21. Construction: Determination of Mean Proportional

Let us Work Out 21

1 A. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

5cm., 2.5cm

Answer

Construction steps:

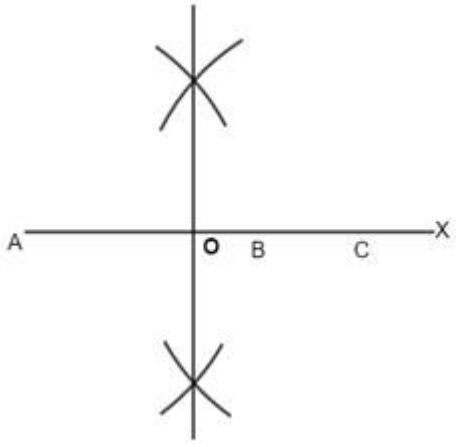
1. Draw a line segment AX with length greater than (5 + 2.5 = 7.5 cm).



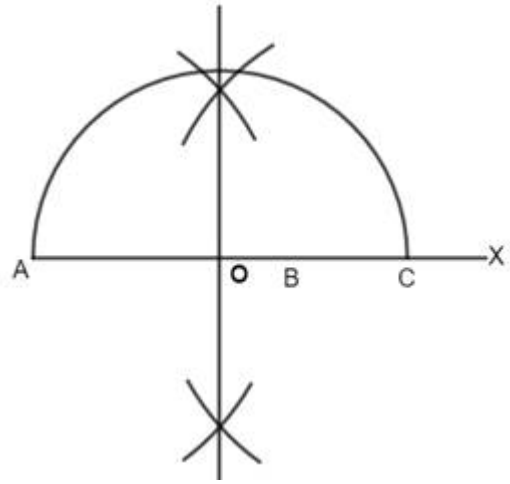
2. From A, mark a point B on AX such that AB = 5 cm and from B mark a point C such that BC = 2.5 cm



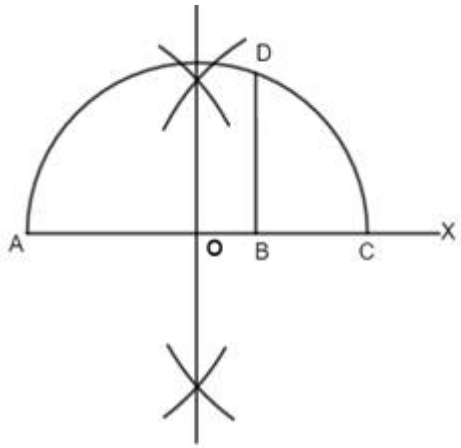
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 5 cm and BC = 2.5 cm.

With the help of scale, we measure BD = 3.5 cm [Appx]

1 B. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

4cm., 3cm.

Answer

Construction steps:

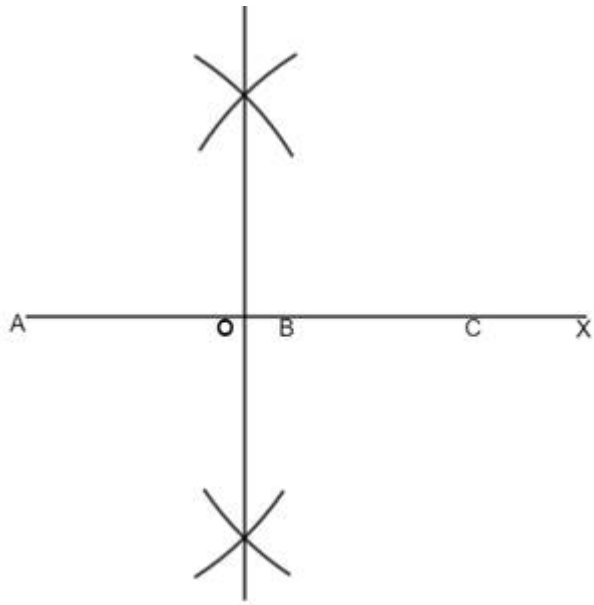
1. Draw a line segment AX with length greater than (4 + 3 = 7 cm).



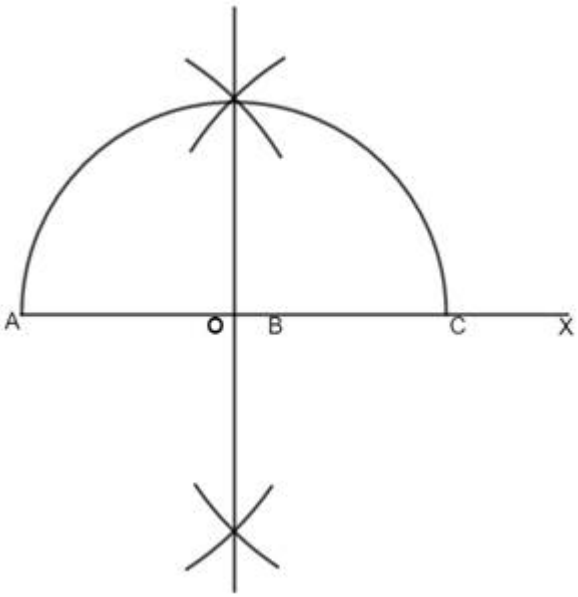
2. From A, mark a point B on AX such that AB = 4 cm and from B mark a point C such that BC = 3 cm



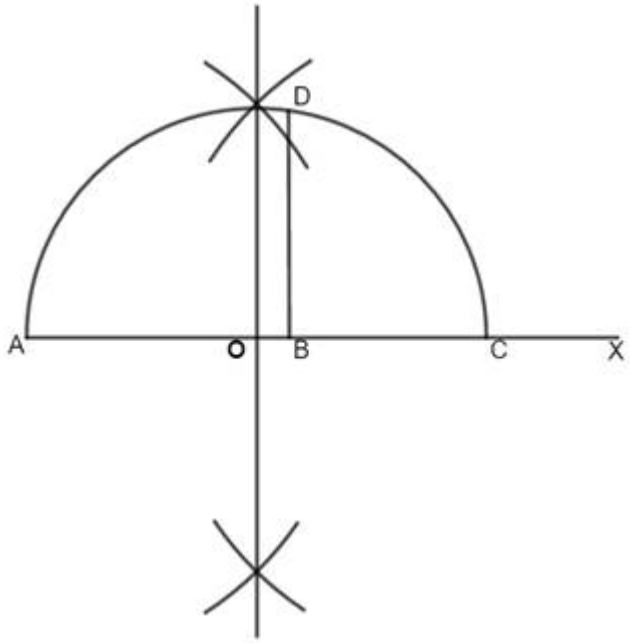
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 4 cm and BC = 3 cm.

With the help of scale, we measure BD = 3.4 cm [Appx]

1 C. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

7.5cm., 4cm.

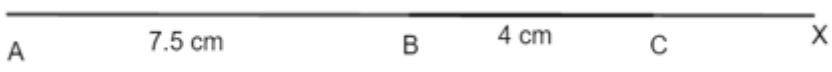
Answer

Construction steps:

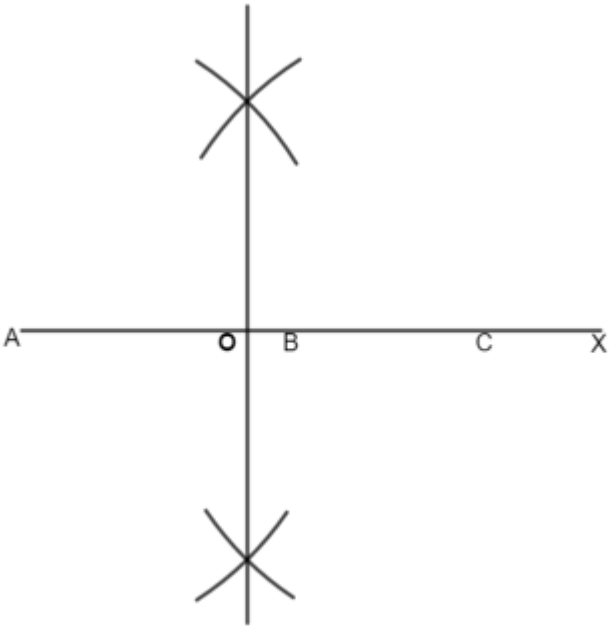
1. Draw a line segment AX with length greater than (7.5 + 4 = 11.5 cm).



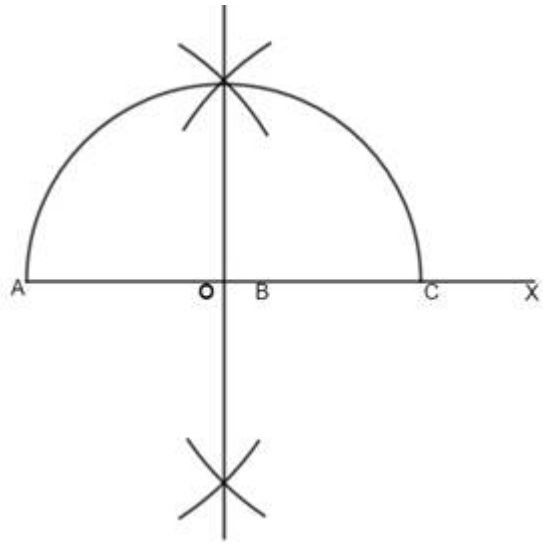
2. From A, mark a point B on AX such that AB = 7.5 cm and from B mark a point C such that BC = 4 cm



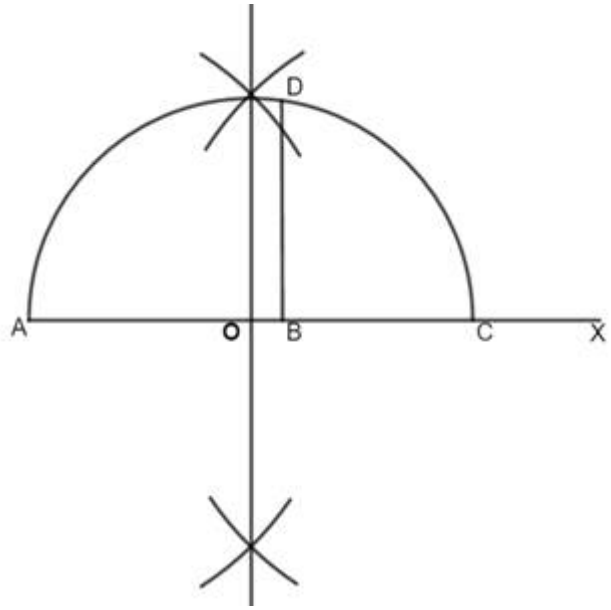
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 7.5 cm and BC = 4 cm.

With the help of scale, we measure BD = 5.5 cm [Appx]

1 D. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

10cm., 4cm.

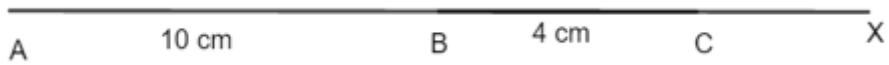
Answer

Construction steps:

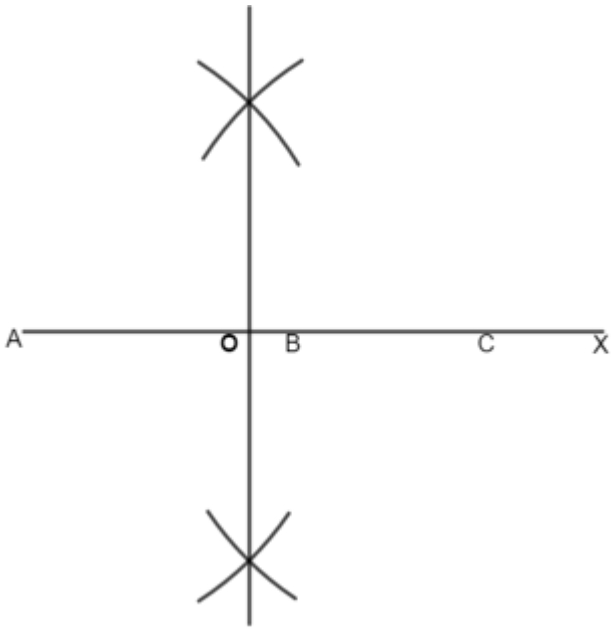
1. Draw a line segment AX with length greater than (10 + 4 = 14 cm).



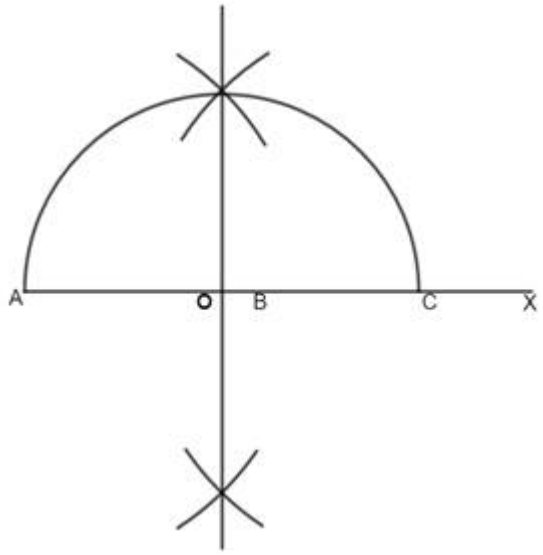
2. From A, mark a point B on AX such that AB = 10 cm and from B mark a point C such that BC = 4 cm



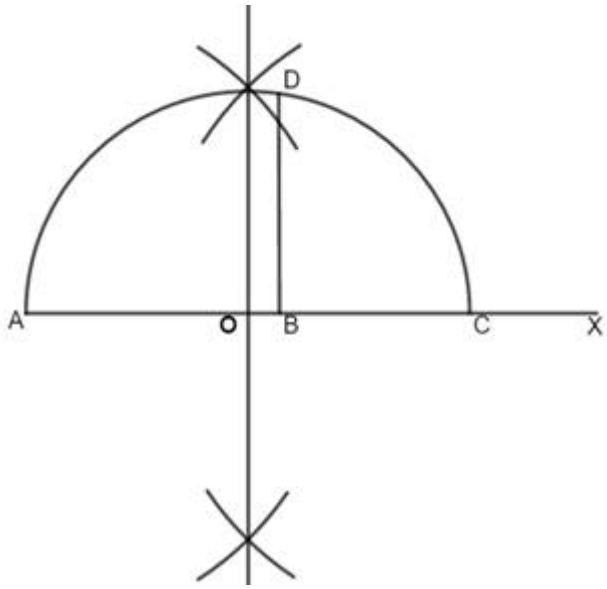
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 10 cm and BC = 4 cm.

With the help of scale, we measure BD = 6.3 cm [Appx]

1 E. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

9cm., 5cm.

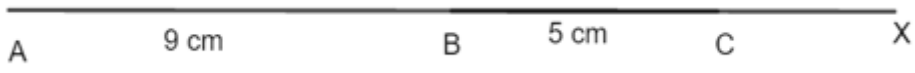
Answer

Construction steps:

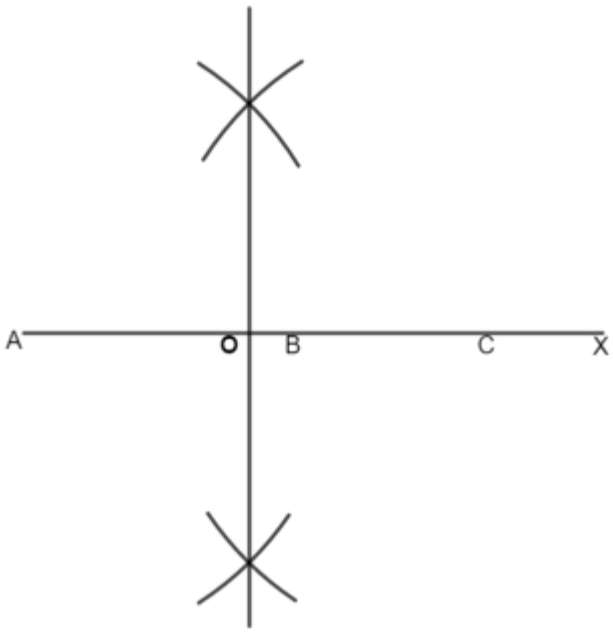
1. Draw a line segment AX with length greater than (9 + 5 = 11.5 cm).



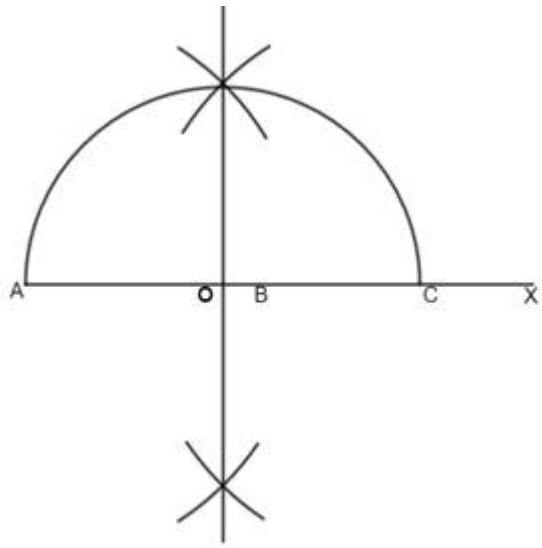
2. From A, mark a point B on AX such that AB = 9 cm and from B mark a point C such that BC = 5 cm



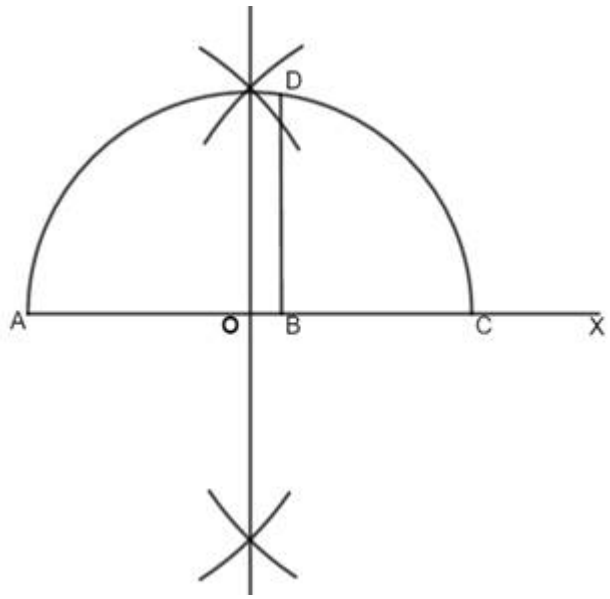
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 9 cm and BC = 5 cm.

With the help of scale, we measure BD = 6.7 cm [Appx]

1 F. Question

Let us draw the mean proportional of the following line segment and let us measure the values of the mean proportionals in each case with help of a scale:

12cm., 3cm.

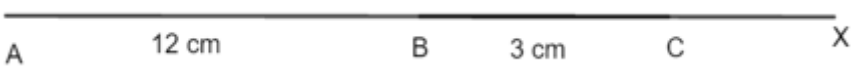
Answer

Construction steps:

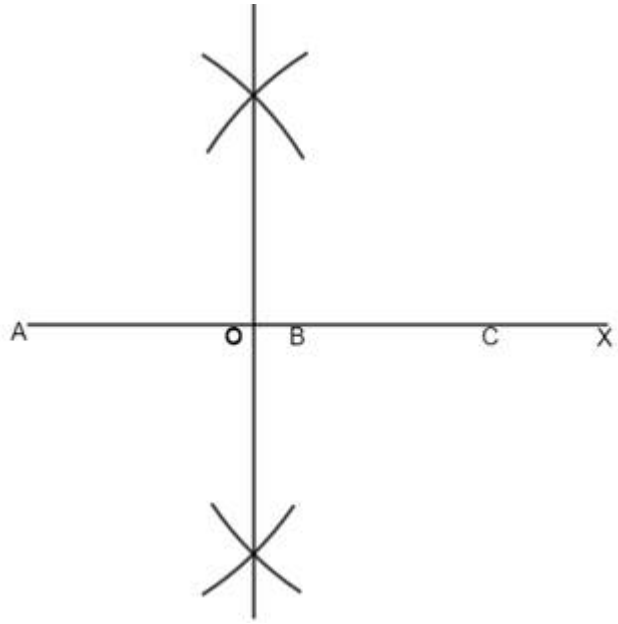
1. Draw a line segment AX with length greater than (12 + 3 = 15 cm).



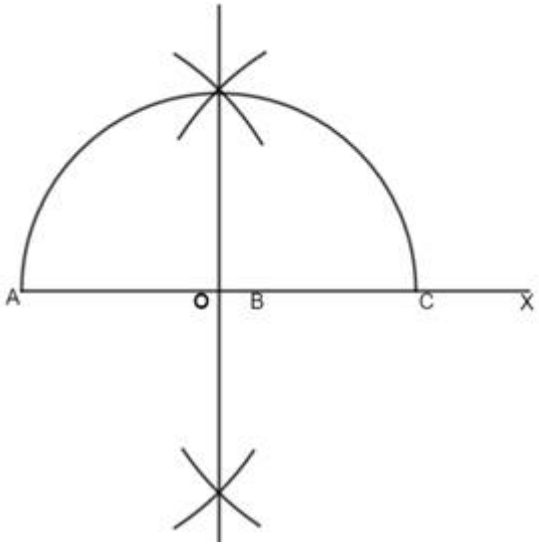
2. From A, mark a point B on AX such that AB = 12 cm and from B mark a point C such that BC = 3 cm



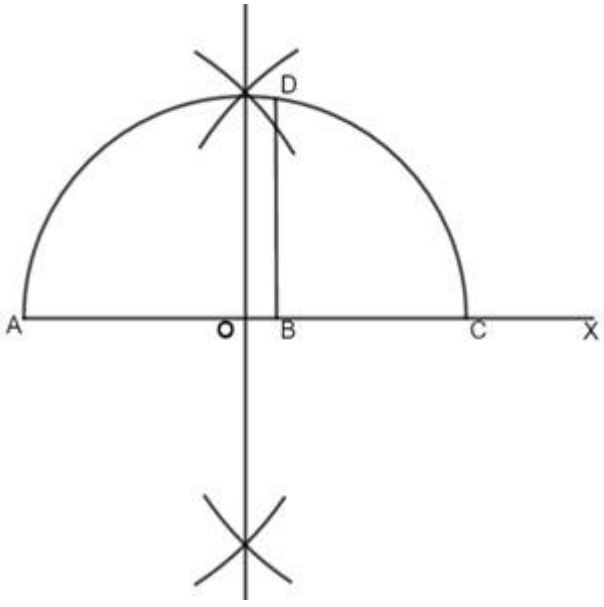
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 12 cm and BC = 3 cm.

With the help of scale, we measure BD = 6 cm [Appx]

2 A. Question

Let us determine the square roots of the following numbers by geometric method:

7

Answer

We know, that mean proportion of two number 'a' and 'b' is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

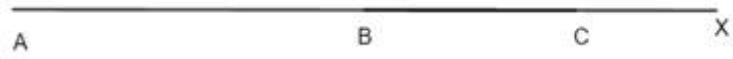
7 = 3.5 × 2

Construction steps:

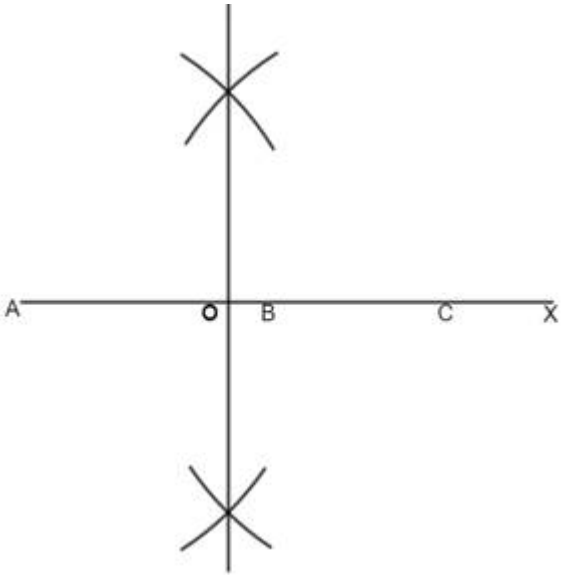
1. Draw a line segment AX with length greater than (3.5 + 2 = 5.5 cm).



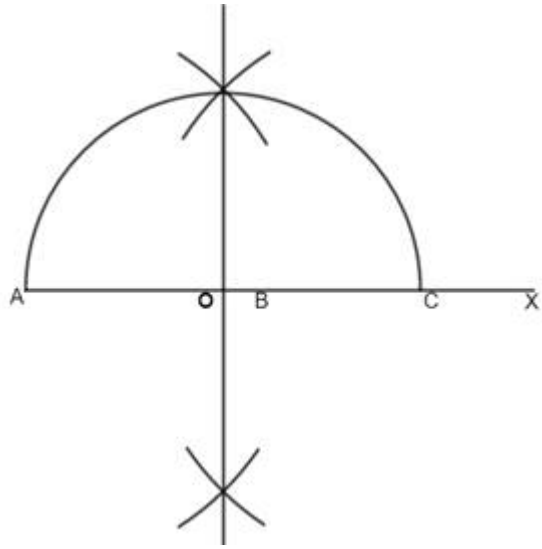
2. From A, mark a point B on AX such that AB = 3.5 cm and from B mark a point C such that BC = 2 cm



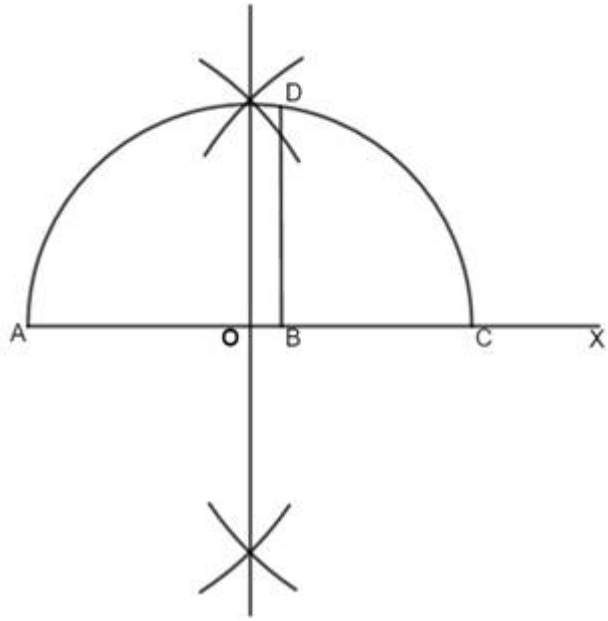
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 3.5 cm and BC = 2 cm.

With the help of scale, we measure BD = 2.6 cm [Appx]

2 B. Question

Let us determine the square roots of the following numbers by geometric method:

8

Answer

We know, that mean proportion of two number ‘a’ and ‘b’ is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

8 = 4 × 2

Construction steps:

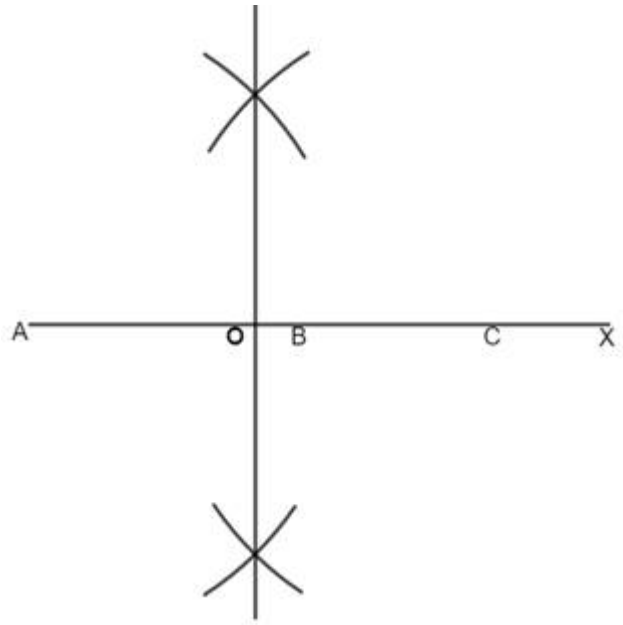
1. Draw a line segment AX with length greater than (4 + 2 = 6 cm).



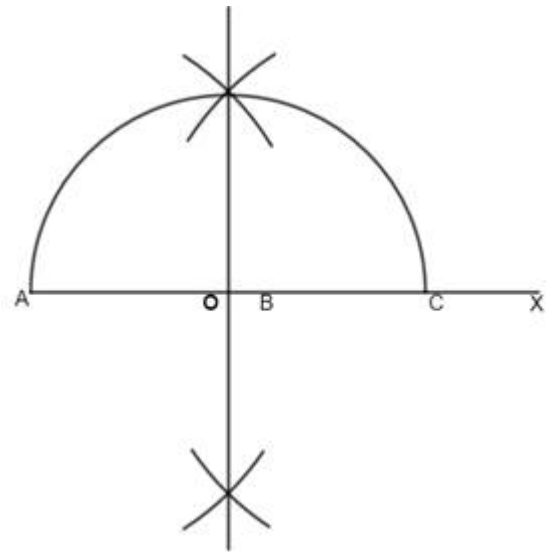
2. From A, mark a point B on AX such that AB = 4 cm and from B mark a point C such that BC = 2 cm



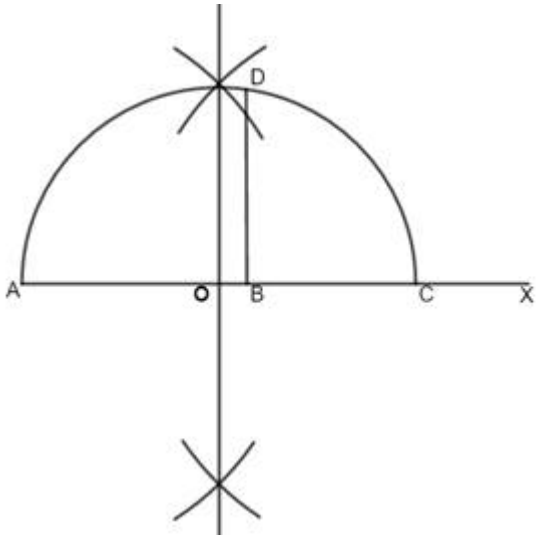
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 4 cm and BC = 2 cm.

With the help of scale, we measure BD = 2.8 cm [Appx]

2 C. Question

Let us determine the square roots of the following numbers by geometric method:

24

Answer

We know, that mean proportion of two number 'a' and 'b' is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

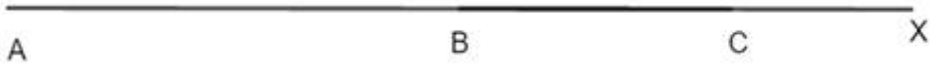
24 = 6 × 4

Construction steps:

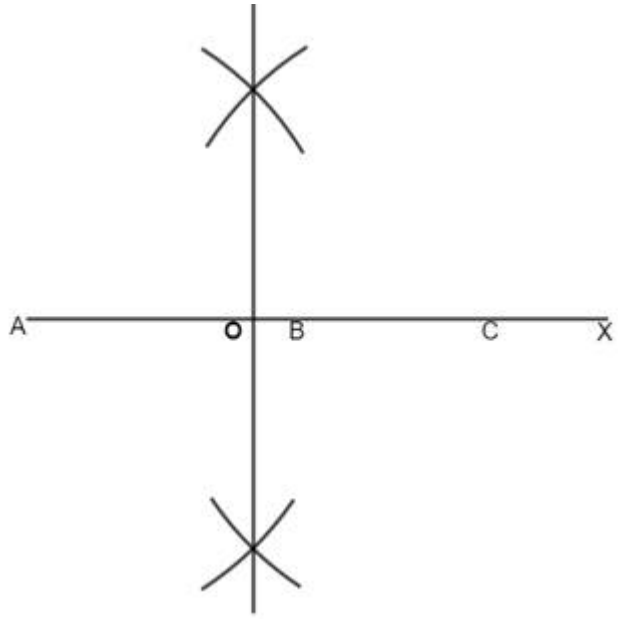
1. Draw a line segment AX with length greater than (6 + 4 = 10 cm).



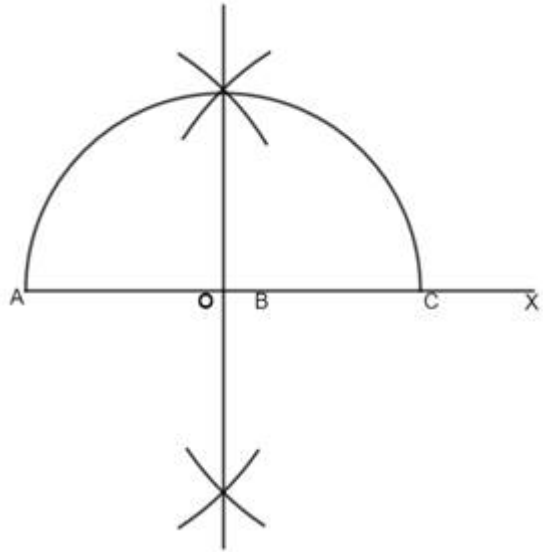
2. From A, mark a point B on AX such that AB = 6 cm and from B mark a point C such that BC = 4 cm



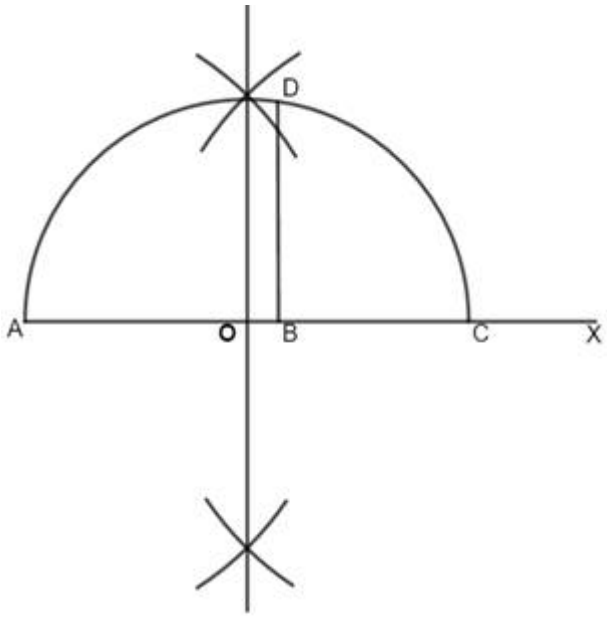
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 6 cm and BC = 4 cm.

With the help of scale, we measure BD = 4.9 cm [Appx]

2 D. Question

Let us determine the square roots of the following numbers by geometric method:

28

Answer

We know, that mean proportion of two number 'a' and 'b' is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

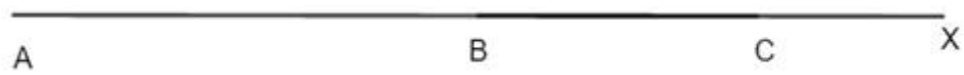
28 = 7 × 4

Construction steps:

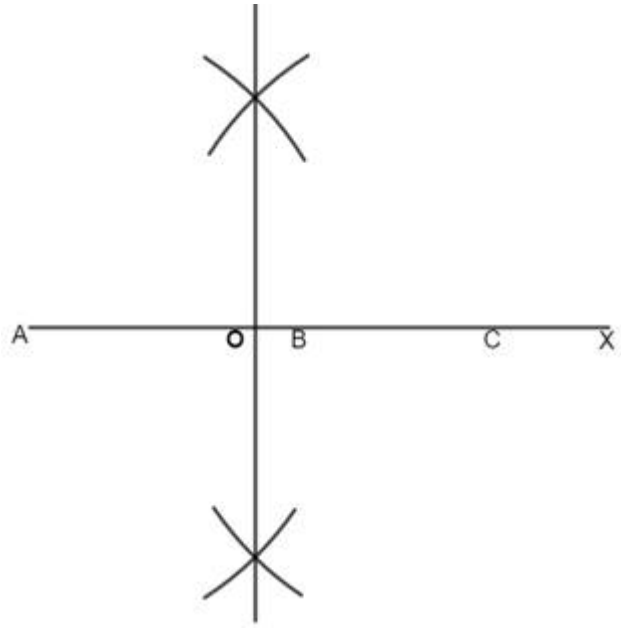
1. Draw a line segment AX with length greater than (7 + 4 = 11 cm).



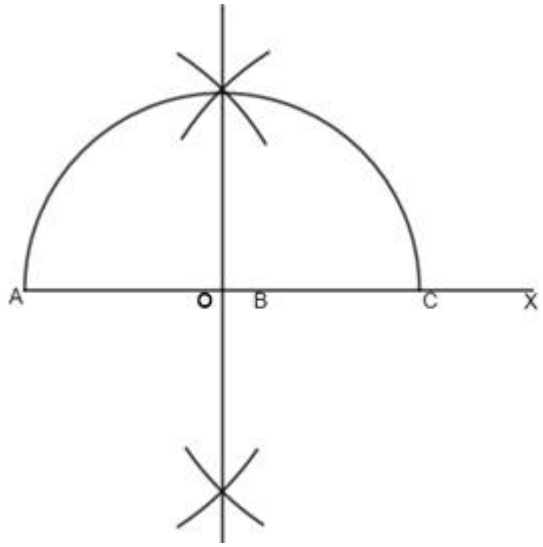
2. From A, mark a point B on AX such that AB = 7 cm and from B mark a point C such that BC = 4 cm



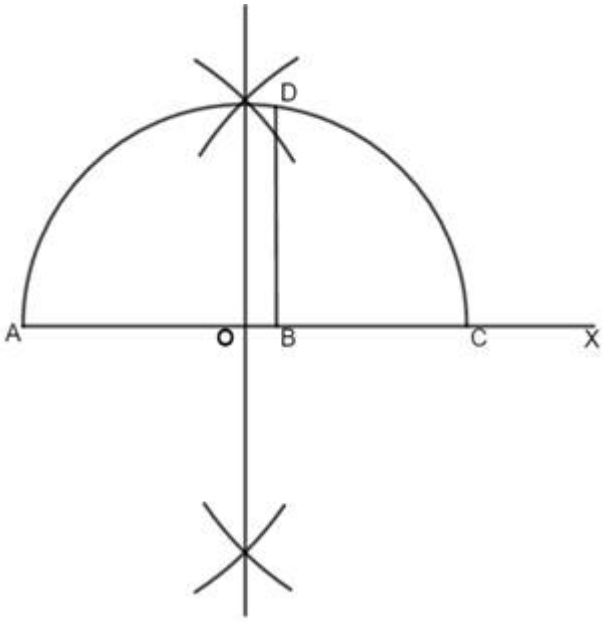
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 7 cm and BC = 4 cm.

With the help of scale, we measure BD = 5.3 cm [Appx]

2 E. Question

Let us determine the square roots of the following numbers by geometric method:

13

Answer

We know, that mean proportion of two number ‘a’ and ‘b’ is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

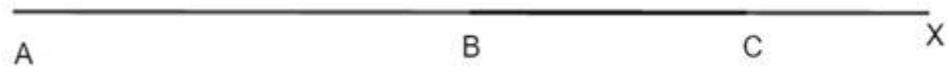
13 = 5 × 2.6

Construction steps:

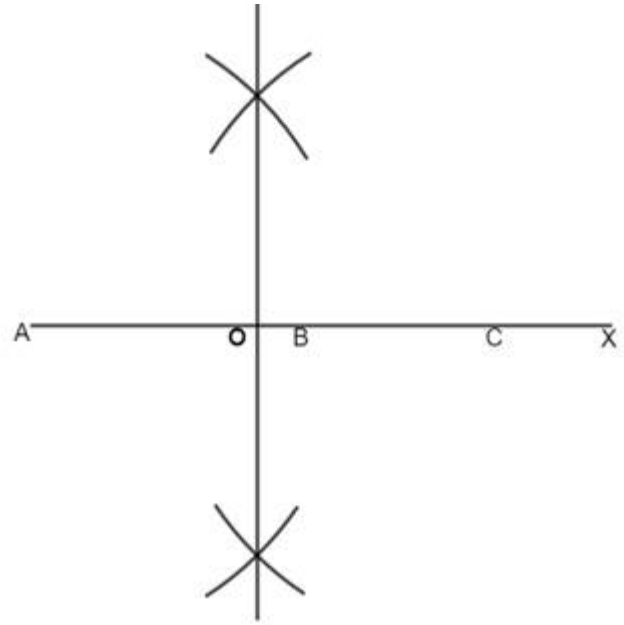
1. Draw a line segment AX with length greater than (5 + 2.6 = 7.6 cm).



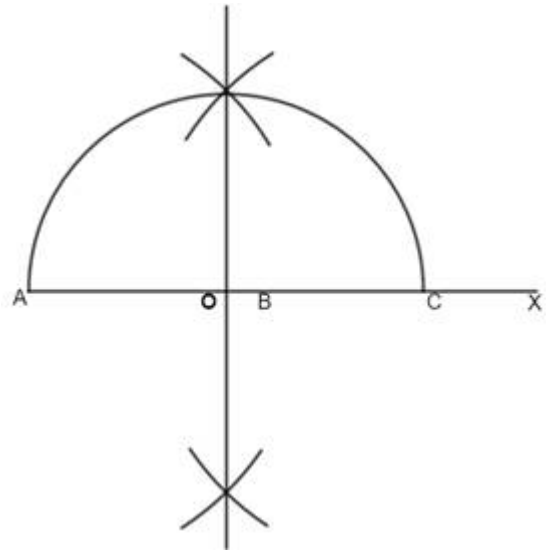
2. From A, mark a point B on AX such that AB = 5 cm and from B mark a point C such that BC = 2.6 cm



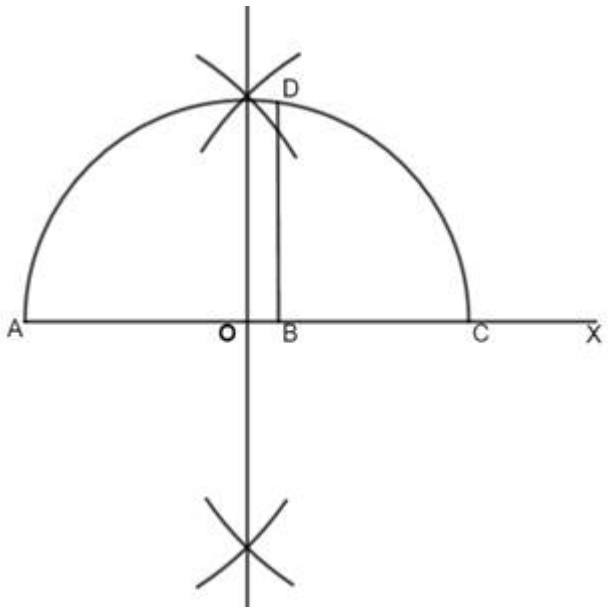
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 5 cm and BC = 2.6 cm.

With the help of scale, we measure BD = 3.6 cm [Appx]

2 F. Question

Let us determine the square roots of the following numbers by geometric method:

29

Answer

We know, that mean proportion of two number ‘a’ and ‘b’ is $\sqrt{ab}$. In order to find the square root of each number, we will factorize them into two factors and then we will find the mean proportion of two numbers.

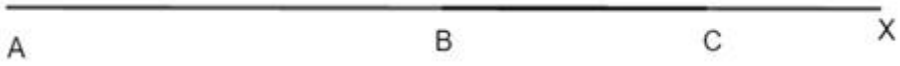
29 = 5.8 × 5

Construction steps:

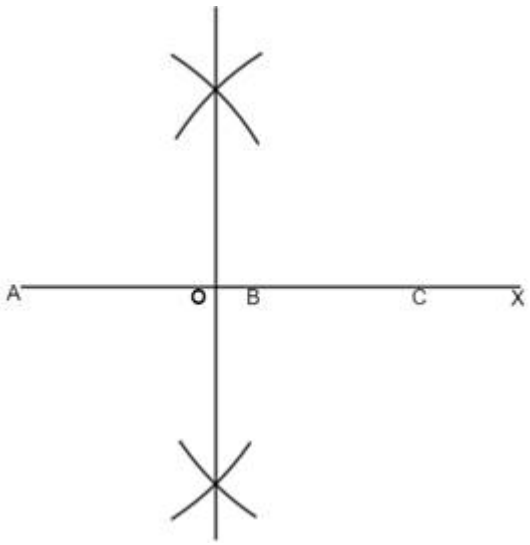
1. Draw a line segment AX with length greater than (5.8 + 5 = 10.8 cm).



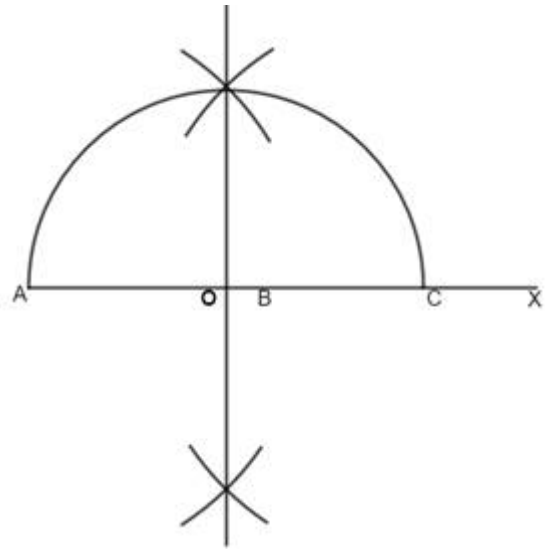
2. From A, mark a point B on AX such that AB = 5.8 cm and from B mark a point C such that BC = 5 cm



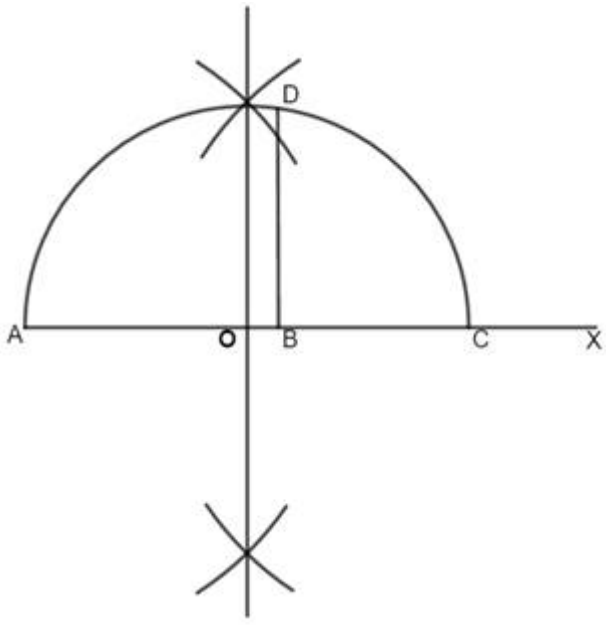
3. Draw the perpendicular bisector of AC, such that it cuts AC at O.



4. Taking OA = OC as radius and O as center draw a semicircle.



5. Draw BD ⊥ AC such that, point D lies on the semicircle and



Here, BD is the mean proportional of AB and BC, and By construction AB = 5.8 cm and BC = 5 cm.

With the help of scale, we measure BD = 5.4 cm [Appx]

3 A. Question

Let us draw the squared figures by taking the following lengths as sides.

$\sqrt{14}$ cm

Answer

We know that, area of a square with side $\sqrt{a}$ will be a.

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

Also, we can draw a square with area equal to a rectangle, we will use the area of rectangle in order to make the area equal to square.

side = $\sqrt{14}$ cm

Area of square = 14 cm^2

Area of rectangle = length × breadth = 14 cm^2

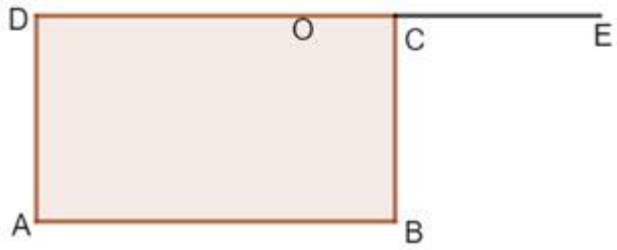
Here, let's choose length = 7 cm and breadth = 2 cm

Construction steps:

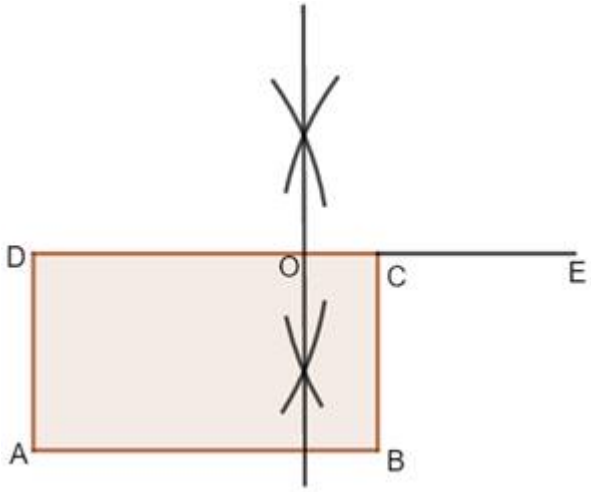
1. Draw a rectangle ABCD with length, AB = 7 cm and breadth, BC = 2 cm.



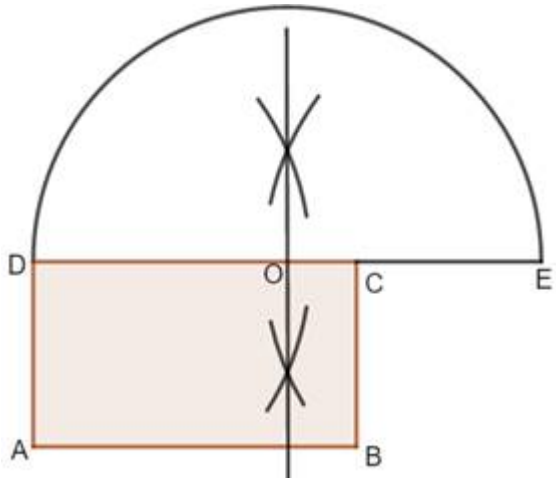
2. Extend CD to CE, such that CE = BC = 2 cm.



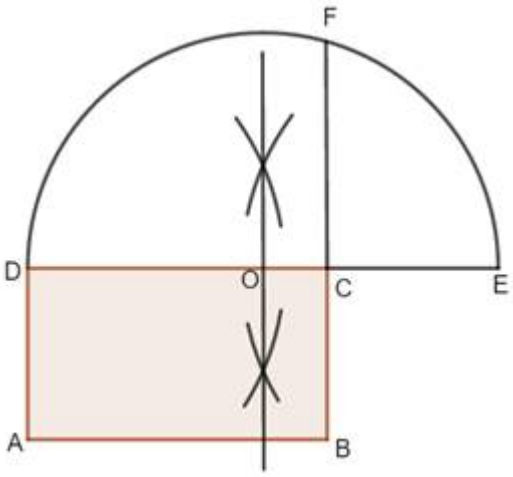
3. Draw the perpendicular bisector of DE which bisects DE at O.



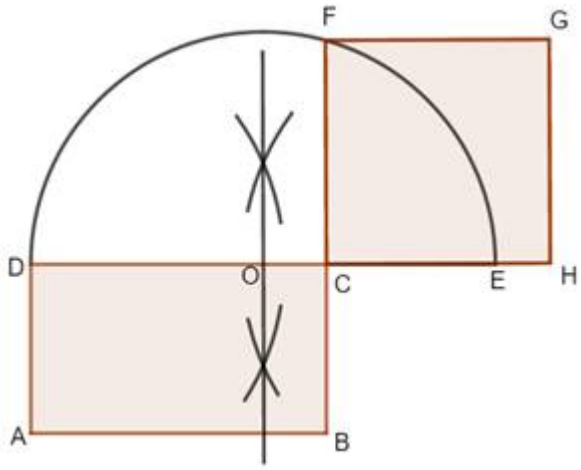
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD = 14 cm^2.

3 B. Question

Let us draw the squared figures by taking the following lengths as sides.

$\sqrt{22}$ cm

Answer

We know that, area of a square with side $\sqrt{a}$ will be a.

[Area of square = $(side)^2$]

Also, we can draw a square with area equal to a rectangle, we will use the area of rectangle in order to make the area equal to square.

side = $\sqrt{22}$ cm

Area of square = 22 cm^2

Area of rectangle = length × breadth = 22 cm^2

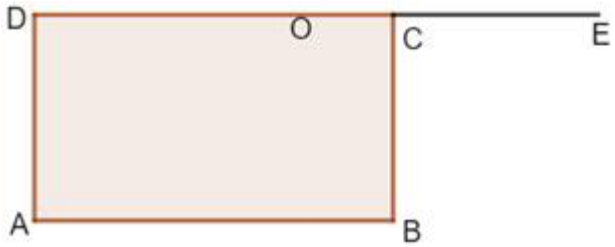
Here, let's choose length = 5.5 cm and breadth = 4 cm

Construction steps:

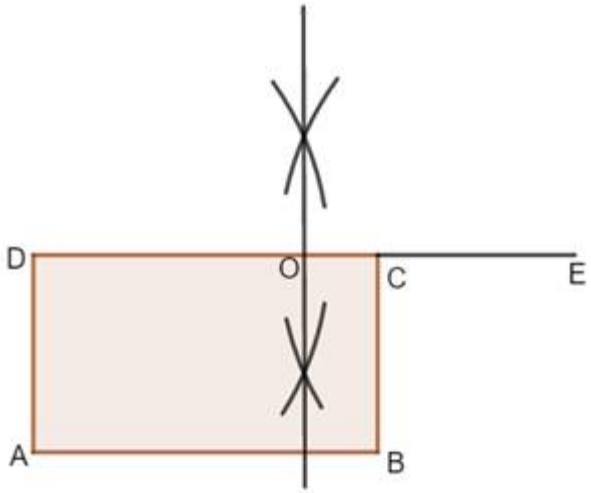
1. Draw a rectangle ABCD with length, AB = 5.5 cm and breadth, BC = 4 cm.



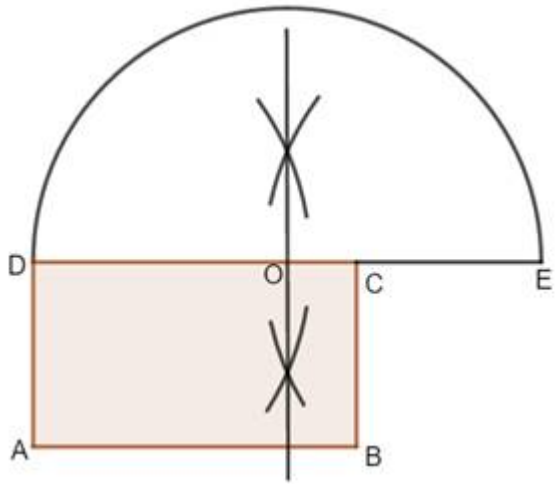
2. Extend CD to CE, such that CE = BC = 4 cm.



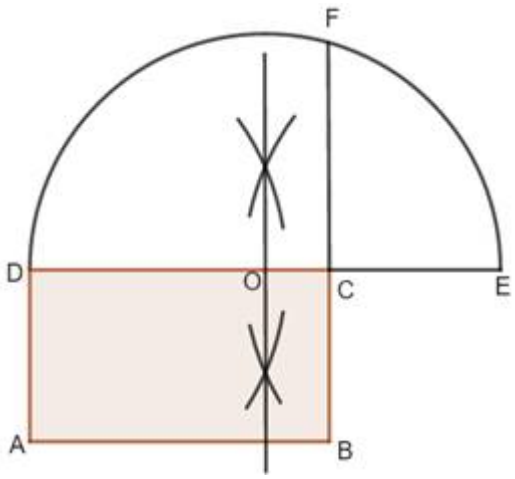
3. Draw the perpendicular bisector of DE which bisects DE at O.



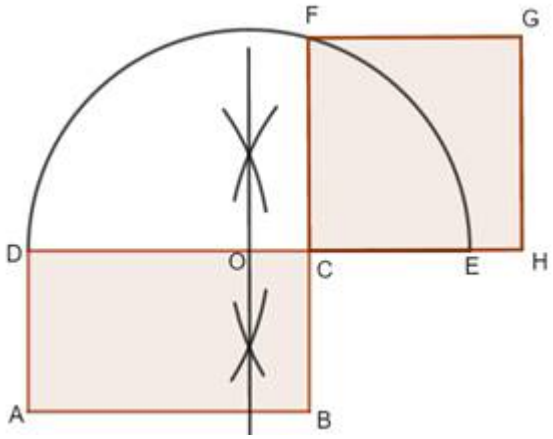
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD = 22 cm^2.

3 C. Question

Let us draw the squared figures by taking the following lengths as sides.

$\sqrt{31}$ cm

Answer

We know that, area of a square with side $\sqrt{a}$ will be a.

[Area of square = $(side)^2$]

Also, we can draw a square with area equal to a rectangle, we will use the area of rectangle in order to make the area equal to square.

side = $\sqrt{31}$ cm

Area of square = 31 cm^2

Area of rectangle = length × breadth = 31 cm^2

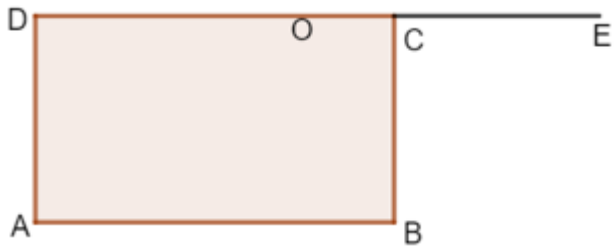
Here, let's choose length = 6.2 cm and breadth = 5 cm

Construction steps:

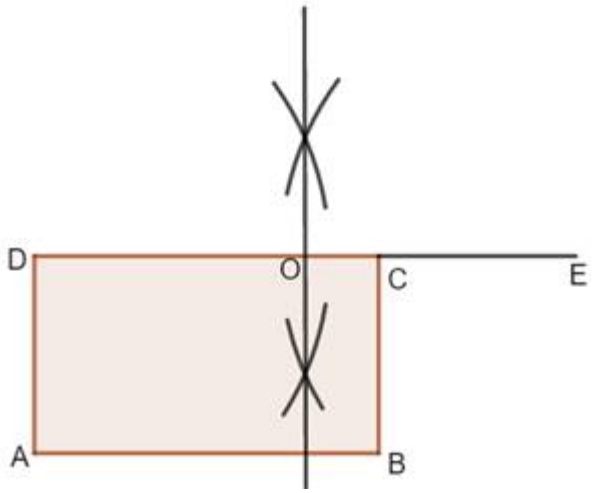
1. Draw a rectangle ABCD with length, AB = 6.2 cm and breadth, BC = 5 cm.



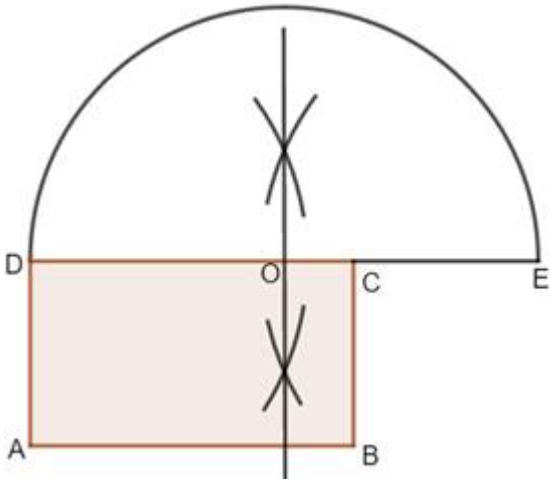
2. Extend CD to CE, such that CE = BC = 5 cm.



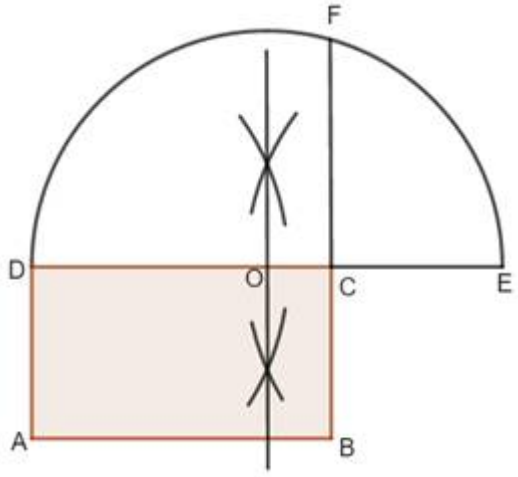
3. Draw the perpendicular bisector of DE which bisects DE at O.



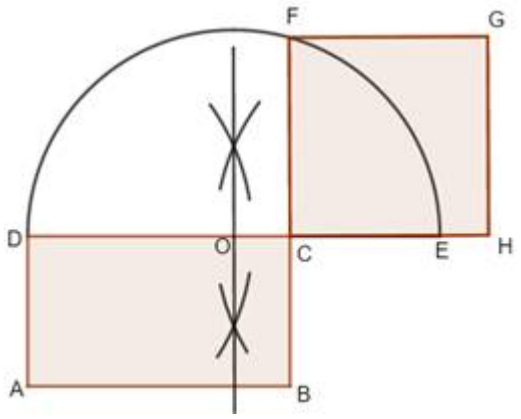
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD = 31 cm^2.

3 D. Question

Let us draw the squared figures by taking the following lengths as sides.

$\sqrt{33}$ cm

Answer

We know that, area of a square with side $\sqrt{a}$ will be a.

[Area of square = $(side)^2$]

Also, we can draw a square with area equal to a rectangle, we will use the area of rectangle in order to make the area equal to square.

side = $\sqrt{33}$ cm

Area of square = 33 cm^2

Area of rectangle = length × breadth = 33 cm^2

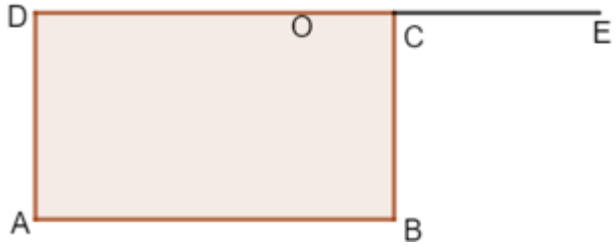
Here, let's choose length = 6.6 cm and breadth = 5 cm

Construction steps:

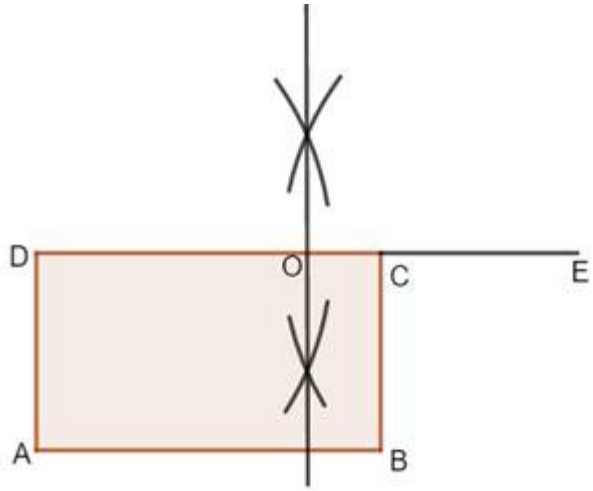
1. Draw a rectangle ABCD with length, AB = 6.6 cm and breadth, BC = 5 cm.



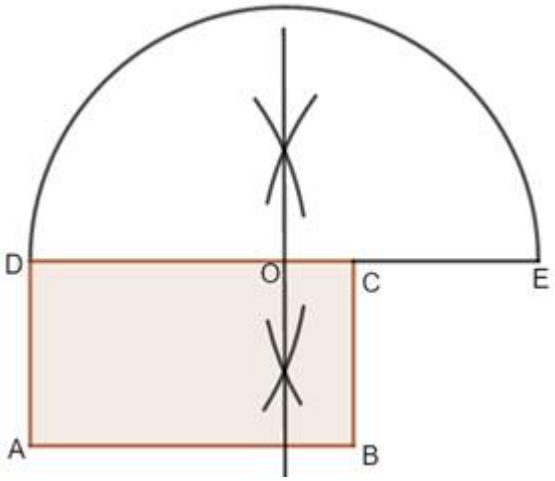
2. Extend CD to CE, such that CE = BC = 5 cm.



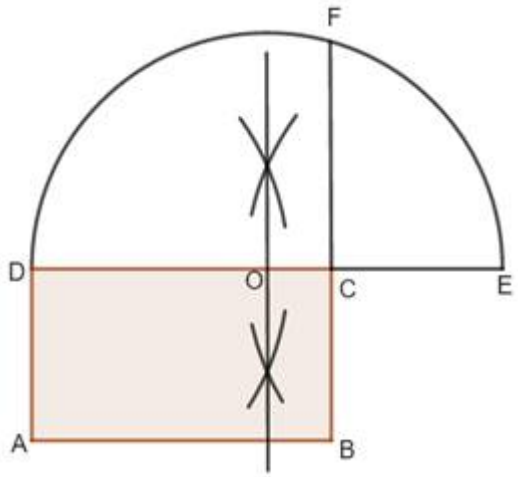
3. Draw the perpendicular bisector of DE which bisects DE at O.



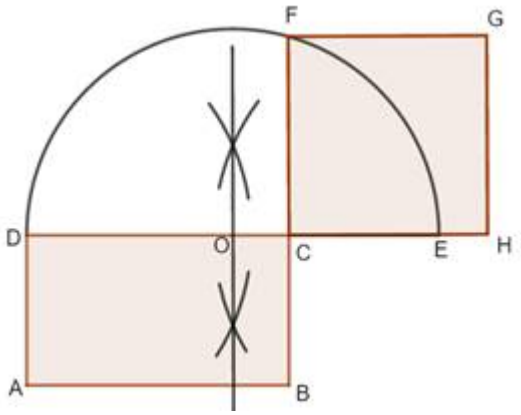
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD = 33 cm^2.

4 A. Question

Let us draw the squares whose areas are equal to the areas of the rectangles by taking following lengths as its sides:

8cm., 6cm.

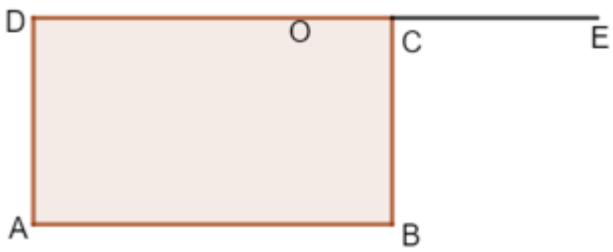
Answer

Construction steps:

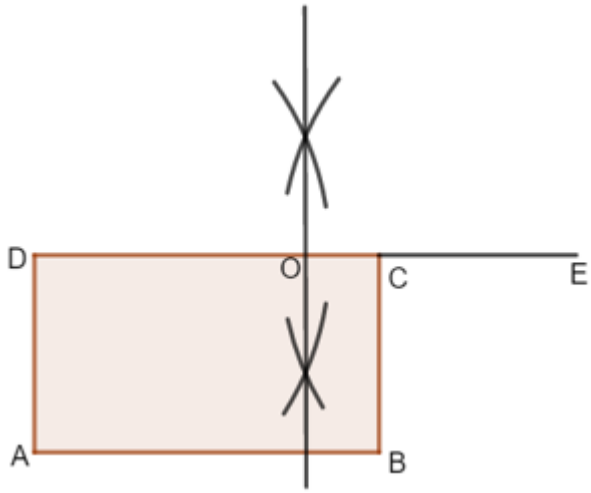
1. Draw a rectangle ABCD with length, AB = 8 cm and breadth, BC = 6 cm.



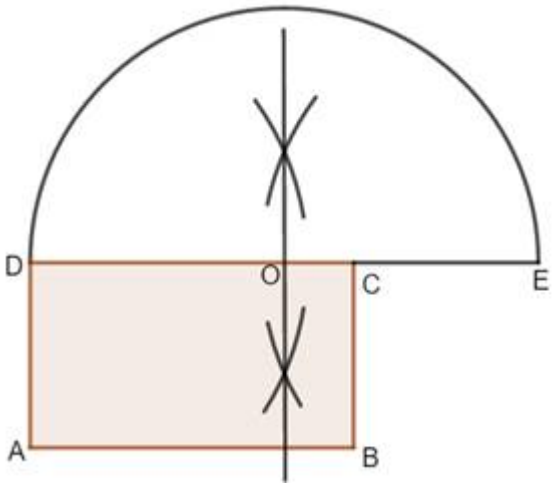
2. Extend CD to CE, such that CE = BC = 6 cm.



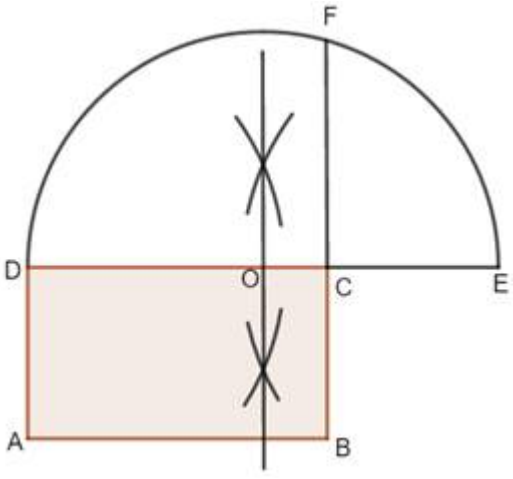
3. Draw the perpendicular bisector of DE which bisects DE at O.



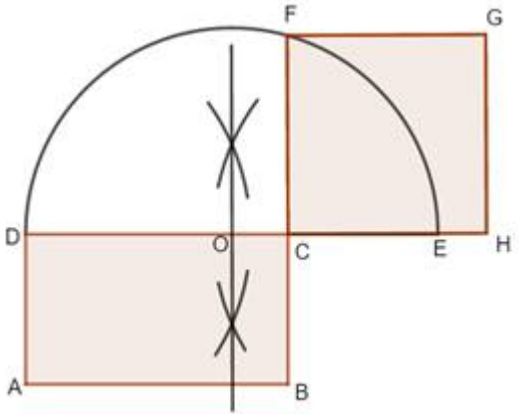
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

4 B. Question

Let us draw the squares whose areas are equal to the areas of the rectangles by taking following lengths as its sides:

6cm., 4cm.

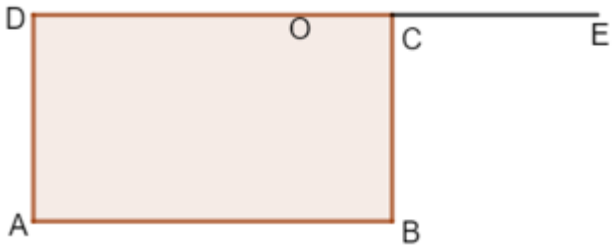
Answer

Construction steps:

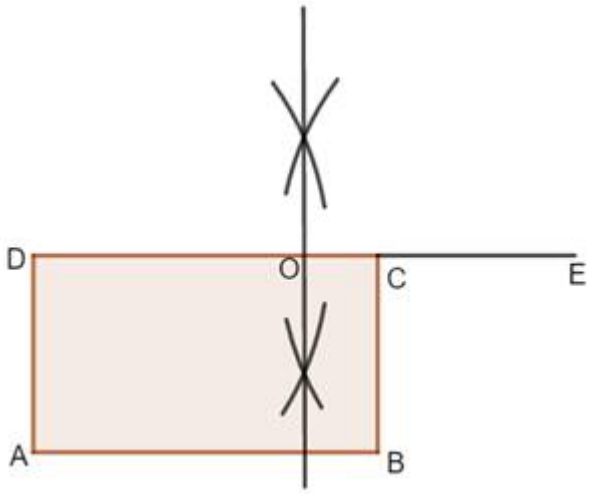
1. Draw a rectangle ABCD with length, AB = 6 cm and breadth, BC = 4 cm.



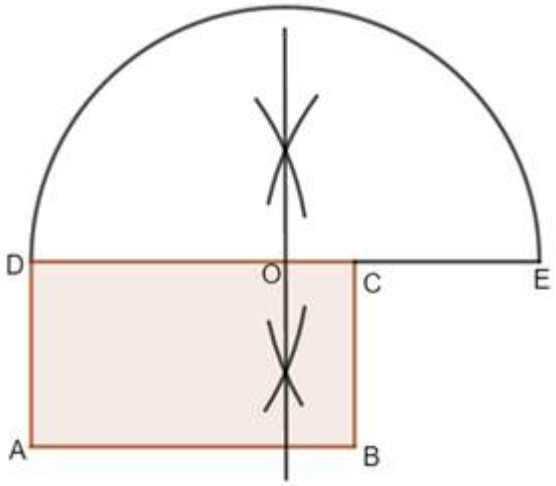
2. Extend CD to CE, such that CE = BC = 4 cm.



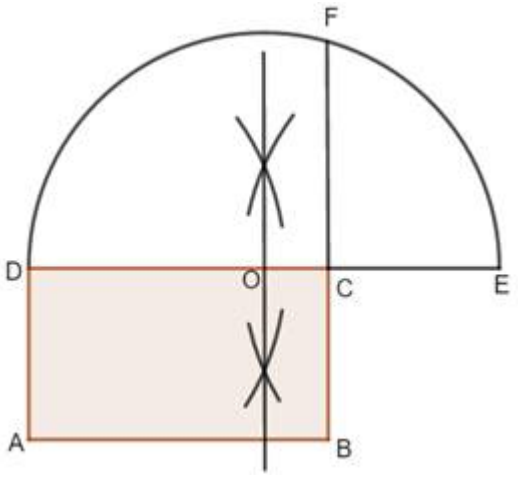
3. Draw the perpendicular bisector of DE which bisects DE at O.



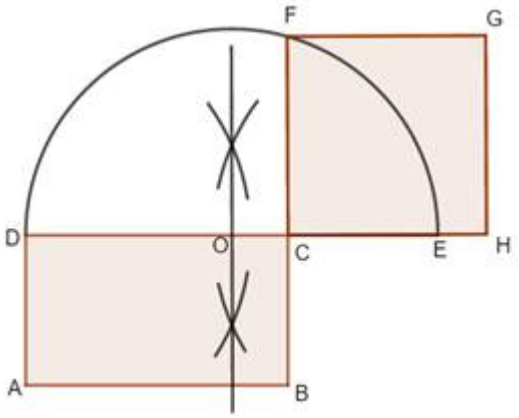
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

4 C. Question

Let us draw the squares whose areas are equal to the areas of the rectangles by taking following lengths as its sides:

4.2cm., 3.5cm

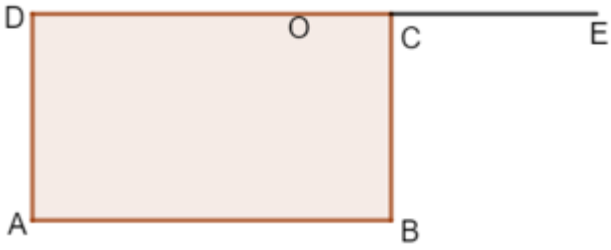
Answer

Construction steps:

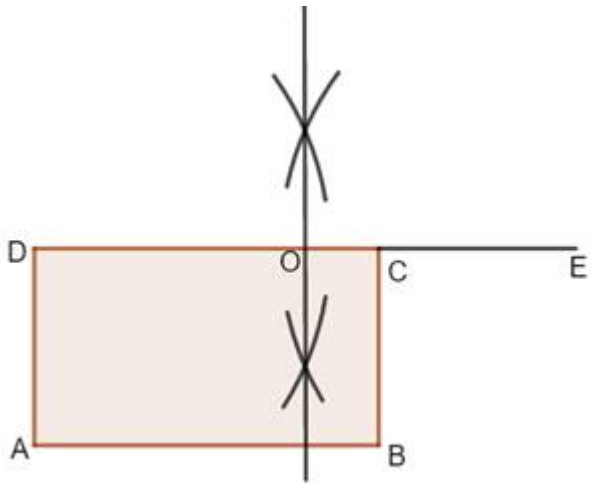
1. Draw a rectangle ABCD with length, AB = 4.2 cm and breadth, BC = 3.5 cm.



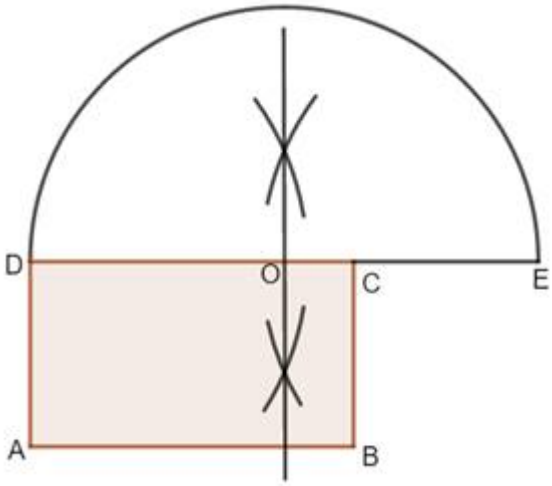
2. Extend CD to CE, such that CE = BC = 3.5 cm.



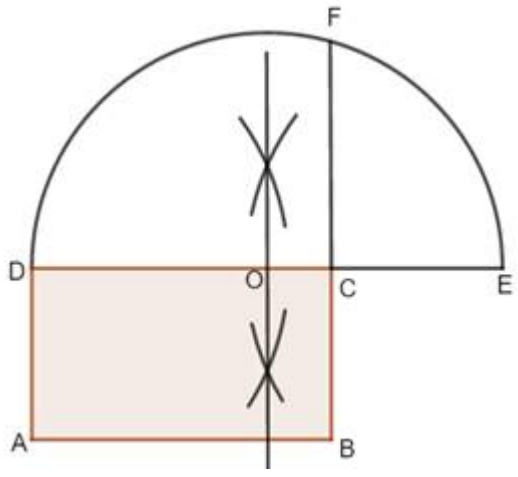
3. Draw the perpendicular bisector of DE which bisects DE at O.



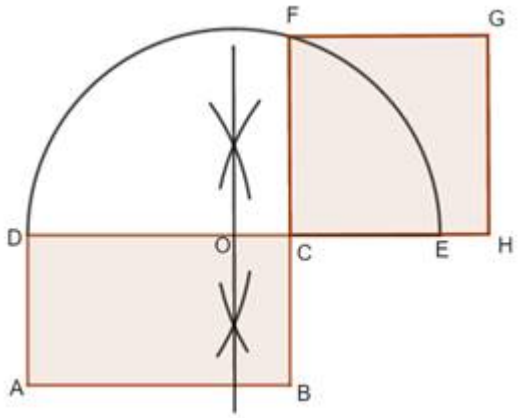
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

4 D. Question

Let us draw the squares whose areas are equal to the areas of the rectangles by taking following lengths as its sides:

7.9cm., 4.1cm.

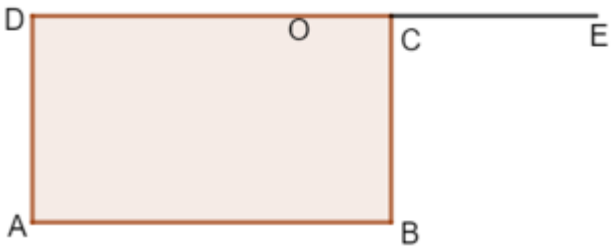
Answer

Construction steps:

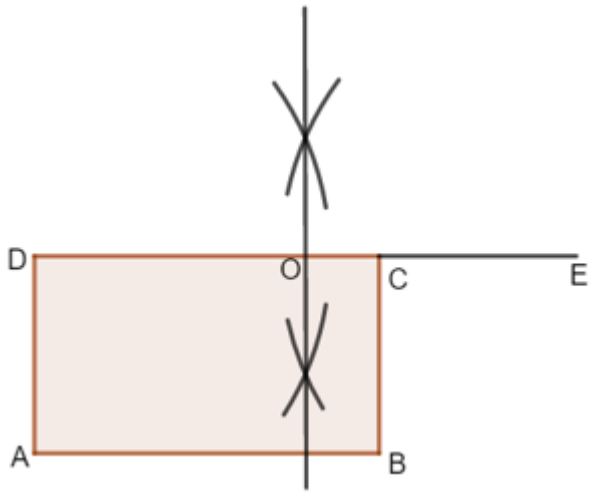
1. Draw a rectangle ABCD with length, AB = 7.9 cm and breadth, BC = 4.1 cm.



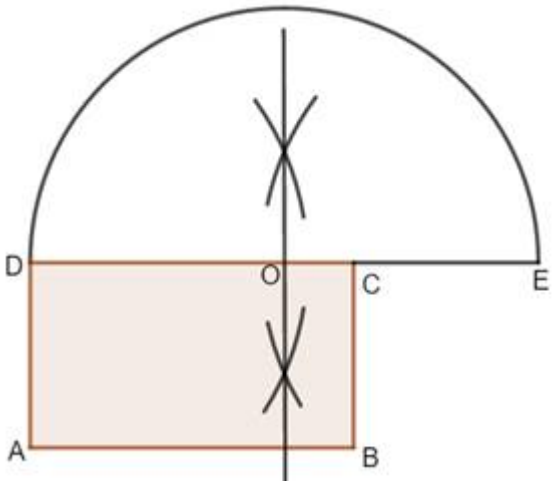
2. Extend CD to CE, such that CE = BC = 4.1 cm.



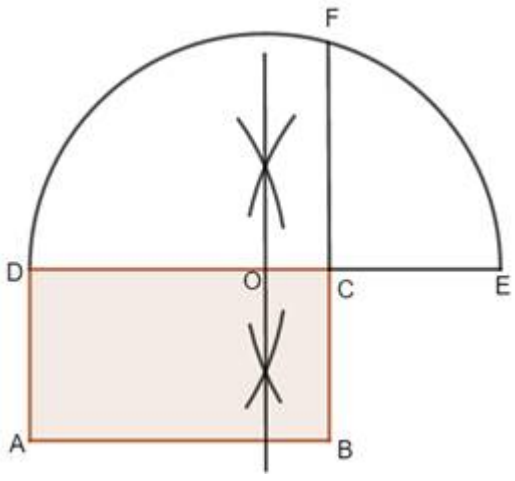
3. Draw the perpendicular bisector of DE which bisects DE at O.



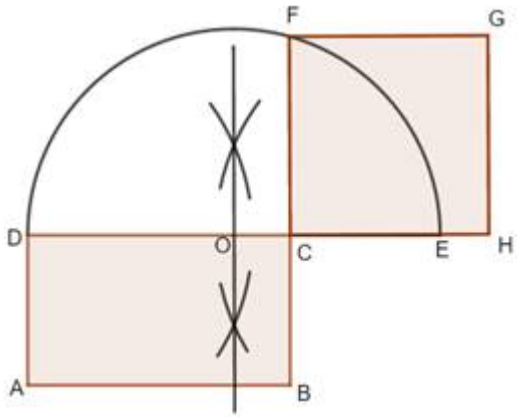
4. Taking O as center and OD = OE as radius, draw a semicircle.



5. Extend BC which intersects semicircle at F.



6. Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

5 A. Question

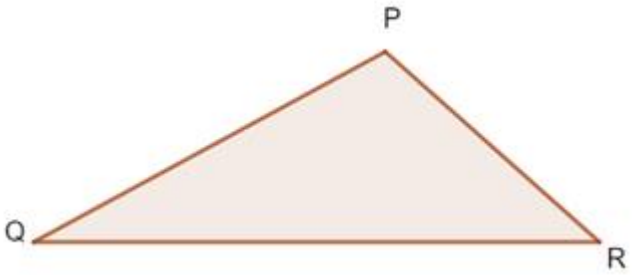
Let us draw the squares whose areas equal to the areas of the following triangles:

The lengths of three sides of a triangles are 10cm., 7cm. and 5cm. respectively.

Answer

Steps of construction:

1) Draw a triangle PQR with sides QR = 10 cm, PQ = 7 cm and PR = 5 cm.



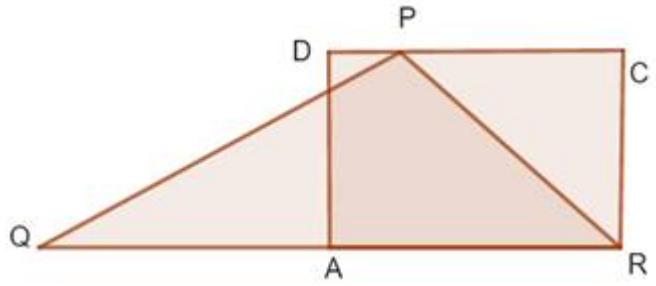
2) Draw a rectangle ARCD with area equal to that of triangle PQR, by choosing length of rectangle as half of base and height same as height of triangle.

[Here, area of rectangle = length × breadth

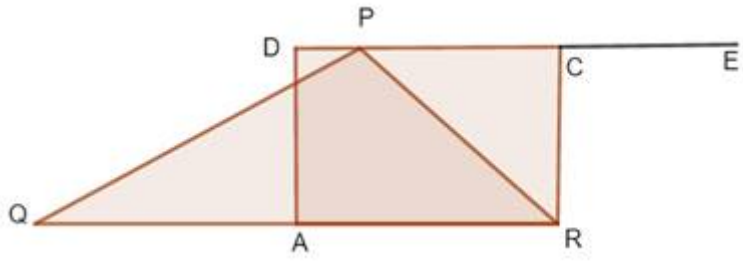
= 1/2 × base × height

= area of triangle]

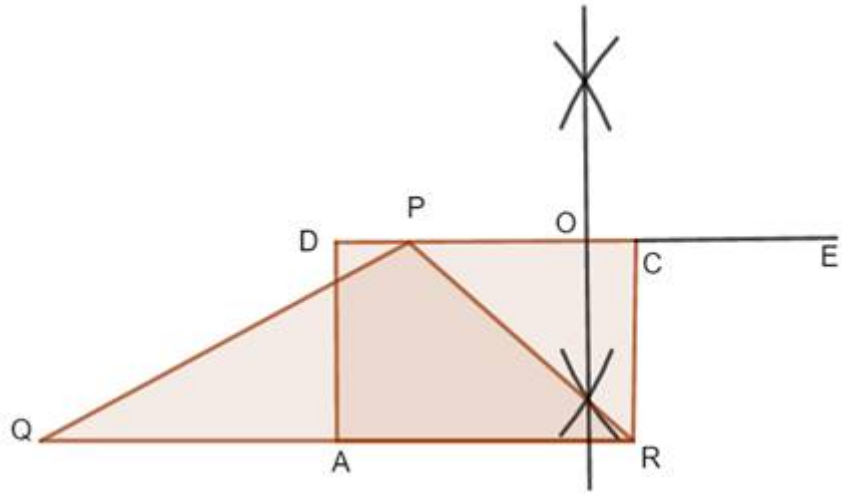
Now, we can make a square with area equal to that of rectangle and hence equal to area of triangle.



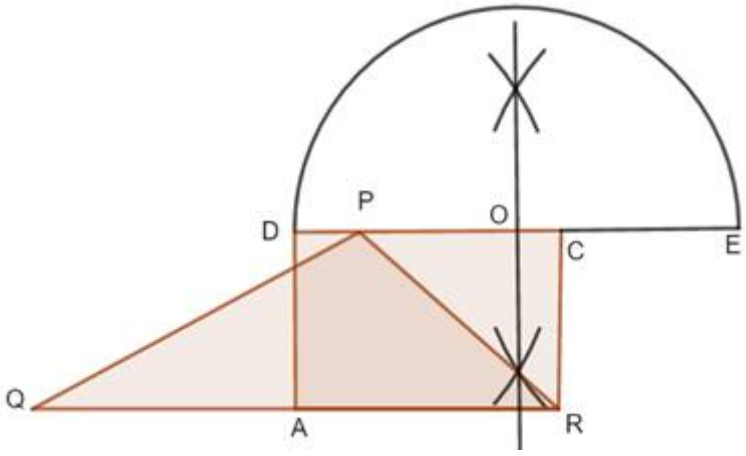
3) Extend CD to CE, such that CE = BC



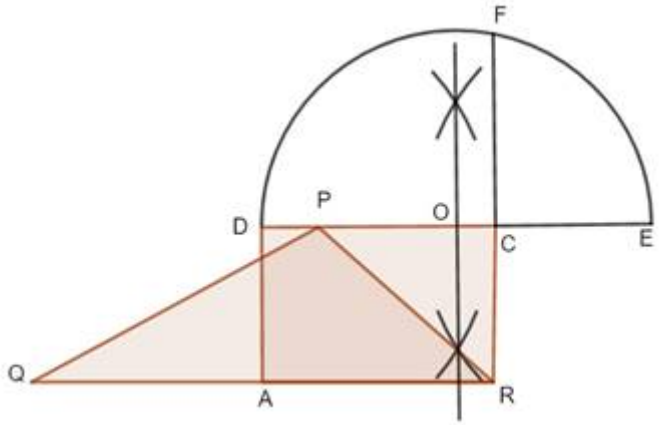
4) Draw the perpendicular bisector of DE which bisects DE at O.



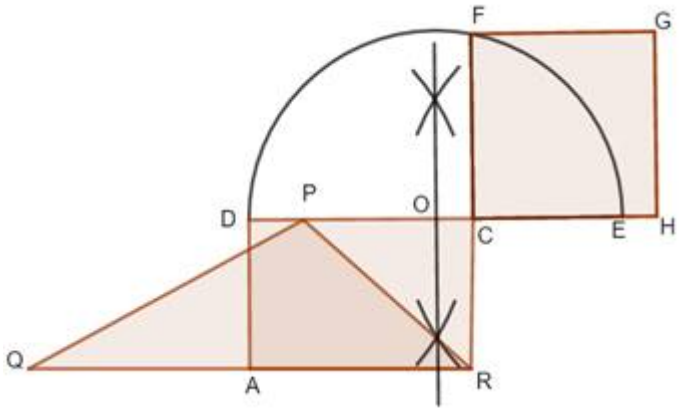
5) Taking O as center and OD = OE as radius, draw a semicircle.



6) Extend BC which intersects semicircle at F.



7) Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

= area of ΔPQR

5 B. Question

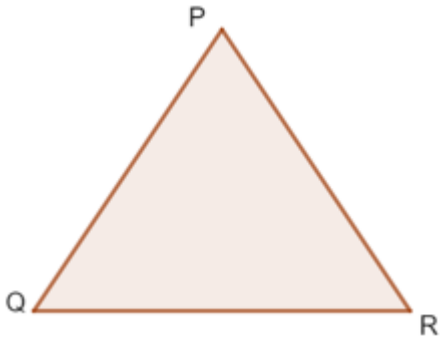
Let us draw the squares whose areas equal to the areas of the following triangles:

An isosceles triangle whose base is 7cm. length and the length of each of two equal sides is 5cm.

Answer

Steps of construction:

1) Draw a triangle PQR with sides QR = 7cm cm, PQ = PR = 5 cm.



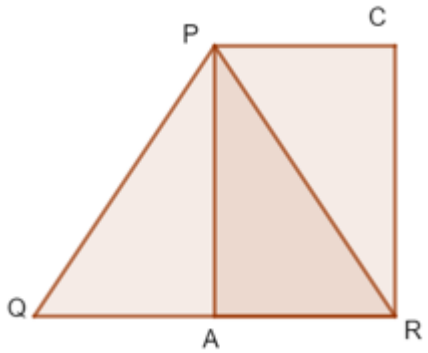
2) Draw a rectangle ARCP with area equal to that of triangle PQR, by choosing length of rectangle as half of base and height same as height of triangle.

[Here, area of rectangle = length × breadth

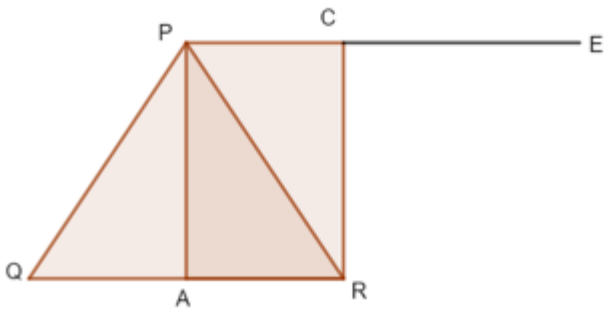
= 1/2 × base × height

= area of triangle]

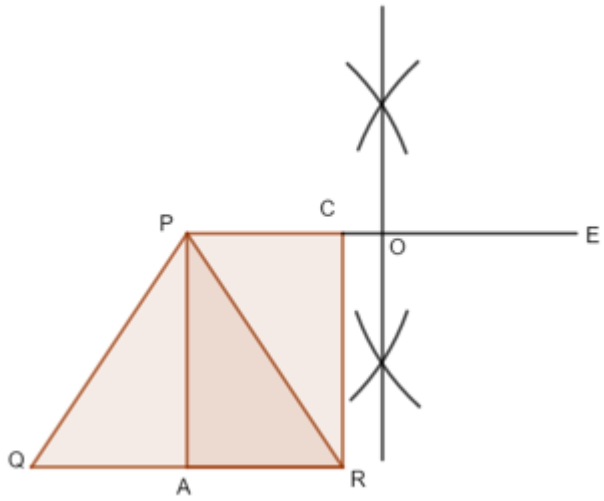
Now, we can make a square with area equal to that of rectangle and hence equal to area of triangle.



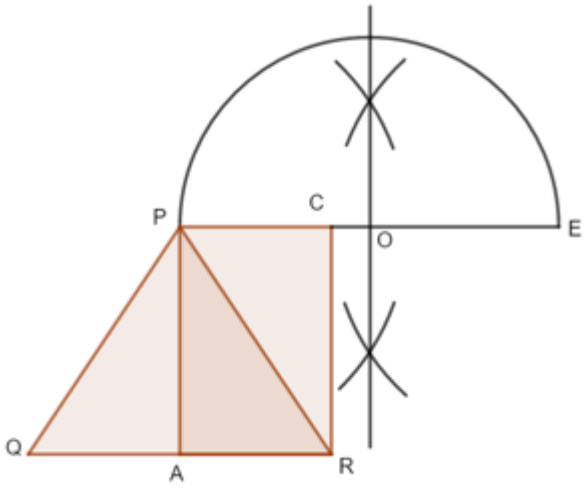
3) Extend CP to CE, such that CE = BC



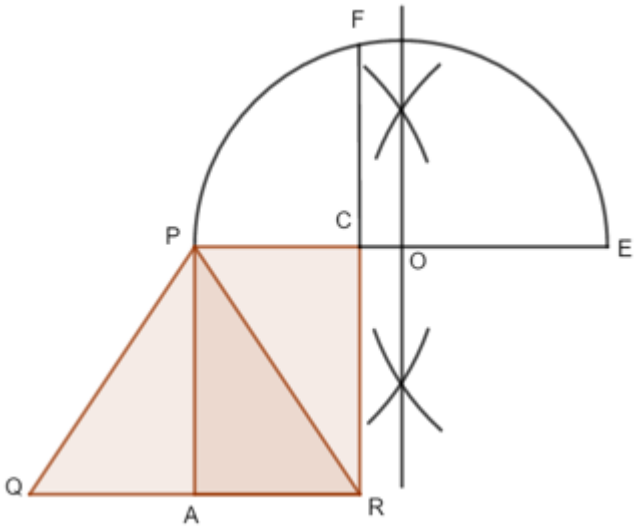
4) Draw the perpendicular bisector of PE which bisects PE at O.



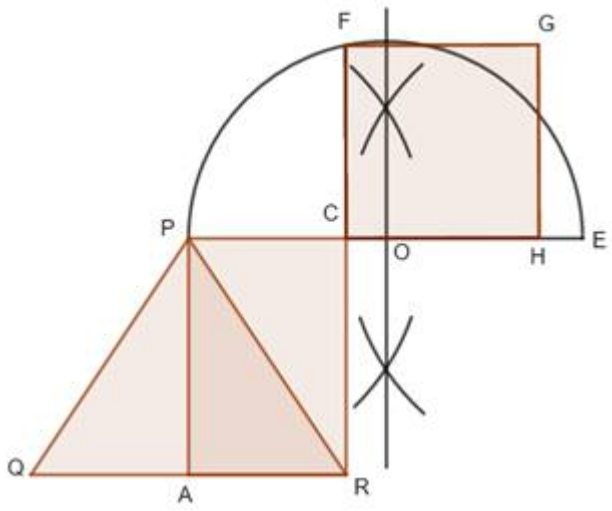
5) Taking O as center and OD = OE as radius, draw a semicircle.



6) Extend BC which intersects semicircle at F.



7) Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

= area of ΔPQR

5 C. Question

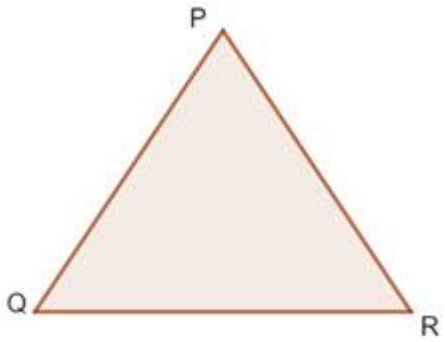
Let us draw the squares whose areas equal to the areas of the following triangles:

An equilateral triangle whose side is 6cm. in length.

Answer

Steps of construction:

1) Draw a triangle PQR with sides PQ = QR = PR = 6 cm.



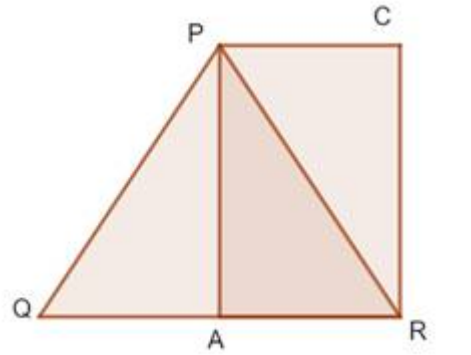
2) Draw a rectangle ARCP with area equal to that of triangle PQR, by choosing length of rectangle as half of base and height same as height of triangle.

[Here, area of rectangle = length × breadth

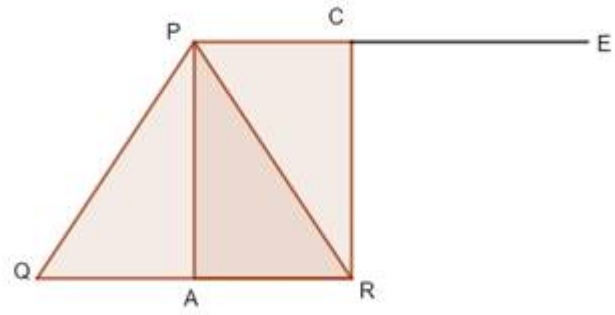
= 1/2 × base × height

= area of triangle]

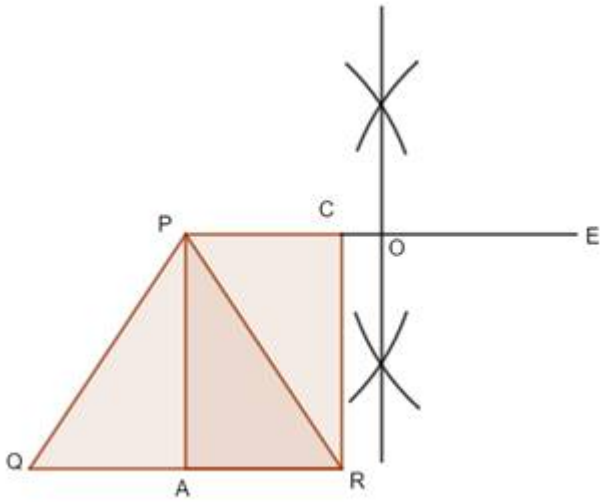
Now, we can make a square with area equal to that of rectangle and hence equal to area of triangle.



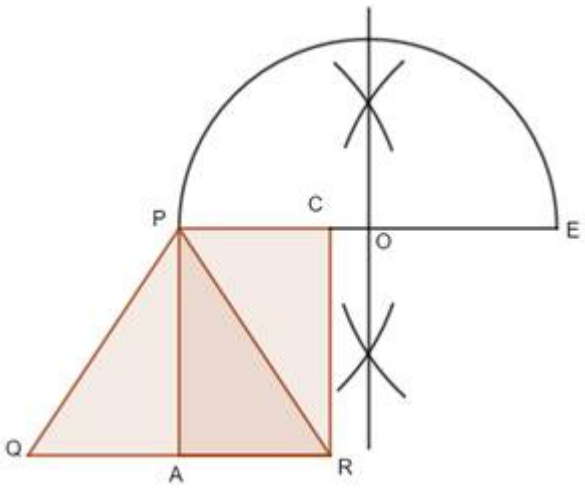
3) Extend CP to CE, such that CE = BC



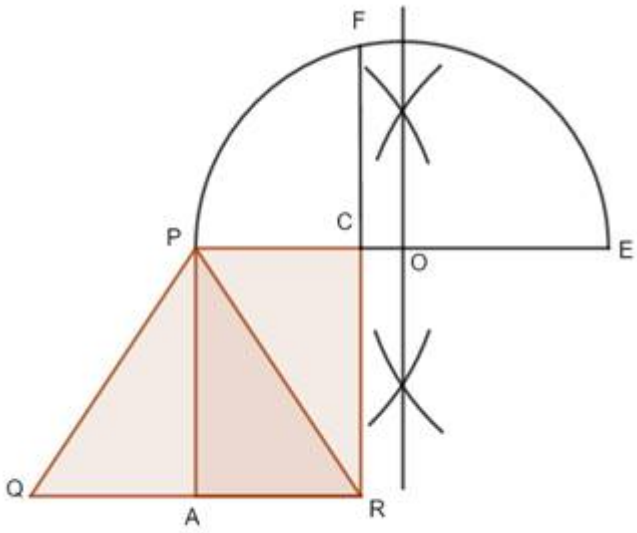
4) Draw the perpendicular bisector of PE which bisects PE at O.



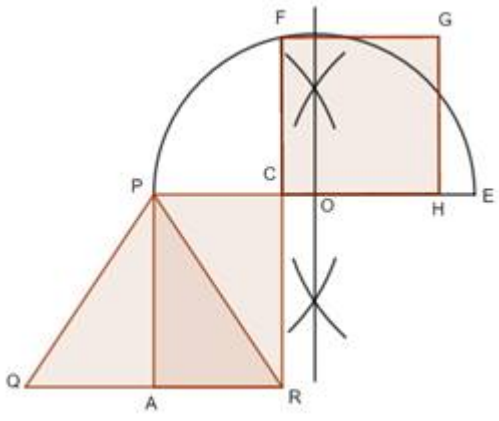
5) Taking O as center and OD = OE as radius, draw a semicircle.



6) Extend BC which intersects semicircle at F.



7) Draw a square CFGH taking CF as side.



Here,

Area of square CFGH = area of rectangle ABCD

= area of ΔPQR