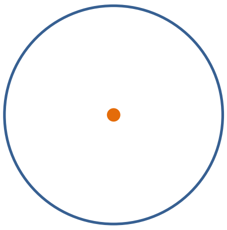
NCERT QUESTIONS WITH SOLUTIONS

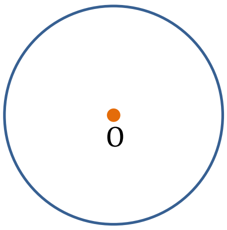
FIGURE IT OUT-01

1. Use the point on the circle and/or the centre to form isosceles triangles.



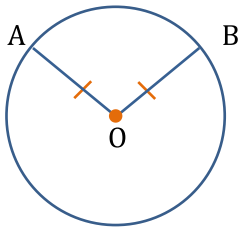
Sol. The steps of construction are given as

(i) Draw a circle of any radius using compass and denote its centre by O.



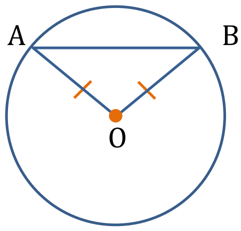
(ii) Take any two points A and B on the circle and join them to centre O.

Then, OA = OB [radii of a circle]



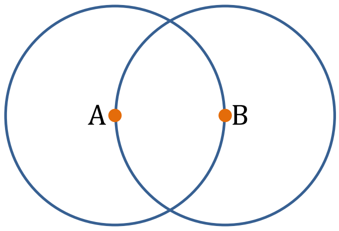
(iii) Now, join AB.

Then the ΔABC is the required isosceles triangle.

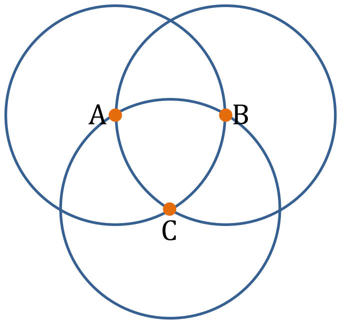


2. Use the points on the circles and/or their centres to form isosceles and equilateral triangles.

The circles are of the same size.

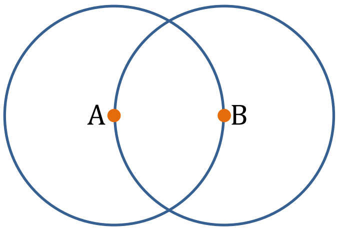


(i)
A and B are the centres
of circles of the same size



(ii)
A, B and C are the centres
of circles of the same size

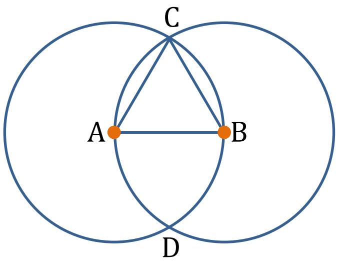
Sol. (i) Given circles in figure (i) are



Let these two circles intersect at point C and D.

Now, join AB, AC and BC.

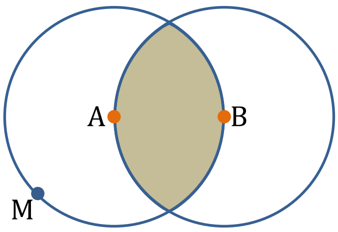
Then, AB = AC = AB [radii of both the circles are same]



Hence, the ΔABC is the required equilateral triangle.

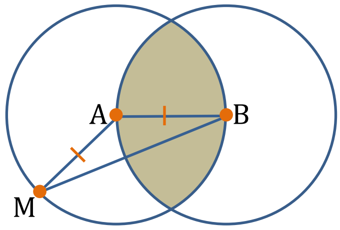
We can also construct an isosceles triangle.

Mark a point M on the circle whose centre is at A, out of the shaded region.



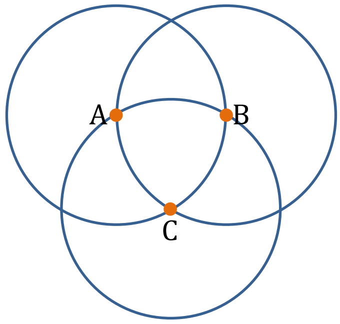
Joint AB, AM and BM.

Then, AM = AB [radii of a circle]



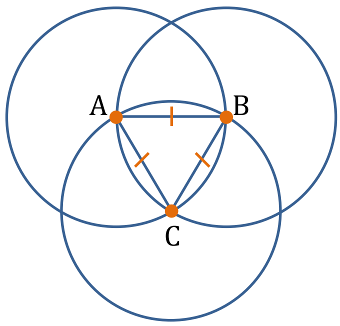
Hence, the ΔABM is the required isosceles triangle.

(ii) Given three circles in figure (ii) are



Join points A to B, B to C and A to C.

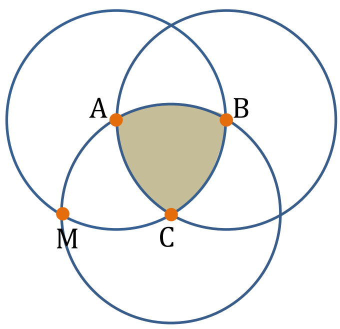
Observe that AB = BC = CA.



Hence, ΔABC is the required equilateral triangle.

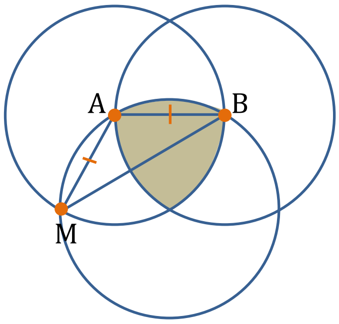
We can also construct an isosceles triangle.

Mark a point M on the intersection of the circles whose centre is at A and C, out of the shaded region.



Joint AB, AM and BM.

Then, AM = AB



Hence, the ΔABM is the required isosceles triangle.

FIGURE IT OUT-02

1. We checked by construction that there are no triangles having side lengths 3 cm, 4 cm and 8 cm; 2 cm, 3 cm and 6 cm. Check if you could have found this without trying to construct the triangle.

Sol. Yes, without constructing the triangles, we could have determined that they cannot exist using the triangle inequality.

i.e. $3 + 4 < 8$

and $2 + 3 < 6$

Hence, both the triangles cannot be formed.

2. Can we say anything about the existence of a triangle for each of the following sets of lengths?

(i) 10 km, 10 km and 25 km

(ii) 5 mm, 10 mm and 20 mm

(iii) 12 cm, 20 cm and 40 cm

Sol. We know that the sum of the lengths of any two sides of a triangle must be greater than the length of the third side.

(i) Here, $10 + 10 < 25$

So, a triangle cannot be formed.

(ii) Here, $5 + 10 < 20$

So, a triangle cannot be formed.

(iii) Here, $12 + 20 < 40$

So, a triangle cannot be formed.

FIGURE IT OUT-03

1. Which of the following lengths can be the side lengths of a triangle? Explain your answers. Note that for each set, the three lengths have the same unit of measure.

(i) 2, 2,5 (ii) 3, 4, 6 (iii) 2, 4, 8 (iv) 5,5,8

(v) 10, 20, 25 (vi) 10, 20, 35 (vii) 24, 26, 28

Sol. We know that the sum of the lengths of any two sides of a triangle must be greater than the length of the third side.

(i) Here, $2 + 2 < 5$

So, a triangle cannot be formed.

(ii) Here, $3 + 4 > 6$,

$4 + 6 > 3$ and $3 + 6 > 4$

So, a triangle is possible.

(iii) Here, $2 + 4 < 8$

So, a triangle cannot be formed.

(iv) Here, $5 + 5 > 8$ and $5 + 8 > 5$

So, a triangle is possible.

(v) Here, $10 + 20 > 25$

$20 + 25 > 10$ and $10 + 25 > 20$

So, a triangle is possible.

(vi) Here, $10 + 20 < 35$

So, a triangle cannot be formed.

(vii) Here, $24 + 26 > 28$ and $24 + 28 > 26$

So, a triangle is possible. $26 + 28 > 24$

FIGURE IT OUT-04

1. Check if a triangle exists for each of the following set of lengths.

(i) 1, 100, 100 (ii) 3, 6, 9 (iii) 1, 1, 5 (iv) 5, 10, 12

Sol. Triangle inequality states that the sum of the lengths of any two sides of a triangle must be greater than the length of the third side.

(i) Here, $1 + 100 > 100$ and $100 + 100 > 1$

So, triangle is possible.

(ii) Here, $3 + 6 = 9$

So, triangle cannot be formed.

(iii) Here, $1 + 1 < 5$

So, triangle cannot be formed.

(iv) Here, $5 + 10 > 12$,

$10 + 12 > 5$ and $12 + 5 > 10$

So, triangle is possible.

2. Does there exist an equilateral triangle with sides 50, 50, 50? In general, does there exist an equilateral triangle of any side length? Justify your answer.

Sol. Yes, an equilateral triangle is possible with side lengths 50,50 and 50.
Since, an equilateral triangle is a triangle in which all three sides are equal.
Hence, there exist an equilateral triangle of any side length.

3. For each of the following, give atleast 5 possible values for the third length, so there exists a triangle having these as side lengths (decimal values could also be chosen).
(i) 1,100 (ii) 5,5 (iii) 3,7

Sol. By the triangle inequality, the sum of the lengths of any two sides of a triangle is always greater than the length of the third side.
Also, the difference between the lengths of any two sides of a triangle is always smaller than the length of the third side.
Let x be the length of third side of the triangle.

(i) Given, two sides of a triangle are 1 and 100.
Then, x satisfies
$100 - 1 < x < 100 + 1$
$\Rightarrow$ $99 < x < 101$
$\therefore$ The five possible values for x are
99.5, 100, 100.2, 100.5, 100.9.

(ii) Given, two sides of a triangle are 5 and 5.
Then, x satisfies
$5 - 5 < x < 5 + 5$
$\Rightarrow$ $0 < x < 10$
$\therefore$ The five possible values of x are 1, 3, 5, 7 and 9.

(iii) Given, two sides of a triangle are 3 and 7.
Then, x satisfies
$7 - 3 < x < 7 + 3$
$\Rightarrow$ $4 < x < 10.$
$\therefore$ The five possible values for x are 4.5, 5, 6, 6.8 and 6.9.

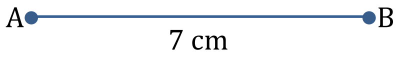
FIGURE IT OUT-05

1. Construct triangles for the following measurements where the angle is included between the sides.
(i) 3 cm, 75°, 7 cm
(ii) 6 cm, 25°, 3 cm
(iii) 3 cm, 120°, 8 cm

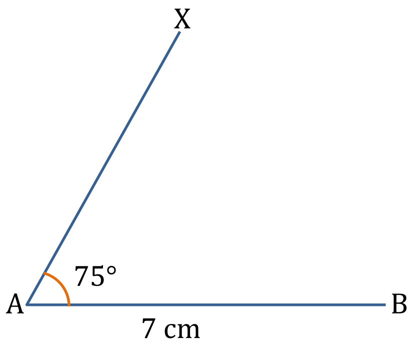
Sol. (i) 3 cm, 75°, 7cm

The steps of construction are given as

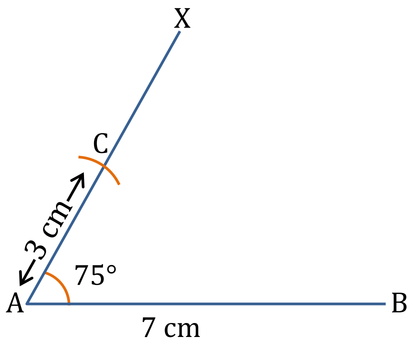
(a) Draw a line segment AB of length 7 cm using a ruler and a pencil.



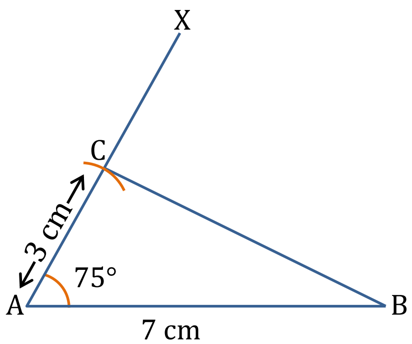
(b) At point A, a draw an angle of 75° using protector and mark X.



(c) At point A, mark a point C along A X such that AC = 3 cm.



(d) Join the point C to B. Then, ΔABC is the required triangle.

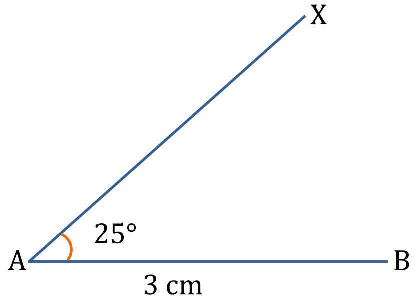


(ii) 6 cm, 25°, 3cm

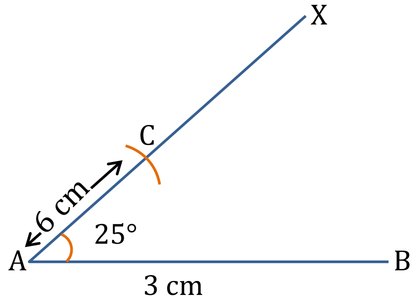
The steps of construction are given as

(a) Draw a line segment AB of length 3 cm using a ruler and a pencil.

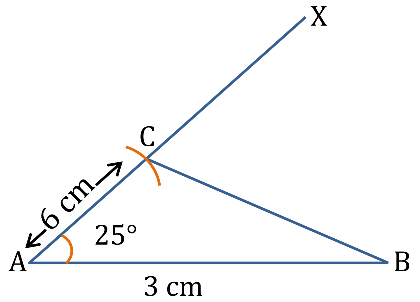
(b) At point A, draw an angle of 25° using protector and mark X.



(c) At point A, mark a point C along A X such that AC = 6 cm.



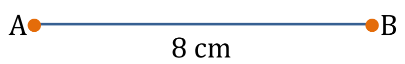
(d) Join the point C to B. Then, ΔABC is the required triangle.



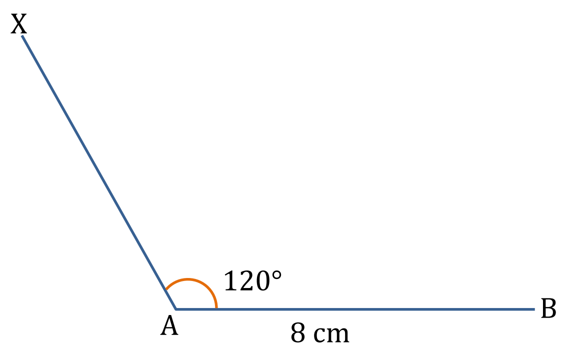
(iii) 3 cm, 120°, 8cm

The steps of construction are given as

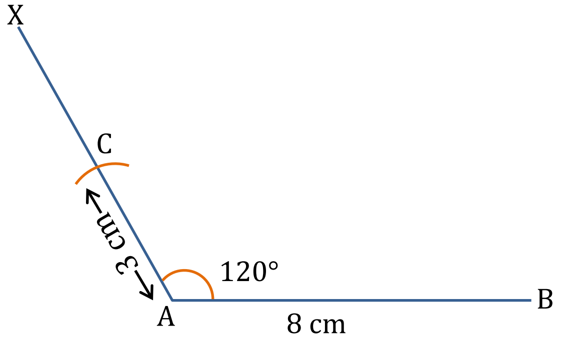
(a) Draw a line segment AB of length 8 cm using a ruler and a pencil.



(b) At point A, draw an angle of 120° using protector and mark X.



(c) At point A, mark a point C along A X such that AC = 3 cm.



(d) Join the point C to B. Then, ∆ABC is the required triangle.

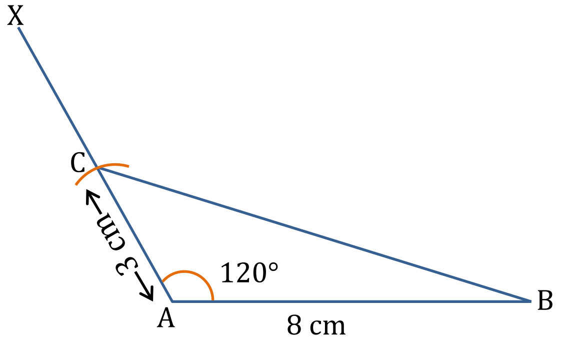


FIGURE IT OUT-06

1. Construct triangles for the following measurements.

(i) 75°, 5 cm, 75°

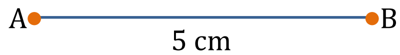
(ii) 25°, 3 cm, 60°

(iii) 120°, 6 cm, 30°

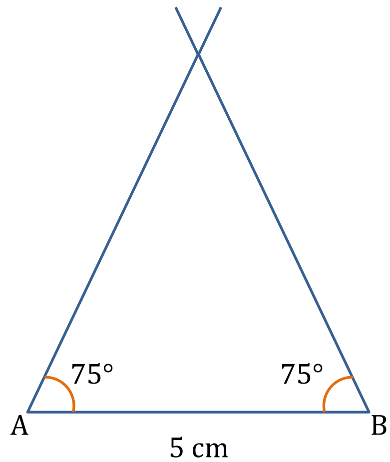
Sol. (i) 75°, 5 cm, 75°

The steps of construction are given as

(a) Draw a line segment AB of length 5 cm using a ruler and a pencil.

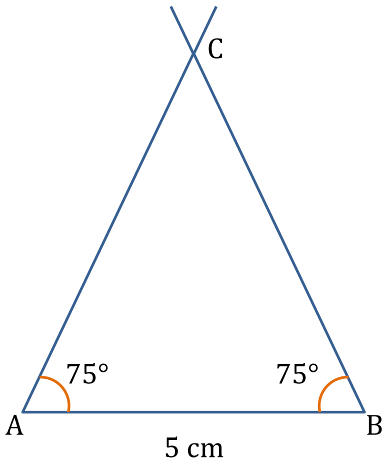


(b) Draw angles of 75° and 75° at points A and B respectively using protector.



(c) Let these two rays intersect at point C.

Then, ΔABC is the required triangle.

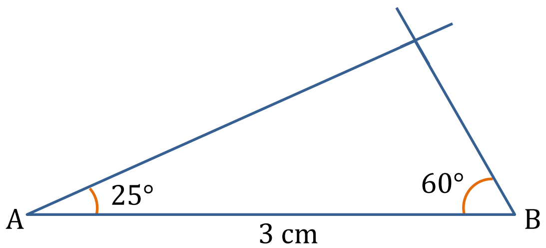


(ii) 25°, 3 cm, 60°

The steps of construction are given as

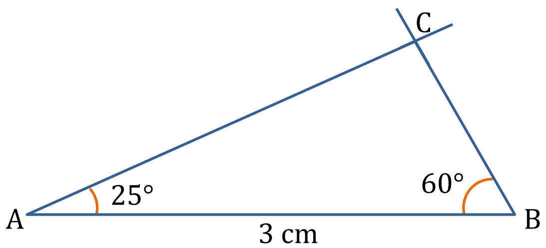
(a) Draw a line segment AB of length 3 cm using a ruler and a pencil.

(b) Draw angles of 25° and 60° at points A and B respectively using protector.



(c) Let these two rays intersect at point C.

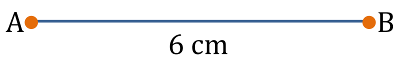
Then, ΔABC is the required triangle.



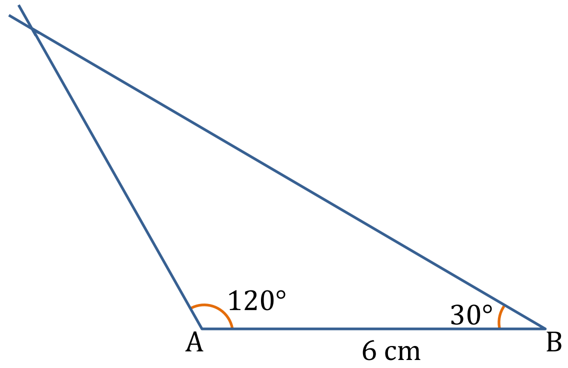
(iii) 120°, 6 cm, 30°

The steps of construction are given as

(a) Draw a line segment AB of length 6 cm using a ruler and a pencil.



(b) Draw angles of 120° and 30° at points A and B respectively using protector.



(c) Let these two rays intersect at point C.

Then, ΔABC is the required triangle.

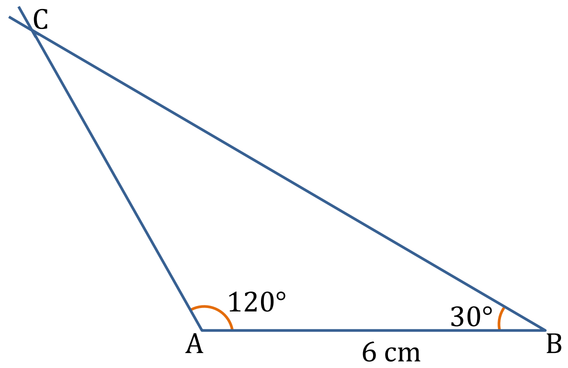


FIGURE IT OUT-07

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1. For each of the following angles, find another angle for which a triangle is (a) possible, (b) not possible. Find atleast two different angles for each category.

(i) 30° (ii) 70° (iii) 54° (iv) 144°

Sol. We know that when the sum of two angles is less than 180° then the triangle exists and when the sum of two angles is greater than or equal to 180° then there exists no triangle.

(i) (a) Two possible angles are 70° and 60°

(b) Two not possible angles are 150° and 155°

(ii) (a) Two possible angles are 105° and 50°

(b) Two not possible angles are 110° and 120°

(iii) (a) Two possible angles are 120° and 110°

(b) Two not possible angles are 126° and 130°

(iv) (a) Two possible angles are 20° and 30°

(b) Two not possible angles are 36° and 40°

2. Determine which of the following pairs can be the angles of a triangle and which cannot.

(i) $35°$, $150°$ (ii) $70°$, $30°$ (iii) $90°$, $85°$ (iv) $50°$, $150°$

Sol. We know that if the sum of two angles of a triangle is greater than or equal to $180°$ then triangle is not possible with these angles.

(i) Given, the two angles of a triangle are $35°$ and $150°$.
Here, $35° + 150° = 185° > 180°$.
Therefore, triangle is not possible.

(ii) Given, the two angles of a triangle are $70°$ and $30°$.
Here, $70° + 30° = 100° < 180°$.
Therefore, triangle is possible.

(iii) Given, the two angles of a triangle are $90°$ and $85°$.
Here, $90° + 85° = 175° < 180°$.
Therefore, triangle is possible.

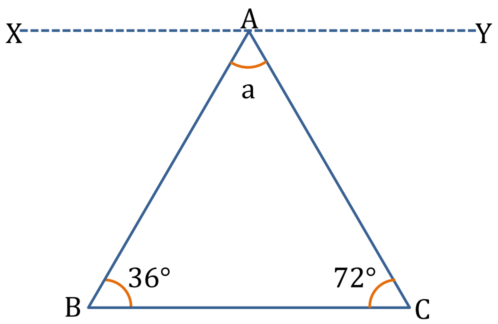
(iv) Given, the two angles of a triangle are $50°$ and $150°$.
Here, $50° + 150° = 200° > 180°$.
Therefore, triangle is not possible.

FIGURE IT OUT-08

1. Find the third angle of a triangle (using a parallel line) when two of the angles are

(i) $36°$, $72°$ (ii) $150°$, $15°$ (iii) $90°$, $30°$ (iv) $75°$, $45°$

Sol. (i) Given, the two angles of a triangle are $36°$ and $72°$.
Let the third angle be a.
Let ΔABC be any triangle with angles
$\angle B = 36°$ $\angle C = 72°$ and $\angle A = a$.
Now, draw a line XY parallel to BC, passing through A.



Then, $\angle XAB = 36°$ and angle $YAC = 72°$ [$\because$ alternate interior angles]

We know that $\angle XAB$, $\angle YAC$ and $\angle BAC$ together form a straight line.
So, $\angle XAB + \angle YAC + \angle BAC = 180°$

$\Rightarrow$ $36° + 72° + a = 180°$

$\Rightarrow$ $108° + a = 180°$

$\Rightarrow$ $a = 72°$

Hence, the third angle of a triangle is $72°$.

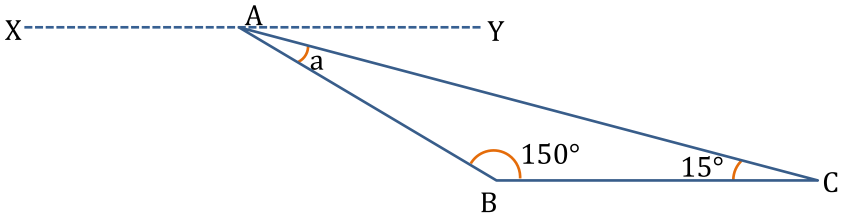
(ii) Given, the two angles of a triangle are 150° and 15°.

Let the third angle be a.

Let ΔABC be any triangle with angles

∠B = 150° ∠C = 15° and ∠A = a.

Now, draw a line XY parallel to BC, passing through A.



Then, ∠XAB = 150° and angle YAC = 15° [∵ alternate angles]

We know that ∠XAB, ∠YAC and ∠BAC together form a straight line.

So, ∠XAB + ∠YAC + ∠BAC = 180°

⇒ 150° + 15° + a = 180°

⇒ 165° + a = 180°

⇒ a = 15°

Hence, the third angle of a triangle is 15° .

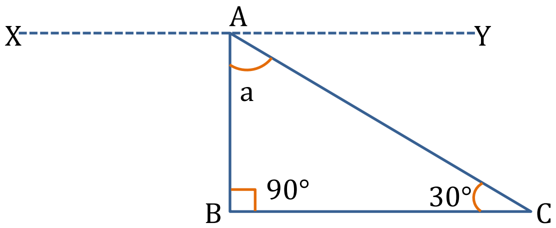
(iii) Given, the two angles of a triangle are 90° and 30°.

Let the third angle be a.

Let ΔABC be any triangle with angles

∠B = 90° ∠C = 30° and ∠A = a.

Now, draw a line XY parallel to BC, passing through A.



Then, ∠XAB = 90° and angle YAC = 30° [∵ alternate angles]

We know that ∠XAB, ∠YAC and ∠BAC together form a straight line.

So, ∠XAB + ∠YAC + ∠BAC = 180°

⇒ 90° + 30° + a = 180°

⇒ 120° + a = 180°

⇒ x = 60°

Hence, the third angle of a triangle is 60°.

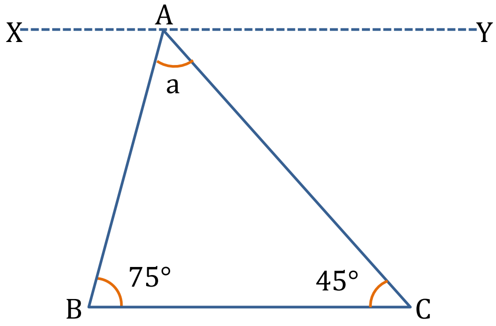
(iv) Given, the two angles of a triangle are 75° and 45°.

Let the third angle be a.

Let ΔABC be any triangle with angles

$\angle B = 75° \ \angle C = 45°$ and $\angle A = a$.

Now, draw a line XY parallel to BC, passing through A.



Then, $\angle XAB = 75°$ and angle $YAC = 45°$ [$\because$ alternate angles]

We know that $\angle XAB$, $\angle YAC$ and $\angle BAC$ together form a straight line.

So, $\angle XAB + \angle YAC + \angle BAC = 180°$

$\Rightarrow \quad 75° + 45° + a = 180°$

$\Rightarrow \quad 120° + a = 180°$

$\Rightarrow \quad a = 60°$

Hence, the third angle of a triangle is 60°.

2. Can you construct a triangle all of whose angles are equal to 70°? If two of the angles are 70°, what would the third angle be? If all the angles in a triangle have to be equal, then what must its measure be? Explore and find out.

Sol. We know that the sum of the angles of a triangle is 180°.

Here, $70° + 70° + 70° = 210° > 180°$.

So, we cannot construct a triangle whose all of angles are equal to 70°.

If two angles are 70° each, then the sum of these two angles is

$70 + 70° = 140°$

Therefore, the third angle $= 180° - 140° = 40°$.

Let all the angles of a triangle to be x.

Then, by angle sum property,

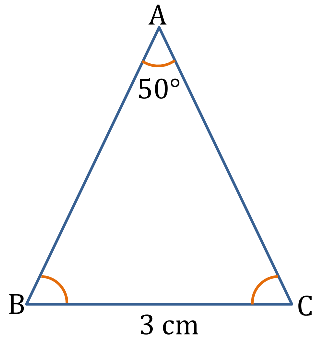
$x + x + x = 180°$

$\Rightarrow \quad 3x = 180°$

$\Rightarrow \quad x = 60°$

Hence, if all the angles of a triangle are equal, then each of them measures to 60°.

3. Here is a triangle in which we know $\angle B = \angle C$ and $\angle A = 50°$. Can you find $\angle B = \angle C$?



Sol. We know that the sum of all angles of a triangle is 180°.

$\therefore \quad \angle A + \angle B + \angle C = 180°$

$\Rightarrow \quad 50° + \angle B + \angle C = 180° \qquad [\therefore \angle A = 50°]$

$\Rightarrow \quad \angle B + \angle C = 180° - 50° = 130°$

$\Rightarrow \quad \angle B + \angle B = 130° \qquad [\therefore \angle B = \angle C \text{ (given)}]$

$\Rightarrow \quad 2\angle B = 130°$

$\Rightarrow \quad \angle B = \dfrac{130}{2} = 65°$

Therefore, the values of $\angle B$ and $\angle C$ are 65°.

FIGURE IT OUT-9

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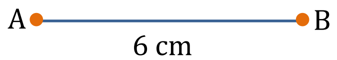
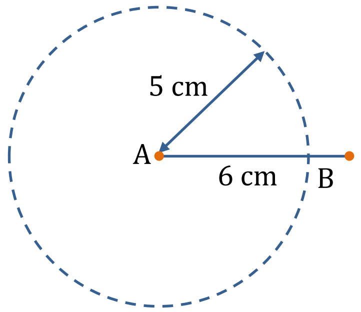
1. Construct a ΔABC with BC = 5 cm, AB = 6 cm, CA = 5 cm. Construct an altitude from A to BC.

Sol. The steps of construction are given as

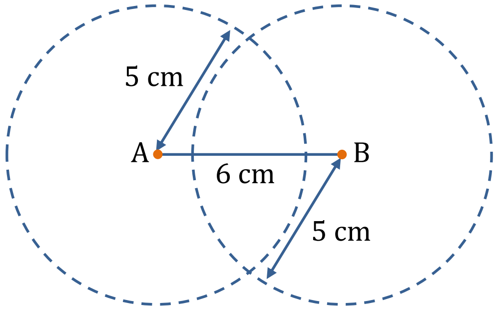
(i) Draw a line segment AB of length 6 cm using a ruler and a pencil.



(ii) Place the compass pointer at point A and open it to 5 cm. Draw a circle.

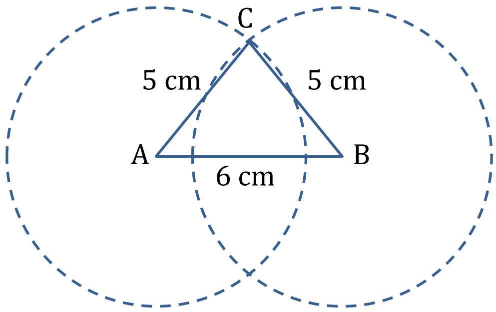


(iii) Place the compass pointer at point B and open it to 5 cm. Draw another circle.



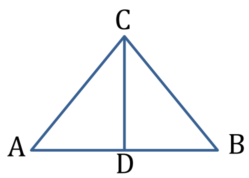
(iv) Let point C be one of the points of intersection of these two circles.

Now, join AC and BC. Then, ΔABC is the required triangle.



(v) Construction of an altitude

Keep the ruler aligned to the base of ΔABC. Place the set square on the ruler such that one of the edges of the right angle touches the ruler and slide it along ruler till the vertical edge touches C. Then, draw an altitude to AB through C.

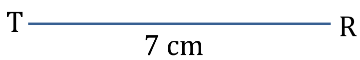


2. Construct a triangle TRY with RY = 4 cm, TR = 7cm ∠R = 140°.

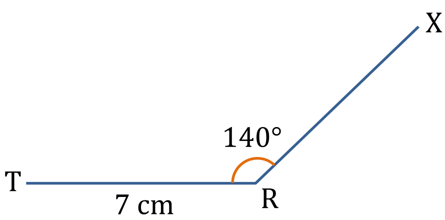
Construct an altitude from T to RY.

Sol. The steps of construction are given as

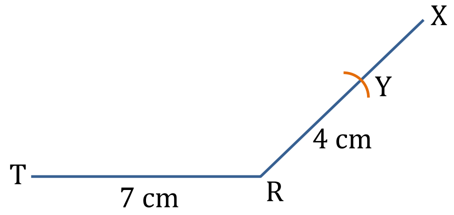
(i) Draw a line segment TR of length 7 cm using a ruler and a pencil.



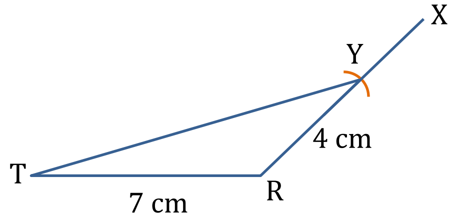
(ii) At point R, draw an angle 140° using protector and mark X.



(iii) At point R, mark a point Y along RX such that RY = 4cm

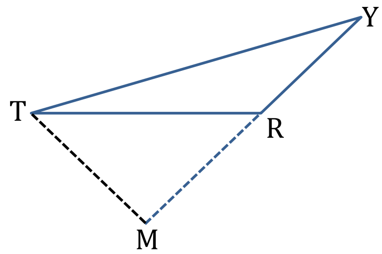


(iv) Join the point Y to T. Then, ΔTRY is the required triangle.



(v) Construction of an altitude

Keep the ruler aligned to the base RY. Place the set square on the ruler such that one of the edges of the right angle touches the ruler and slide it along ruler till the vertical edge touches T. Then, draw the altitude TM on extended RY.



Hence, an altitude from T to RY is outside of a ΔTRY.

3. Through construction, explore if it is possible to construct an equilateral triangle that is

(i) right angled (ii) obtuse angled.

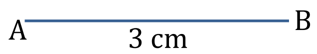
Also, construct an isosceles triangle that is

(i) right angled (ii) obtuse angled

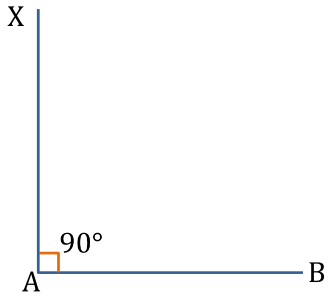
Sol. (i) Consider the length of sides of an equilateral triangle to be 3 cm.

The steps of the construction are given as

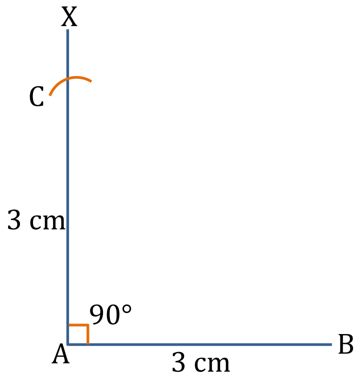
1. Draw a line segment AB of length 3 cm using pencil and ruler.



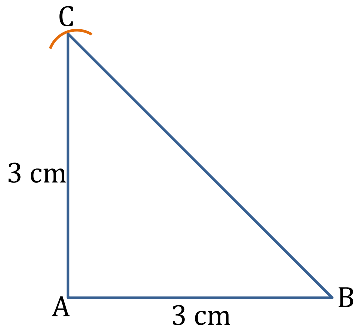
2. At point A, draw an angle of 90° using protector and mark X.



3. At point A, mark a point C along AX such that AC = 3 cm.



4. Join BC.



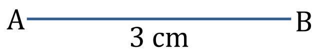
Here, we observe that the length of BC is no longer 3 cm.

Hence, it is not possible to construct an equilateral triangle that is right angled but can construct an isosceles triangle.

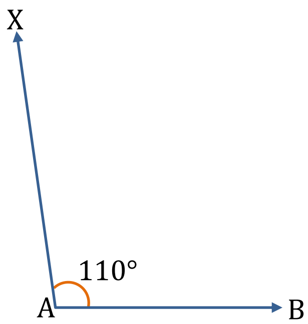
(ii) Consider the length of sides of an equilateral triangle to be 3 cm and an obtuse angle to be 110°.

The steps of the construction are given as

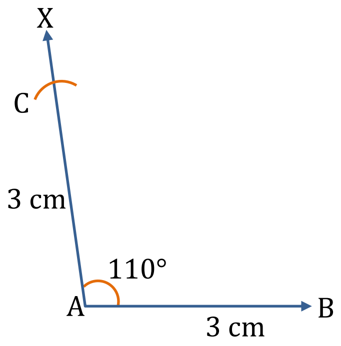
1. Draw a line segment AB of length 3 cm using ruler and pencil.



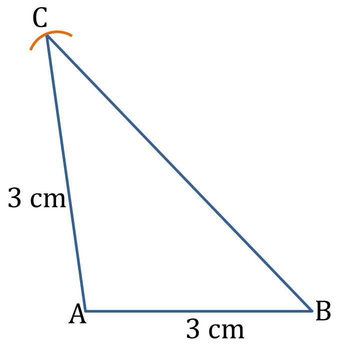
2. At point A, draw an angle of 110° using protector and mark X.



3. At point A mark a point C along AX such that AC = 3 cm.



4. Join BC.



Here, we observe that the length of BC is no longer 3 cm.

Hence, it is not possible to construct an equilateral triangle that is obtuse angled but can construct an isosceles triangle.