorem, the triangle with given measures is a right angled triangle.
∴ Ans: yes

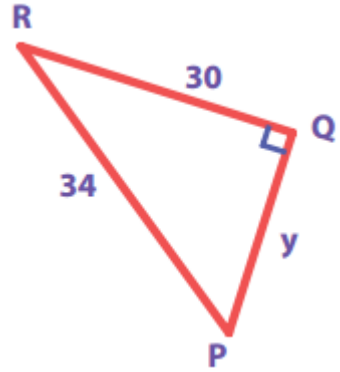
(v) 24, 45, 51
Answer:
Take $a = 24, b = 45$ and $c = 51$
Now $a^2 + b^2 = 24^2 + 45^2 = 576 + 2025 = 2601$
$c^2 = 51^2 = 2601$
$\therefore a^2 + b^2 = c^2$
By the converse of Pyhtagoreas theorem, the triangle with given measure is a right angled triangle.
∴ Ans: yes

Question 4.
Find the unknown side in the following triangles.
(i)



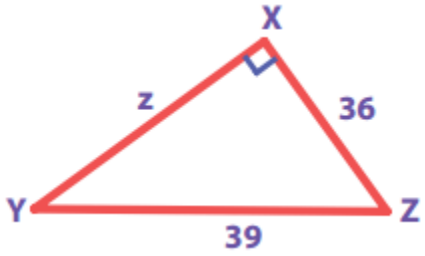
Answer:
From Δ ABC, by Pythagoras theorem
$BC^2 = AB^2 + AC^2$
Take $AB^2 + AC^2 = 9^2 + 40^2 = 81 + 1600 = 1681$
$BC^2 = AB^2 + AC^2 = 1681 = 41^2$
$BC^2 = 41^2 \Rightarrow BC = 41$
$\therefore x = 41$

(ii)



Answer:
From Δ PQR, by Pythagoras theorem.
$PR^2 = PQ^2 + QR^2$
$34^2 = y^2 + 30^2$
$\Rightarrow y^2 = 34^2 - 30^2$
$= 1156 - 900$
$= 256 = 16^2$
$y^2 = 16^2 \Rightarrow y = 16$

(iii)



Answer:

From Δ XYZ, by Pythagoras theorem,

$= YZ^2 = XY^2 + XZ^2$

$\Rightarrow XY^2 = YZ^2 - XZ^2$

$Z^2 = 39^2 - 36^2$

$= 1521 - 1296$

$= 225 = 15^2$

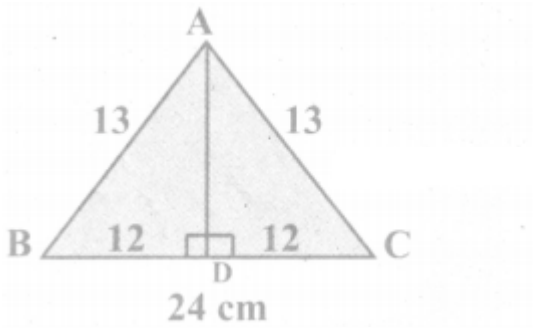
$z^2 = 15^2$

$\Rightarrow z = 15$

Question 5.

An isosceles triangle has equal sides each 13 cm and a base 24 cm in length. Find its height.

Answer:



In an isosceles triangle the altitude dives its base into two equal parts.

Now in the figure, ΔABC is an isosceles triangle with AD as its height

In the figure, AD is the altitude and ΔABD is a right triangle.

By Pythagoras theorem,

$AB^2 = AD^2 + BD^2$

$\Rightarrow AD^2 = AB^2 - BD^2$

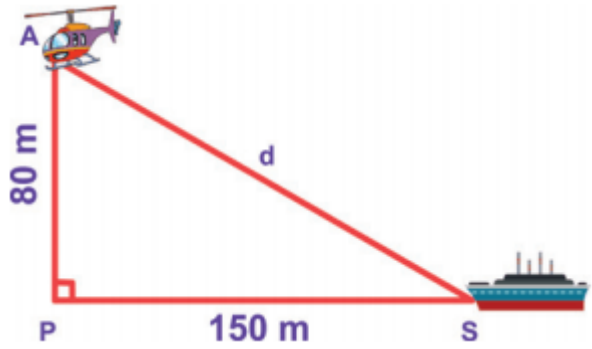
$= 13^2 - 12^2 = 169 - 144 = 25$

$AD^2 = 25 = 5^2$

Height: AD = 5cm

Question 6.

Find the distance between the helicopter and the ship.



Answer:

From the figure AS is the distance between the helicopter and the ship.

Δ APS is a right angled triangle, by Pythagoras theorem,

$AS^2 = AP^2 + PS^2$

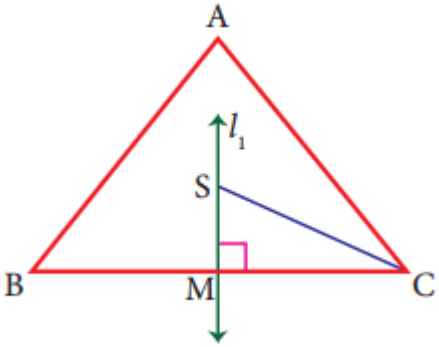
$= 80^2 + 150^2 = 6400 + 22500 = 28900 = 170^2$

∴ The distance between the helicopter and the ship is 170 m

Question 7.

In triangle ABC, line I, is a perpendicular bisector of BC.

If BC = 12cm, SM = 8cm, find CS.



Answer:

Given l_1, is the perpendicular bisector of BC.

∴ ∠SMC = 90°and BM = MC

BC = 12cm

⇒ BM + MC = 12cm

MC + MC = 12cm

2MC = 12

$MC = \frac{12}{2}$

MC = 6cm

Given SM = 8 cm

By Pythagoras theorem $SC^2 = SM^2 + MC^2$

$SC^2 = 8^2 + 6^2$

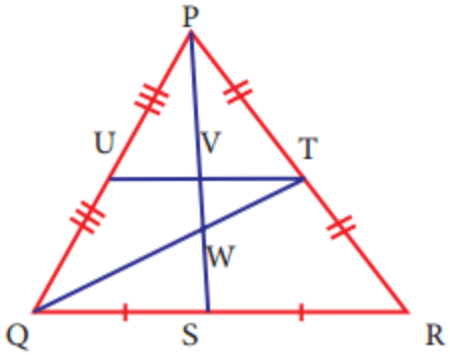
$SC^2 = 64 + 36$

$CS^2 = 100$

$CS^2 = 10^2$

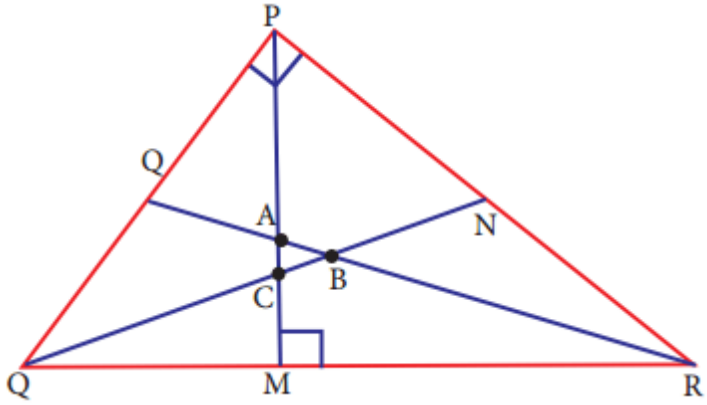
CS = 10 cm

Question 8.
Identify the centroid of ΔPQR.



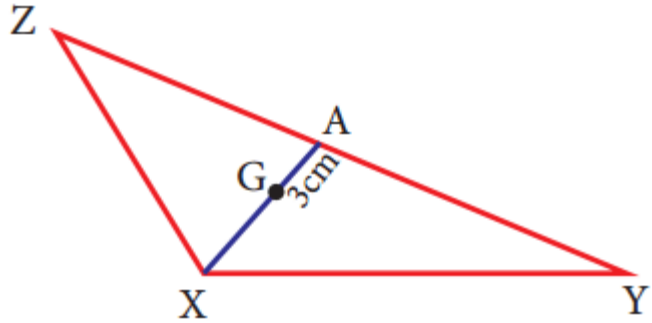
Answer:
In ΔPQR, PT = TR ⇒ QT is a median from vertex Q.
QS = SR ⇒ PS is a median from vertex P.
QT and PS meet at W and therefore W is the centroid of ΔPQR.

Question 9.
Name the orthocentre of ΔPQR.



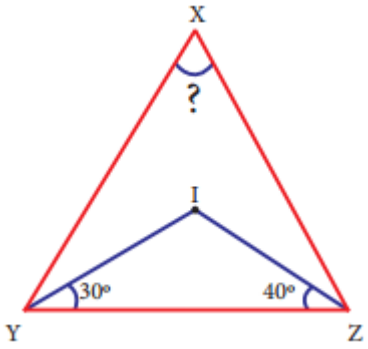
Answer:
This is a right triangle
∴ orthocentre = P [∵ In right triangle orthocentre is the vertex containing 90°]

Question 10.
In the given figure, A is the midpoint of YZ and G is the centroid of the triangle XYZ. If the length of GA is 3 cm, find XA.



Answer:
Given A is the midpoint of YZ.
∴ ZA = AY
G is the centroid of XYZ centroid divides each median in a ratio 2 : 1 ⇒ XG : GA = 2:1
$\frac{XG}{GA}=\frac{2}{1}$
$\frac{XG}{3}=\frac{2}{1}$
XG = 2 × 3
XG = 6 cm
XA = XG + GA = 6 + 3 ⇒ XA = 9cm

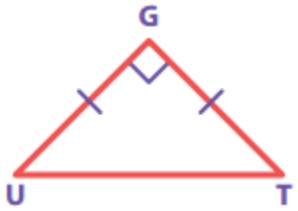
Question 11.
If I is the incentre of ΔXYZ, ∠IYZ = 30° and ∠IZY = 40°, find ∠YXZ.



Answer:
Since I is the incentre of AXYZ
∠IYZ = 30° ⇒ ∠IYX = 30°
∠IZY = 40° ⇒ ∠IZX = 40°
∴ ∠XYZ = ∠XYI + ∠IYZ = 30° + 30°
∠XYZ = 60°
||| ly ∠XYZ = ∠XZI + ∠IZY = 40° + 40°
∠XYZ = 80°
By angle sum property of a triangle
∠XZY + ∠XYZ + ∠YXZ = 180°
80° + 60° + ∠YXZ = 180°
140° + ∠YXZ = 180°
∠YXZ = 180° – 140°
∠YXZ = 40°

Objective Type **Questions**

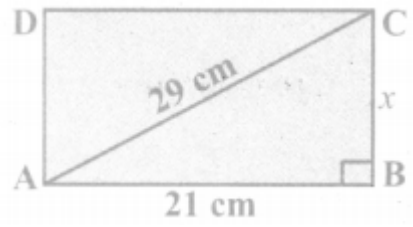
Question 12.
If ΔGUT is isosceles and right angled, then ∠TUG is _____ .



(A) 30°
(B) 40°
(C) 45°
(D) 55°
Answer:
(C) 45°
Hint:
∠U ∠T = 45° (∵ GUT is an isosceles given)
∴ ∠TUG = 45°

Question 13.
The hypotenuse of a right angled triangle of sides 12cm and 16cm is _____ .
(A) 28 cm
(B) 20 cm
(C) 24 cm
(D) 21 cm
Answer:
(B) 20 cm
Hint:
Side take a = 12 cm
b = 16cm
The hypotenuse $c^2 = a^2 + b^2$
$= 12^2 + 16^2$
$= 144 + 256$
$c^2 = 400 \Rightarrow c = 20$ cm

Question 14.
The area of a rectangle of length 21cm and diagonal 29 cm is _____ .
(A) 609 cm^2
(B) 580 cm^2
(C) 420 cm^2
(D) 210 cm^2
Answer:
(C) 420 cm^2

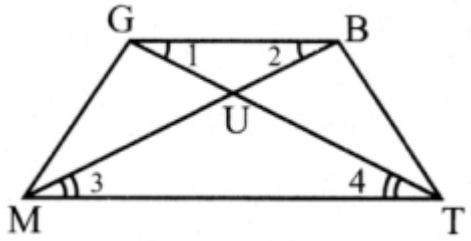


length = 21 cm
diagonal = 29 cm
By the converse of Pythagoras theorem,
$AB^2 + BC^2 = AC^2$
$21^2 + x^2 = 29^2$
$x^2 = 841 - 441\ 400 = 20^2$
x = 20 cm
Now area of the rectangle = length × breadth.
ie AB × BC = 21 cm × 20 cm = 420 cm^2

Question 15.
The sides of a right angled triangle are in the ratio 5:12:13 and its perimeter is 120 units then, the sides are .
(A) 25, 36, 59
(B) 10, 24, 26
(C) 36, 39, 45
(D) 20, 48, 52
Answer:
(D) 20,48,52
Hint:
The sides of a right angled triangle are in the ratio 5 : 12 : 13
Take the three sides as 5a, 12a, 13a
Its perimeter is 5a + 12a + 13a = 30a
It is given that 30a = 120 units
a = 4 units
∴ the sides 5a = 5 × 4 = 20 units
12a = 12 × 4 = 48 units
13a = 13 × 4 = 52 units

Ex 5.3

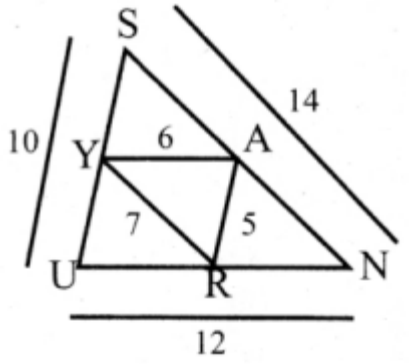
Question 1.
In the figure, given that ∠1 = ∠2 and ∠3 ≡ ∠4. Prove that Δ MUG ≡ ΔTUB.



Answer:

Statements	Reasons
1. In △MUG and △TUG Mu = TU	∠3 = ∠4, opposite sides of equal angles
2. UG = UB	∠1 = ∠2 Side opposite to equal angles are equal
3. ∠GUM = ∠BUT	Vertically opposite angle
4. ΔMUG ≡ ΔTUG	SAS criteria By 1,2 and 3

Question 2.
From the figure, prove that ΔSUN ~ ΔRAY.



Answer:
Proof: from the Δ SUN and ΔRAY
SU = 10
UN = 12
SN = 14
RA = 5
AY = 6

RY = 7

We have $\frac{SU}{RA} = \frac{10}{5} = \frac{2}{1}$ ....(1)

$\frac{UN}{AY} = \frac{12}{6} = \frac{2}{1}$ ....(2)

$\frac{SN}{RY} = \frac{14}{7} = \frac{2}{1}$ ....(3)

From (1), (2) and (3) we have

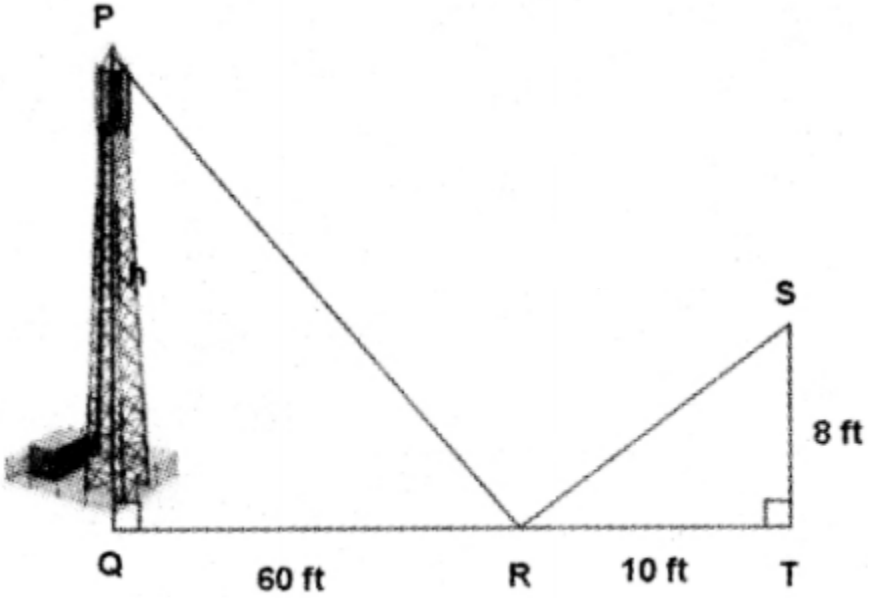
$\frac{SU}{RA} = \frac{UN}{AY} = \frac{SN}{RY} = \frac{2}{1}$

The sides are proportional

∴ ΔSUN ~ ΔRAY

Question 3.

The height of a tower is measured by a mirror on the ground at R by which the top of the tower's reflection is seen. Find the height of the tower. If ΔPQR ~ ΔSTR



Answer:

The image and its reflection make similar shapes

∴ ΔPQR ~ ΔSTR

$\frac{PQ}{ST} = \frac{QR}{TR} = \frac{PR}{SR}$

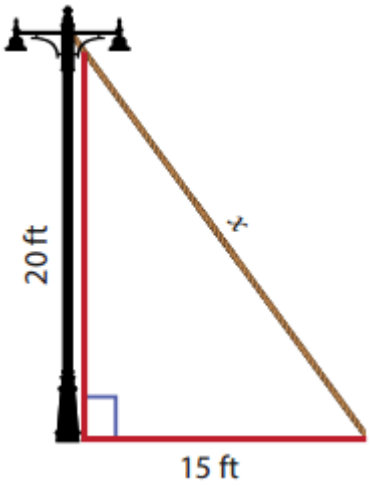
$\frac{PQ}{ST} = \frac{QR}{TR}$

$\Rightarrow \frac{h}{8} = \frac{60}{10}$

$h = \frac{60}{10} \times 8$

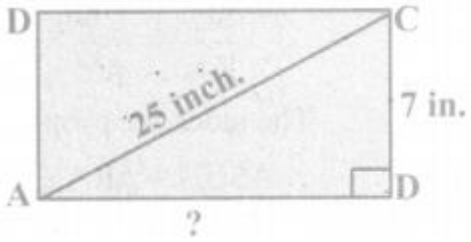
= 48 feet
∴ Height of the tower = 48 feet.

Question 4.
Find the length of the support cable required to support the tower with the floor.



Answer:
From the figure, by Pythagoras theorem,
$x^2 = 20^2 + 15^2$
$= 400 + 225 = 625$
$x^2 = 25^2 \Rightarrow x = 25$ft.
∴ The length of the support cable required to support the tower with the floor is 25ft.

Question 5.
Rithika buys an LED TV which has a 25 inches screen. If its height is 7 inches, how wide is the screen? Her TV cabinet is 20 inches wide. Will the TV fit into the cabinet? Give reason.
Answer:

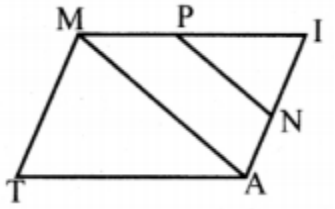


Take the sides of a right angled triangle ΔABC as
a = 7 inches
b = 25 inches
c = ?
By Pythagoras theorem,
$b^2 = a^2 + c^2$
$25^2 = 7^2 + c^2$
$\Rightarrow c^2 = 25^2 - 7^2 = 625 - 49 = 576$
$\therefore c^2 = 24^2$
$\Rightarrow$ c = 24 inches

∴ Width of TV cabinet is 20 inches which is lesser than the width of the screen ie.24 inches.
∴ The TV will not fit into the cabinet.

Challenging Problems

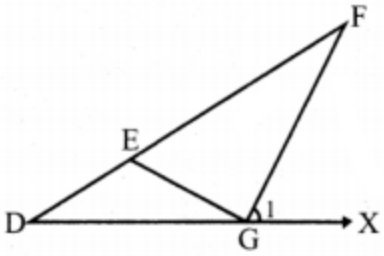
Question 6.
In the figure, ∠TMA ≡∠IAM and ∠TAM ≡ ∠IMA. P is the midpoint of MI and N is the midpoint of AI. Prove that Δ PIN ~ Δ ATM.



Answer:
proof:

S.No.	Statements	Reasons
1.	∠TMA ≡ ∠IAM ∠TAM = ∠IMA	given
2.	∠ATM = ∠TIM	Remaining angle By angle sum property
3.	$IP = PM \Rightarrow \frac{IP}{PM} = 1$ $In = NA \Rightarrow \frac{IN}{NA} = 1$	P is the midpoint of IM and N is the midpoint of IA
4.	$\frac{IP}{PM} = \frac{IN}{NA}$	By 3
5.	PN || MA	By 4
6.	∠IPN = ∠IMN ∠INP = ∠IAM	By 5
7.	In ΔPIN and ΔATM (i) ∠IPN = ∠TAM (ii) ∠INP = ∠TMA (iii) ∠ATM = ∠PIN	By 1, 2 and 6
8.	ΔPIN ~ ΔATM	By AAA criteria

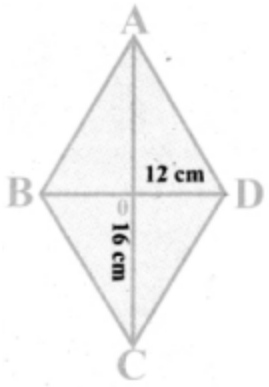
Question 7.
In the figure, if $\angle FEG \equiv \angle 1$ then, prove that $DG^2 = DE.DF$.



Answer:
Proof:

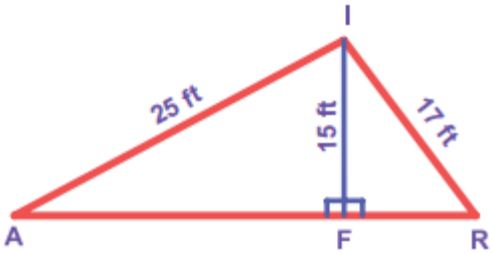
S.No.	Statements	Reasons
1.	$\angle FEG \equiv \angle 1$ $\Rightarrow \angle DEG = 180° - \angle FEG$	Given linear pair
2.	$\angle FDG + \angle DFG = 1$ $\angle EDG + \angle DFG = 1$	Exterior angle = Sum of interior opposite angles $\because \angle FDG = \angle EDG$
3.	$\angle DEG = 180° - \angle FEG$ $\angle DEG = 180 - \angle 1$	By 1
4.	In ΔDFG $\angle DGF = 180° - [\angle FDG + \angle DFG]$	Angle sum property
5.	$\angle DGF = 180° - \angle 1$	By 2
6.	$\angle DGF = \angle DEG$	By 3
7.	$\angle EDG = \angle EDG$	Common in ΔFDG and ΔEDG
8.	$\therefore \angle DGE = \angle DFG$	Remaining angle by angle sum property and by 6
9.	$\therefore \Delta DGF \sim \Delta DEG$	By 6, 7, 8 By AAA similarity
10.	$\frac{DG}{DE} = \frac{GF}{EG} = \frac{DF}{DG}$	Corresponding sides of similar trianlge are proportional.
11.	$\frac{DG}{DE} = \frac{DF}{DG}$ $DG.\ DG = DF.\ DE$ $DG^2 = DE.DF$	From 9

Question 8.
The diagonals of the rhombus is 12 cm and 16 cm. Find its perimeter. (Hint: the diagonals of rhombus bisect each other at right angles).
Answer:



Here AO = CO = 8cm
BO = DO = 6cm
(∴the diagonals of rhombus bisect each other at right angles)
∴ In Δ AOB, $AB^2 = AO^2 + OB^2$
$= 8^2 + 6^2 = 64 + 36$
$= 100 = 10^2$
∴ AB = 10
Since it is a rhombus, all the four sides are equal.
AB = BC = CD = DA
∴ Its Perimeter = 10 + 10 + 10 + 10 = 40 cm

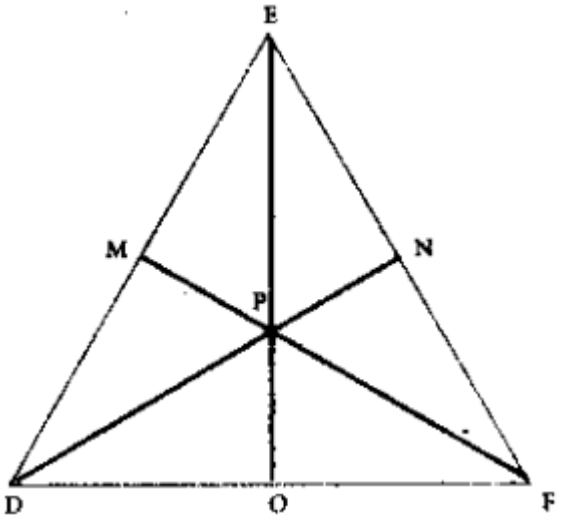
Question 9.
In the figure, find AR.



Answer:
Δ AFI, Δ FRI are right triangles.
By Pythagoras theorem,
$AF^2 = AI^2 - FI^2$
$= 25^2 - 15^2$
$= 625 - 225 = 400 = 20^2$
∴ AF = 20ft.
$FR^2 = RI^2 - FI^2$
$= 17^2 - 15^2 = 289 - 225 = 64 = 8^2$
FR = 8ft.

∴ AR = AF + FR
= 20 + 8 = 28 ft.

Question 10.
In ΔDEF, DN, EO, FM are medians and point P is the centroid. Find the following.
(i) IF DE = 44, then DM = ?
(ii) IFPD=12, then PN= ?
(iii) IfDO = 8, then PD = ?
(iv) IF 0E = 36 then EP = ?



Answer:
Given DN, EO, FM are medians.
∴ FN = EN
DO = FO
EM = DM

(i) If DE = 44,then
DM = $\frac{44}{2}$ = 22
DM = 22

(ii) If PD = 12,PN = ?
$\frac{PD}{PN} = \frac{2}{1}$
$\frac{12}{PN} = \frac{2}{1} \Rightarrow PN = \frac{12}{2} = 6.$
PN = 6

(iii) If DO = 8, then
FD = DO + OF
= 8 + 8
FD = 16

(iv) If OE = 36

$$\text{then } \frac{EP}{PO} = \frac{2}{1}$$

$$\frac{EP}{2} = PO$$

$$OE = OP + PE$$

$$36 = \frac{PE}{2} + PE$$

$$36 = \frac{PE}{2} + \frac{2PE}{2}$$

$$36 = \frac{3PE}{2}$$

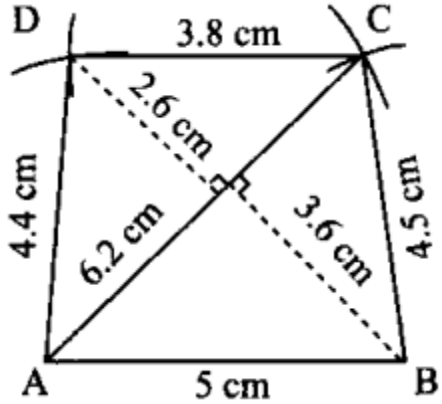
$$PE = \frac{36 \times 2}{3}$$

PE = 24

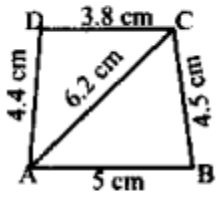
Ex 5.4

I. Construct the following quadrilaterals with the given measurements and also find their area.

Question 1.
ABCD, AB = 5 cm, BC = 4.5 cm, CD = 3.8 cm, DA = 4.4 cm and AC = 6.2 cm.
Answer:
Given ABCD, AB = 5 cm, BC = 4.5 cm, CD = 3.8 cm, DA = 4.4 cm and AC = 6.2 cm.



Rough Diagram

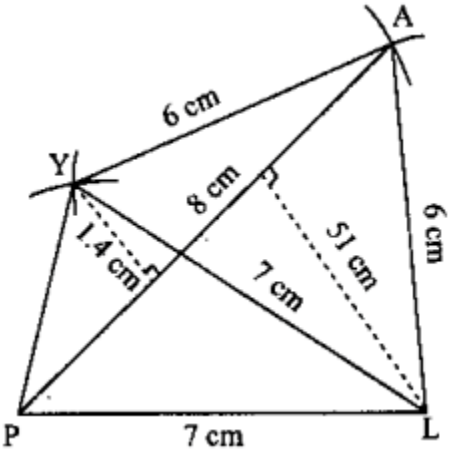


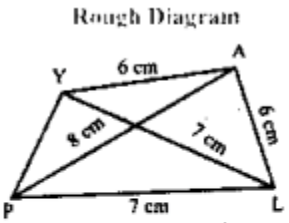
Steps:

- Draw a line segment AB = 5 cm
- With A and B as centers drawn arcs of radii 6.2 cm and 4.5cm respectively and let them cut at C.
- Joined AC and BC.
- With A and C as centrers drawn arcs of radii 4.4cm and 3.8 cm respectively and let them at D.
- Joined AD and CD.
- ABCD is the required quadrilateral.

Calculation of Area:
Area of the quadrilateral ABCD $= \frac{1}{2} \times d \times (h_1 1 + h_2)$ sq. units
$= \frac{1}{2} \times 6.2 \times (2.6 + 3.6) cm^2 = 3.1 \times 6.2 = 19.22\ cm^2$

Question 2.
PLAY, PL = 7cm, LA = 6cm, AY = 6cm, PA = 8cm and LY = 7cm.
Answer:
Given PLAY, PL = 7cm, LA = 6cm, AY = 6cm, PA = 8cm and LY = 7cm





Steps:

- Drawn a line segment PL = 7 cm
- With P and L as centers, drawn arcs of radii 8 cm and 6 cm respectively, let them cut at A.
- Joined PA and LA.
- With L and A as centers, drawn arcs of radii 7 cm and 6 cm respectively and let them cut at Y.
- Joined LY, PY and AY.
- PLAY is the required quadrilateral.

Calculation of Area:

Area of the quadrilateral PLAY $= \frac{1}{2} \times d \times (h_1 + h_2)$ sq. units $= \frac{1}{2} \times 8 \times (5.1 + 1.4)$ cm^2

$\frac{1}{2} \times 8 \times 6.5$ cm^2 $= 26$ cm^2

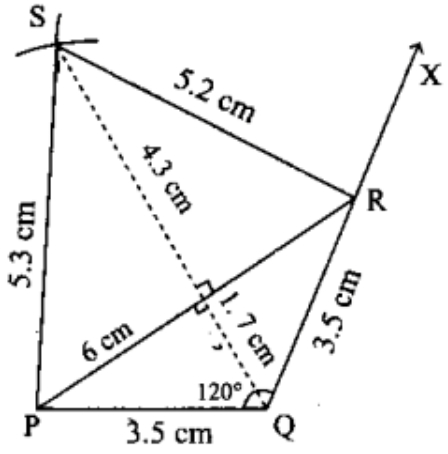
Area of the quadrilateral $= 26$ cm^2

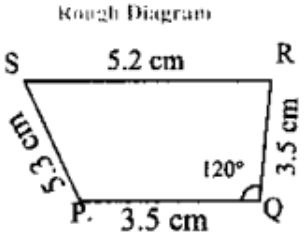
Question 3.

PQRS, PQ = QR = 3.5 cm, RS = 5.2 cm, SP = 5.3 cm and ∠Q = 120°.

Answer:

Given PQ = QR = 3.5 cm, RS = 5.2 cm, SP = 5.3 cm and ∠Q = 120°





Steps:

- Draw a line segment PQ = 3.5 cm
- Made ∠Q = 120°. Drawn the ray QX.
- With Q as centre drawn an arc of radius 3.5 cm. Let it cut the ray QX at R.
- With R and P as centres drawn arcs of radii 5.2cm and 5.5 cm respectively and let them cut at S.
- Joined PS and RS.
- PQRS is the required quadrilateral.

Calculation of Area:

Area of the quadrilateral PQRS $= \frac{1}{2} \times d \times (h_1 + h_2)$ sq. units

$= \frac{1}{2} \times 6 \times (4.3 + 17) cm^2$

$= 3 \times 6 cm^2$

$= 18\ cm^2$

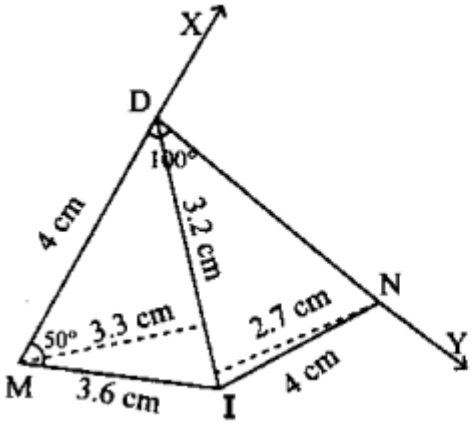
Area of the quadrilateral PQRS $= 18\ cm^2$

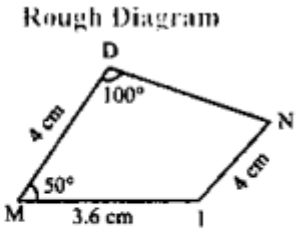
Question 4.

MIND, MI = 3.6 cm, ND = 4 cm, MD = 4 cm, ∠M = 50° and ∠D = 100°.

Answer:

Given MI = 3.6 cm, ND = 4 cm, MD = 4 cm, ∠M = 50° and ∠D = 100°





Steps:

- Drawn a line segment MI = 3.6 cm
- At M on MI made an angle ∠IMX = 500
- Drawn an arc with center M and radius 4 cm let it cut MX it D
- At D on DM made an angle ∠MDY = 100°
- With I as center drawn an arc of radius 4 cm, let it cut DY at N.
- Joined DN and IN.
- MIND is the required quadrilateral.

Calculation of Area:

Area of the quadrilateral MIND $= \frac{1}{2} \times d \times (h_1 + h_2)$ sq. units $= \frac{1}{2} \times 3.2 \times (2.7 + 33)$ cm^2

$= \frac{1}{2} \times 3.2 \times 6$ cm$^2 = 9.6$ cm^2

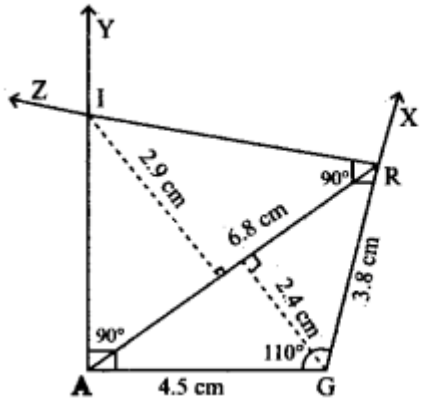
Area of the quadrilateral $= 9.6$ cm^2

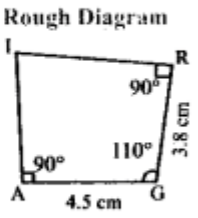
Question 5.

AGRI, AG = 4.5 cm, GR = 3.8 cm, ∠A = 60°, ∠G = 110° and ∠R = 90°.

Answer:

AG = 4.5 cm, GR = 3.8 cm, ∠A = 60°, ∠G = 110° and ∠R = 90°.





Steps:

- Draw a line segment AG = 4.5 cm
- At G on AG made ∠AGX = 110°
- With G as centre drawn an arc of radius 3.8 cm let it cut GX at R.
- At R on GR made ∠GRZ = 90°
- At A on AG made ∠GAY = 90°
- AY and RZ meet at I.
- AGRI is the required quadrilateral.

Calculation of Area:

Area of the quadrilateral AGRI $= \frac{1}{2} \times d \times (h_1 + h_2)$ sq. units $= \times 6.8 \times (2.9 + 2.4)$ cm^2

$= \frac{1}{2} \times 6.8 \times 5.3 \times$ cm^2

Area of the quadrilateral $= 18.02$ cm^2

II. Construct the following trapeziums with the given measures and also find their area.

Question 1.

AIMS with $\overline{AI} \parallel \overline{SM}$, AI = 6cm, IM = 5cm, AM = 9cm and MS = 6.5cm.

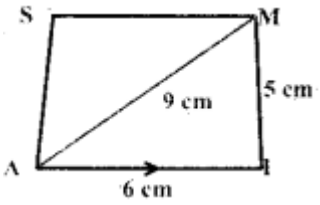
Answer:

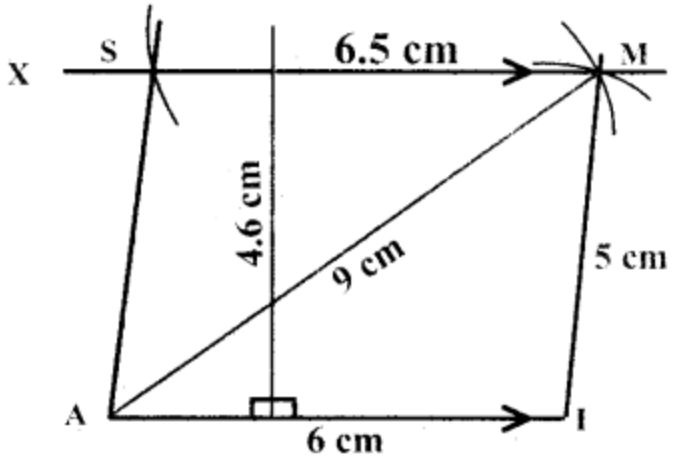
Given AI = 6 cm, IM = 5 cm

AM = 9 cm, and $\overline{AI} \parallel \overline{SM}$

MS = 6.5 cm

Rough Diagram





Construction:

Steps:

- Draw a line segment AI = 6cm.
- With A and I as centres, draw arcs of radii 9 cm and 5 cm respectively and let them cut at M
- Join AM and IM.
- Draw MX parallel to AI
- With M as centre, draw an arc of radius 6.5 cm cutting MX at S.
- Join AS AIMS is the required trapezium.

Calculation of Area

Area of the trapezium AIMS $= \frac{1}{2} \times h \times (a + b)$ sq.units

$= \frac{1}{2} \times 4.6 \times (6 + 6.5)$

$= \frac{1}{2} \times 4.6 \times 12.5$
$= 28.75$ Sq.cm

Question 2.

CUTE with $\overline{CD} \parallel \overline{ET}$, CU = 7cm, ∠ UCE = 80° CE = 6cm and TE = 5cm.

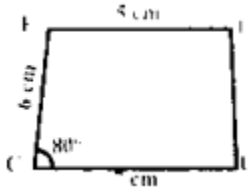
Answer:

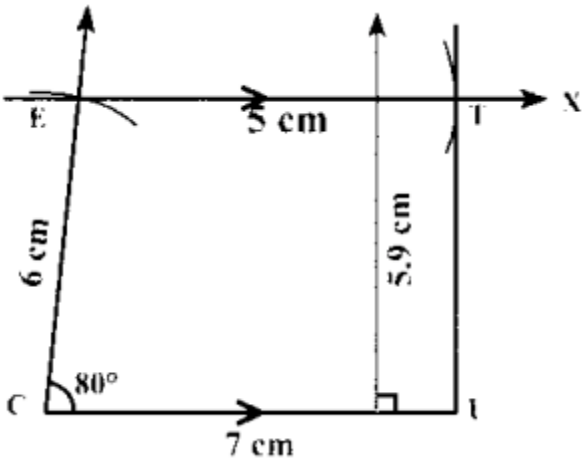
Given: In the trapezium CUTE,

CU = 7cm, ∠UCE = 80°,

CE = 6cm,TE = 5cm and $\overline{CD} \parallel \overline{ET}$

Rough Diagram





Construction:
Steps:

- Draw a line segment CU = 7cm.
- Construct an angle ∠UCE = 80° at C
- With C as centre, draw an arc of radius 6 cm cutting CY at E
- Draw EX parallel to CU
- With E as centre, draw an arc 7 cm of radius 5 cm cutting EX at T
- Join UT. CUTE is the required trapezium.

Calculation of area:

Area of the trapezium CUTE $= \frac{1}{2} \times h \times (a + b)$ sq. units

$= \frac{1}{2} \times 5.9 \times (7 + 5)$sq. units
$= 35.4$ sq.cm

Question 3.

ARMY with $\overline{AR} \parallel \overline{YM}$, AR = 7cm, RM = 6.5 cm ∠RAY = 100° and ∠ARM = 60°

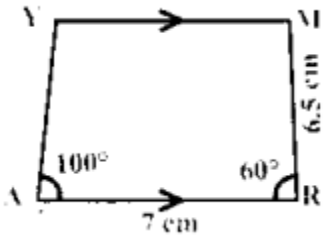
Answer:

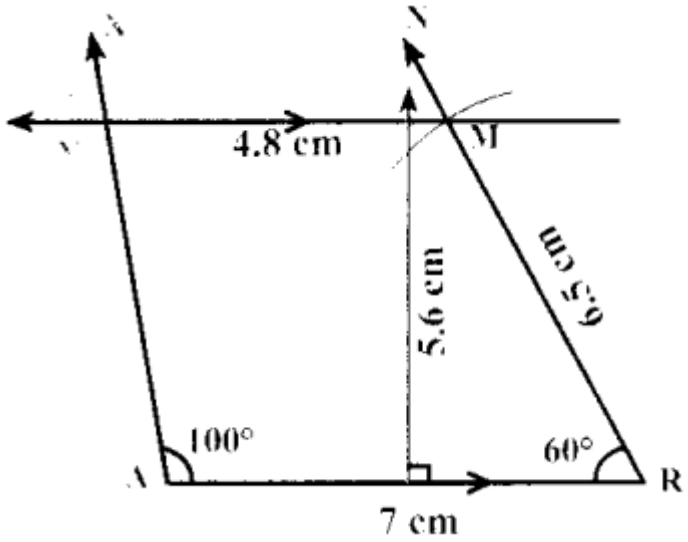
Given: In the trapezium ARMY

AR = 7cm,RM = 6.5cm,

∠RAY = 100° and ARM 60°, $\overline{AR} \parallel \overline{YM}$

Rough Diagram





Construction:
Steps:

- Draw a line segment AR = 7 cm.
- Construct an angle ∠RAX = 100° at A
- Construct an angle ∠ARN = 60° at R
- With R as centre, draw an arc of radius 6.5 cm cutting RN at M
- Draw MY parallel to AR
- ARMY is the required trapezium.

Calcualtion of Area:

Area of the trapezium ARMY $= \frac{1}{2} \times h \times (a + b)$ sq. units

$= \frac{1}{2} \times 5.6 \times (7 + 4.8)$ sq. units

$= \frac{1}{2} \times 5.6 \times 1.18$

$= 33.04$ sq.cm

Question 4.

CITY with $\overline{CI} \parallel \overline{YT}$, CI = 7cm, IT = 5 .5 cm, TY = 4cm and YC = 6cm.

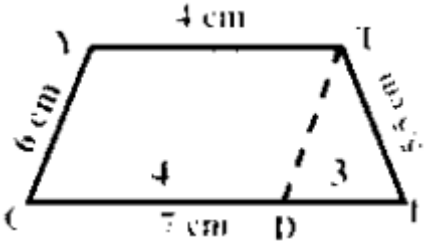
Answer:

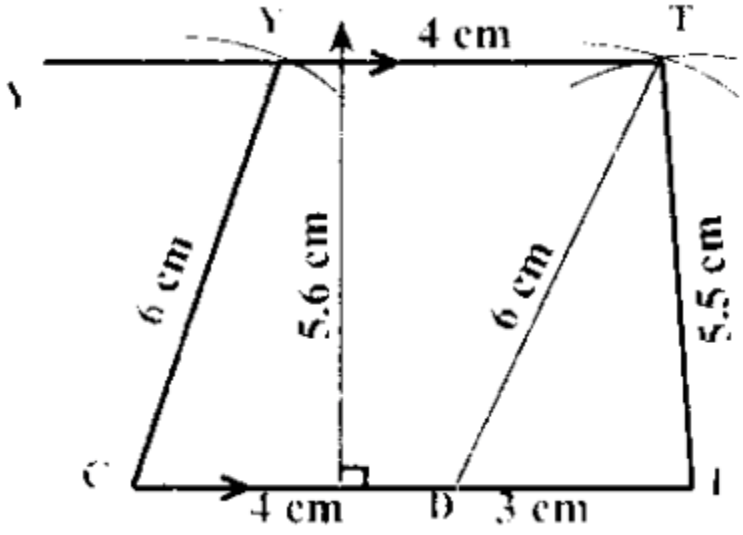
Given: In the trapezium CITY,

CI = 7cm,IT = 5.5cm, TY = 4cm

YC = 6cm, and $\overline{CI} \parallel \overline{YT}$

Rough Diagram





Construction:

Steps:

- Draw a line segment CI = 7 cm.
- Mark a point D on CI such that CD = 4cm

- With D and I as centres, draw arcs of radii 6 cm and 5.5 cm respectively. Let them cut at T. Join DT and IT.
- With C as centre, draw an arc of radius 6 cm.
- Draw TY parallel to Cl. Let the line cut the previous arc at Y.
- Join CY. CITY is the required trapezium.

Construction of area:

Area of the trapezium CITY $= \frac{1}{2} \times h \times (a + b)$ sq. units

$= \frac{1}{2} \times 5.5 \times (7 + 4)$sq.units

$= \frac{1}{2} \times 5.5 \times 11$

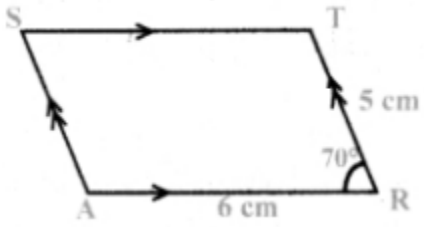
$= 30.25$ sq.cm

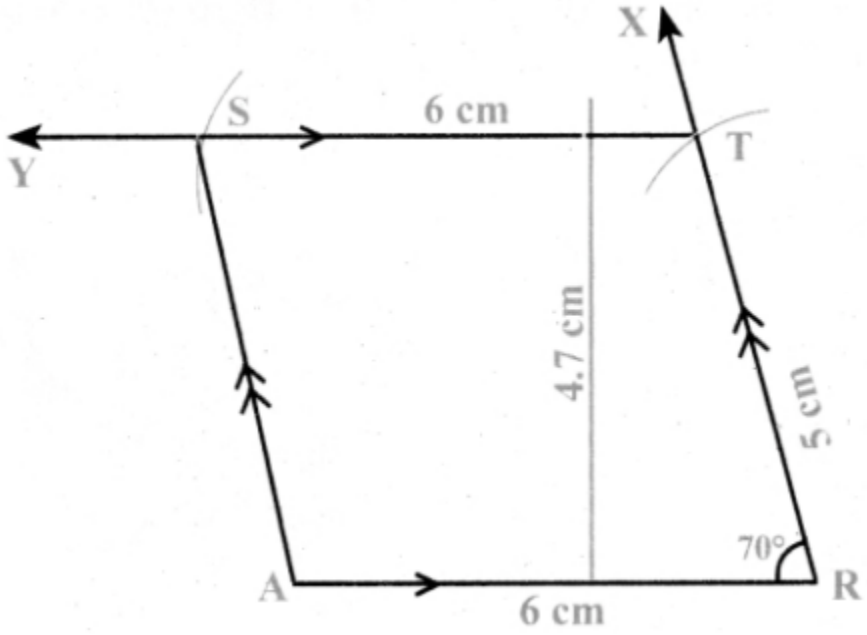
Ex 5.5

I. Construct the following parallelograms with the given measurements and find their area.

Question 1.
ARTS, AR = 6cm, RT = 5cm and ∠ART = 70°.
Answer:
Given : In the Parallelogram ARTS,
AR = 6 cm, RT = 5 cm, and ∠ART = 70°

Rough Diagram





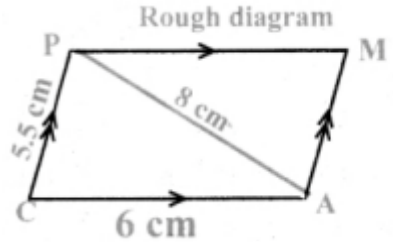
Construction:
Steps:

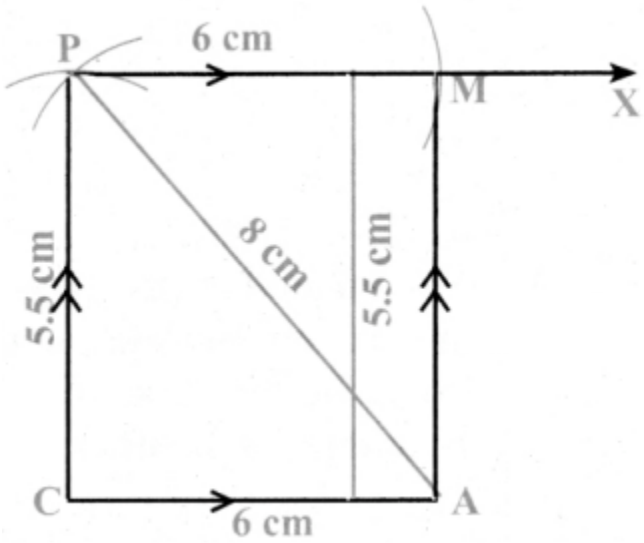
- Draw a line segment AR = 6 cm.
- Make an angle ∠ART = 70° at R on AR
- With R as centre, draw an arc of radius 5 cm cutting RX at T
- Draw a line TY parallel to AR through T.
- With T as centre, draw an arc of radius 6 cm cutting TY at S. Join AS
- ARTS is the required parallelogram.

Calculation of area:
Area of the parallelogram ARTS = b × h sq. units
= 6 × 4.7 = 28.2 sq.cm

Question 2.
CAMP, CA = 6cm, AP = 8cm and CP = 5.5cm.
Answer:
Given : In the parallelogram CAMP,
CA = 6 cm, AP = 8 cm, and CP = 5.5cm

Rough Diagram





Construction:
Steps:

- Draw a line segment CA = 6 cm.
- With C as centre, draw an arc of length 5.5 cm
- With A as centre, draw an arc of length 8 cm
- Mark the intersecting point of these two arcs as P
- Draw a line PX parallel to CA
- With P as centre draw an arc of radius 6 cm cutting PX at M. Join AM
- CAMP is the required parallelogram.

Calculation of area:
Area of the Parallelogram CAMP = b × h sq. units
= 6 × 5.5 = 33 sq.cm

Question 3.

EARN, ER = 10cm, AN = 7cm and ∠EOA = 110° where $\overline{ER}$ and $\overline{AN}$ intersect at O.

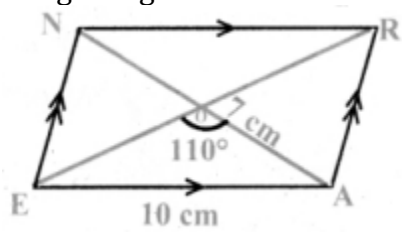
Answer:

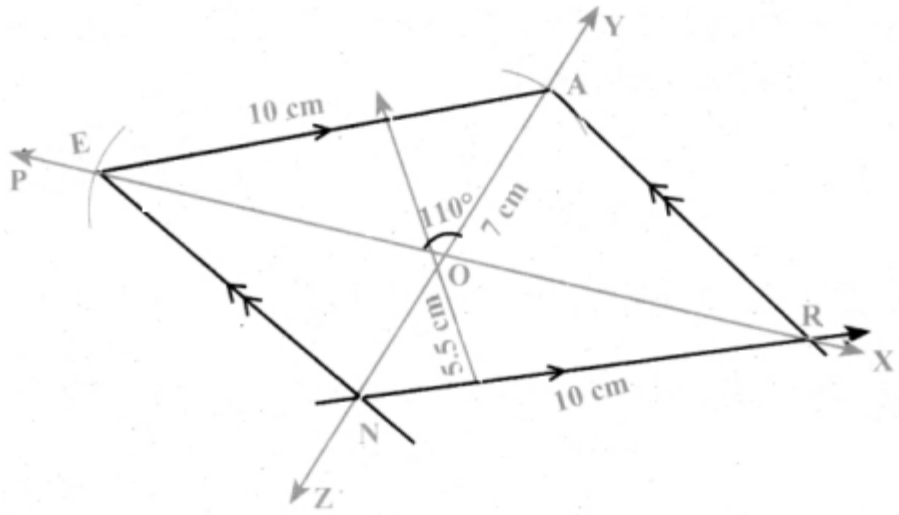
Given: In the parallelogram EARN,

ER = 10 cm, AN = 7 cm, and LEOA = 1100

Where $\overline{ER}$ and $\overline{AN}$ intersect at 0

Rough diagram



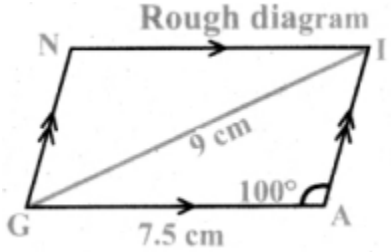


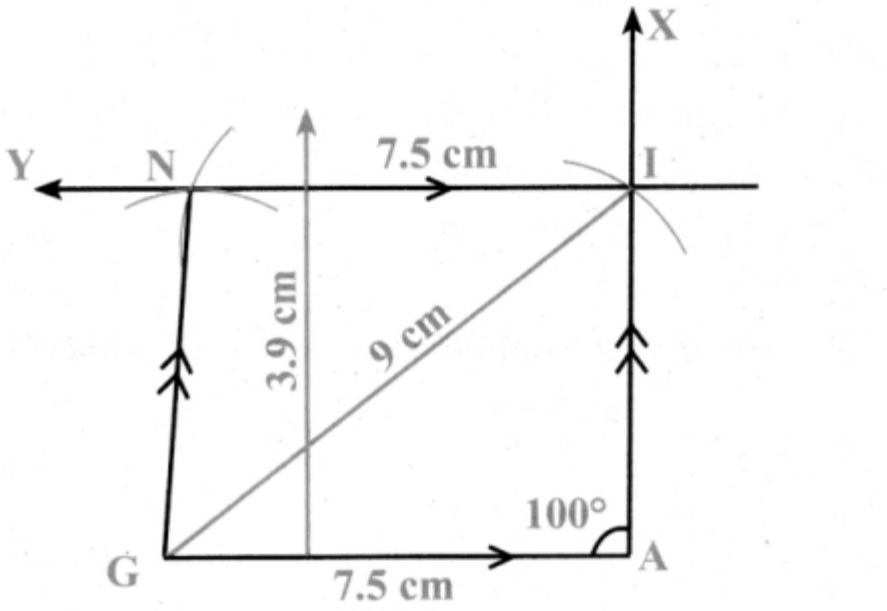
Construction:
Steps:

- Draw a line segment PX. Mark a point O on PX
- Make an angle ∠EOA = 1100 on PX at O
- Draw arcs of radius 3.5 cm with O as centre on either side of PX. Cutting YZ on A and N
- With A as centre, draw an arc of radius 10 cm, cutting PX at E. Join AE
- Draw a line parallel to AE at N cutting PX at R. Join EN and AR
- EARN is the required parallelogram

Calculation of area:
Area of the Parallelogram EARN = b × h sq. units
= 10 × 5.5 = 55 sq.cm

Question 4.
GAIN, GA = 7.5cm, GI = 9cm and ∠GAI = 100°.
Answer:
Given : In the parallelogram GAIN,
GA = 7.5 cm, GI = 9 cm, and ∠GAI = 100°





Construction:
Steps:

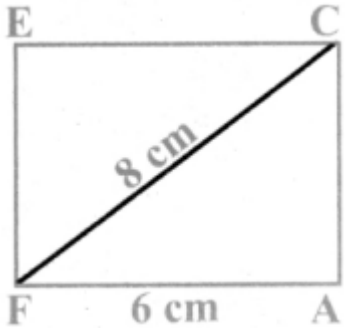
- Draw a line segment GA = 7.5 cm.
- Make an angle GAI = 100° at A.
- With G as centre, draw an arc of radius 9 cm cutting AX at I. Join GI.
- Draw a line IY parallel to GA through I.
- With I as centre, draw an arc of radius 7.5 cm on IY cutting at N. Join GN
- GAIN is the required parallelogram.

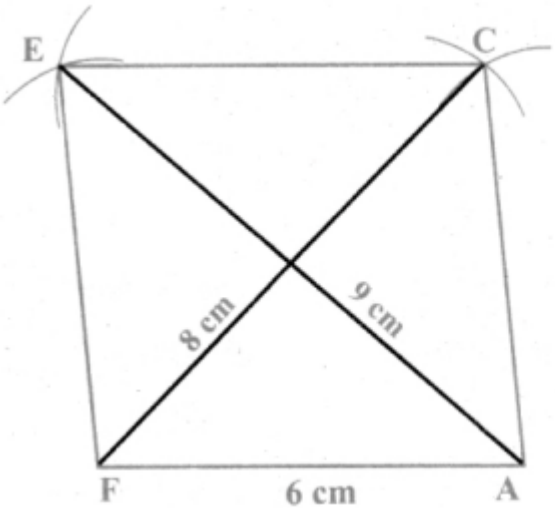
Construction of area:
Area of the Parallelogram GAIN = b × h sq. units
= 7.5 × 39 = 29.25 sq. cm

II. Construct the following rhombuses with the given measurements and also find their area.

(i) FACE, FA = 6 cm and FC = 8 cm
Answer:
Given FA = 6 cm and FC = 8 cm

Rough Diagram





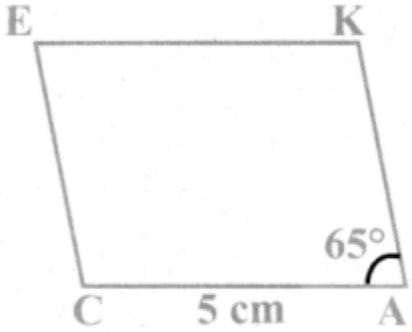
Steps:

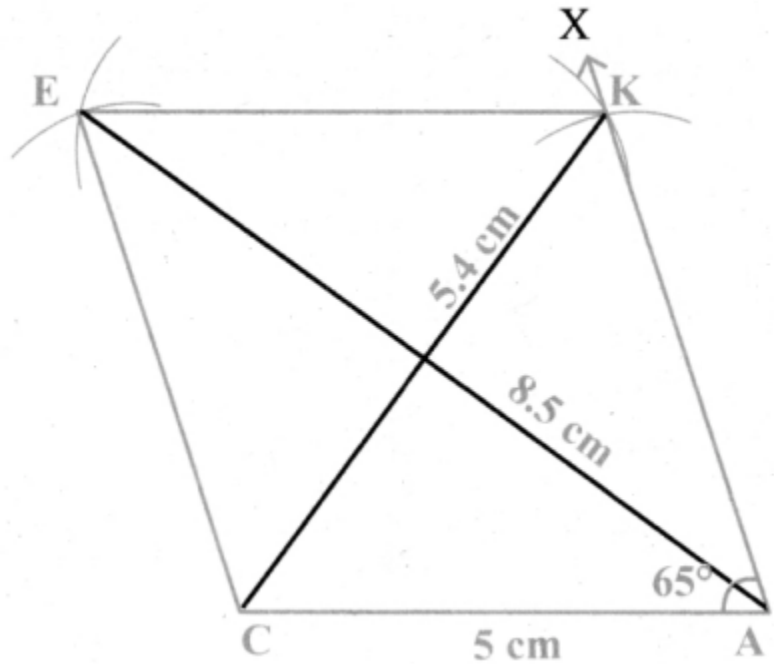
- Drawn a line segment FA = 6 cm.
- With F and A as centres, drawn arcs of radii 8 cm and 6 cm respectively and let them cut at C.
- Joined FC and AC.
- With F and C as centres, drawn arcs of radius 6 cm each and let them cut at E.
- Joined FE and EC.
- FACE is the required rhombus.

Calculation of Area :
Area of the rhombus $= 12 \times d_1 \times d_2$ sq.units $= 12 \times 8 \times 9$ sq.units $= 36$ cm

(ii) CAKE, CA = 5 cm and $\angle A = 65°$
Answer:
Given CA = 5 cm and $\angle A = 65°$

Rough Diagram





Steps:

- Drawn a line segment CA = 5 cm.
- At A on AC, made $\angle CAX = 65°$
- With A as centre, drawn arc of radius 5 cm. Let it cut AX at K.
- With K and C as centres, drawn arcs of radius 5 cm each and let them cut at E.
- Joined KE and CE.
- CAKE is the required rhombus.

Calculation of Area:

Area of the rhombus $= \frac{1}{2} \times d_1 \times d_2$ sq.units $= \frac{1}{2} \times 54 \times 85 cm^2$

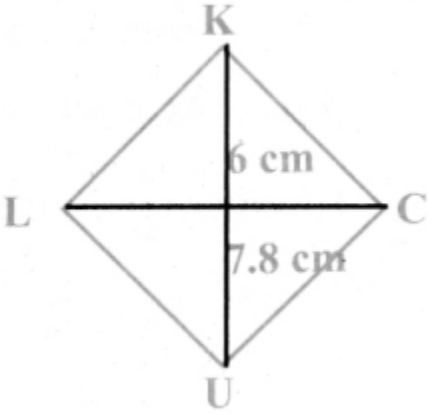
$= 22.95\ cm^2$

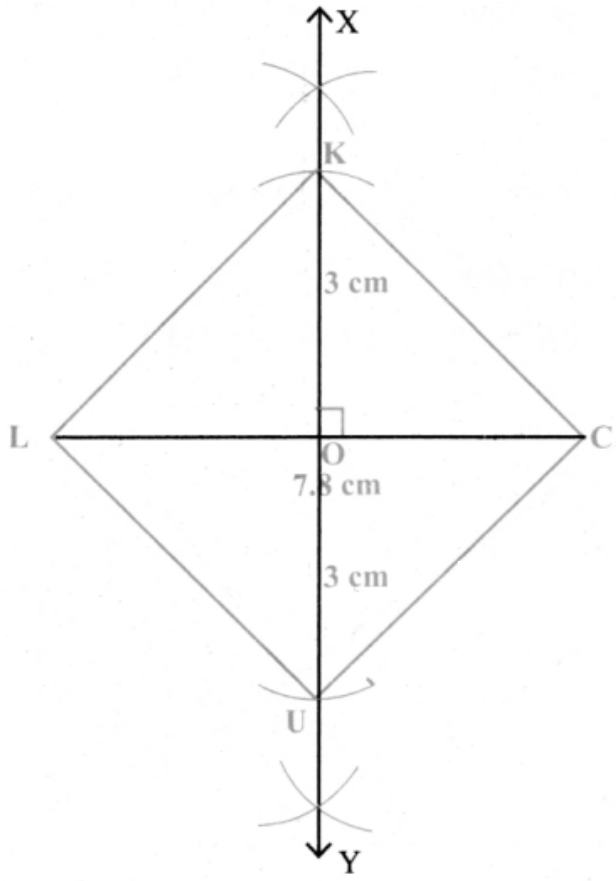
(iii) LUCK, LC = 7.8 cm and UK = 6 cm

Answer:

Given LC = 7.8 cm and UK = 6 cm

Rough Diagram





Steps:

- Drawn a line segment LC = 7.8 cm.
- Drawn the perpendicular bisector XY to LC. Let it cut LC at 'O'
- With O as centres, drawn arc of radius 3 cm on either side of O which cut OX at K and OY at U.
- Joined LU, UC, CK and LK.
- UCK is the required rhombus.

Calculation of Area:

Area of the rhombus $= \frac{1}{2} \times d_1 \times d_2$ sq.units

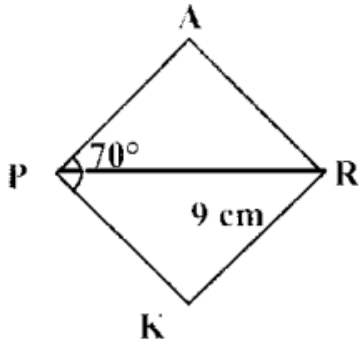
$= \frac{1}{2} \times 7.8 \times 6 \text{ cm}^2 = 23.4 \text{ cm}^2$

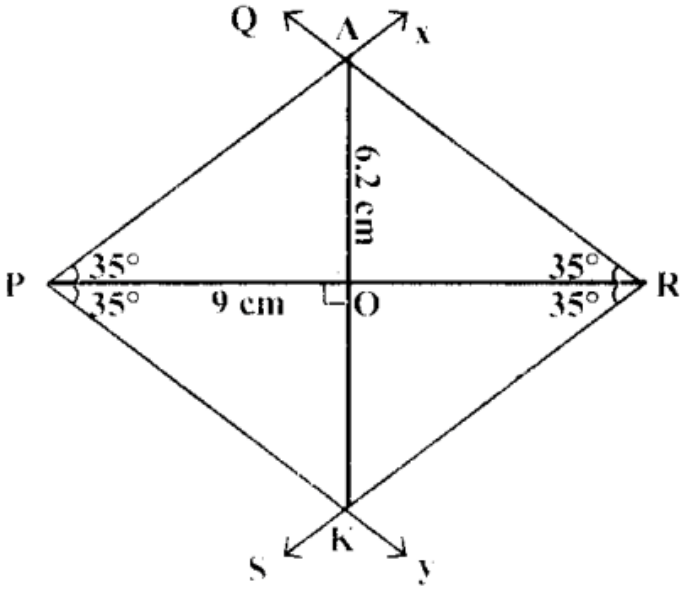
(iv) PARK, PR = 9 cm and ∠P = 70°

Answer:

Given PR = 9 cm and ∠P = 70°

Rough Diagram





Steps:

- Drawn a line segment PR = 9 cm.
- At P, made ∠RPX ∠RPY = 35° on either side of PR.
- At R, made ∠PRQ = ∠PRS = 35° on either side of PR
- Let PX and RQ cut at A and PY and RS at K.
- PARK is the required rhombus

Constructon of Area:

Area of the rhombus $= \frac{1}{2} \times d_1 \times d_2$ sq.units

$= \frac{1}{2} \times 9 \times 6.2$ cm^2 $= 27.9$ cm^2

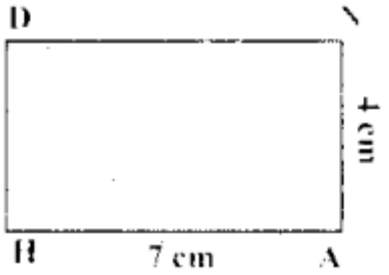
III. Construct the following rectangles with the given measurements and also find their area.

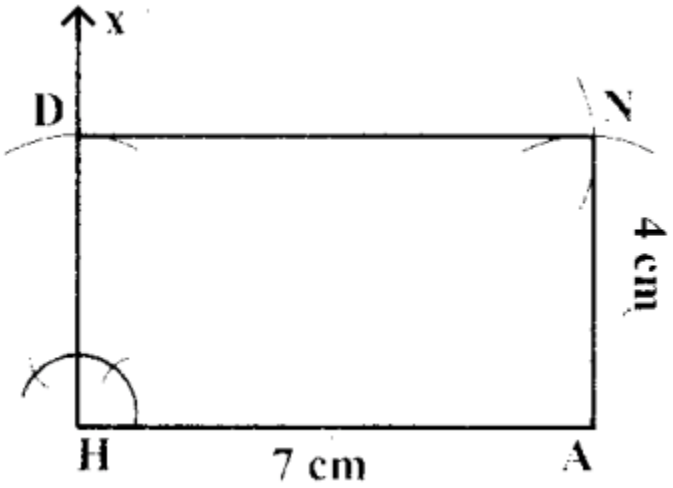
(i) HAND,HA = 7cm and AN = 4 cm

Answer:

Given HA = 7cm and AN = 4 cm

Rough Diagram



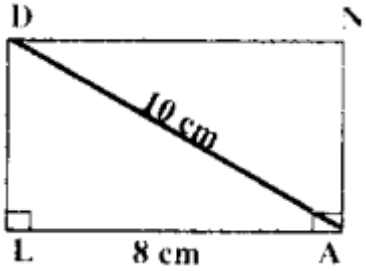


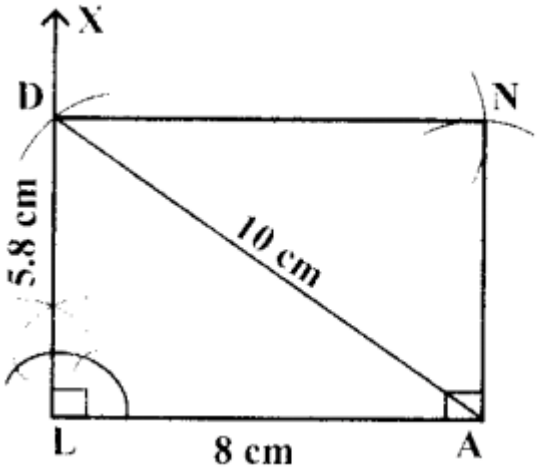
Steps:

- Drawn a line segment HA = 7 cm.
- At H, constructed HX ⊥ HA.
- With H as centre, drawn an arc of radius 4 cm and let it cut at HX at D.
- With A and D as centres, drawn arcs of radii 4 cm and 7 cm respectively and let them cut at N.
- Joined AN and DN.
- HAND is the required rectangle.

calculation of' area :
Area of the rectangle HAND = l × b sq.units
$= 7 \times 4 \text{ cm}^2$
$= 28 \text{ cm}^2$

(ii) LAND, LA = 8cm and AD = 10 cm
Answer:
Given LA = 8cm and AD = 10 cm





Sleps :

- Drawn a line segment LA = 8 cm.
- At L, constructed LX ⊥ LA.
- With A as centre, drawn an arc of radius 10 cm and let it cut at LX at D.
- With A as centre and LD as radius drawn an arc. Also with D as centre and LA as radius drawn another arc. Let then cut at N.
- Joined DN and AN.

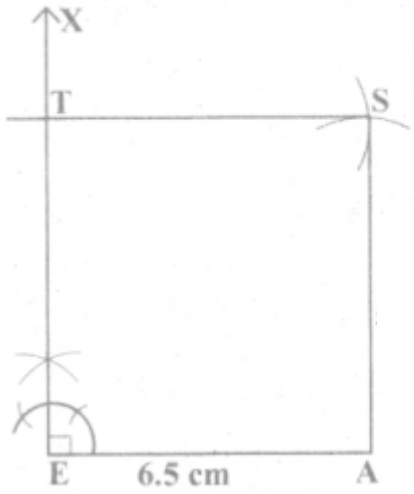
- LAND is the required rectangle.

Calcualtion of arca :
Area of the rectangle LAND = l × b sq.units
= 8 × 5.8 cm^2
= 46.4 cm^2

IV. Construct the following squares with the given measurements and also find their area.

(i) EAST, EA = 6.5 cm
Answer:
Given side = 6.5 cm

Rough diagram



Steps:

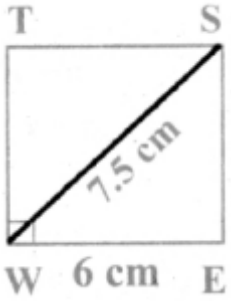
- Drawn a line segment EA = 6.5 cm.
- At E, constructed EX⊥ EA.
- With E as centre, drawn an arc of radius 6.5 cm and let it cut EX at T.
- With A and T as centre drawn an arc of radius 6.5 cm each and let them cut at S.
- Joined TS and AS.

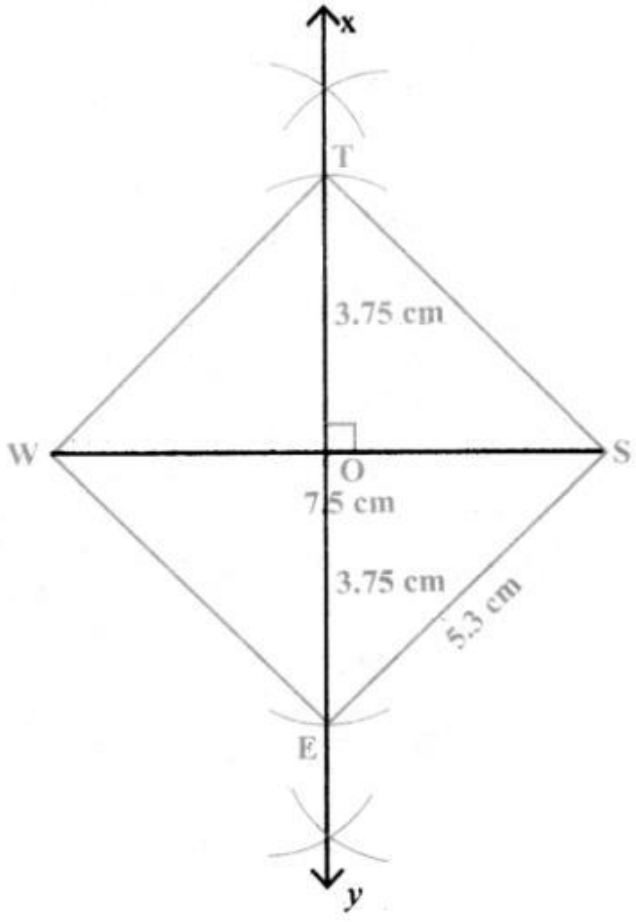
- EAST is the required square.

Calcualtion of Area:
Area of the square EAST = a^2 sq.units
= 6.5×6.5 cm^2
= 42.25 cm^2

(ii) WEST, WS = 7.5 cm
Answer:
Given diagonal = 7.5 cm

Rough Diagram





Steps:

- Drawn a line segment WS = 7.5 cm.
- Drawn the perpendicular bisector XY to WS. Let it bisect BS at O.
- With O as centre, drawn an arc of radius 3.7 cm on either side of O which cut OX at T and OY at E
- Joined BE, ES, ST and BT.
- WEST is the required square.

Calculation of Area:
Area of the square WEST = a^2 sq.units
= 5.3×53 cm^2
= 28.09 cm^2.