

Name _____

Date _____

Constructing a 60° Angle

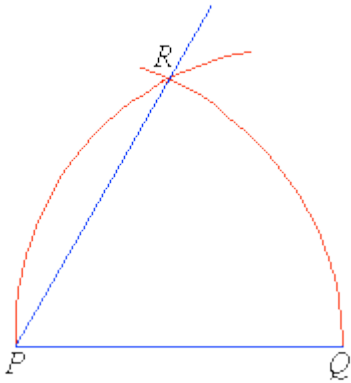
We know that the angles in an [equilateral triangle](#) are all 60° in size. This suggests that to construct a 60° angle we need to construct an equilateral triangle as described below.

Step 1: Draw the arm PQ .

Step 2: Place the point of the [compass](#) at P and draw an [arc](#) that passes through Q .

Step 3: Place the point of the compass at Q and draw an arc that passes through P . Let this arc cut the arc drawn in Step 2 at R .

Step 4: Join P to R . The angle QPR is 60°, as the ΔPQR is an equilateral triangle.



Constructing a 30° Angle

We know that:

$$\frac{1}{2} \text{ of } 60^\circ = 30^\circ$$

So, to construct an angle of 30°, first construct a 60° angle and then [bisect](#) it. Often, we apply the following steps.

Step 1: Draw the arm PQ .

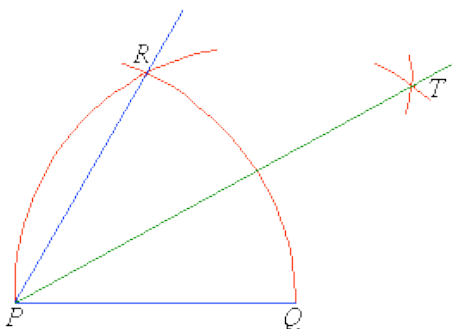
Step 2: Place the point of the [compass](#) at P and draw an [arc](#) that passes through Q .

Step 3: Place the point of the compass at Q and draw an arc that cuts the arc drawn in Step 2 at R .

Step 4: With the point of the compass still at Q , draw an arc near T as shown.

Step 5: With the point of the compass at R , draw an arc to cut the arc drawn in Step 4 at T .

Step 6: Join T to P . The angle QPT is 30°.

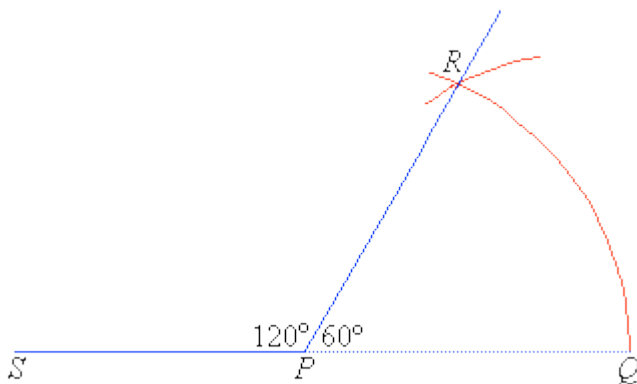


Constructing a 120° Angle

We know that:

$$60^\circ + 120^\circ = 180^\circ$$

This means that 120° is the supplement of 60° . Therefore, to construct a 120° angle, construct a 60° angle and then extend one of its arms as shown below.



Constructing a 90° Angle

We can construct a 90° angle either by bisecting a straight angle or using the following steps.

Step 1: Draw the arm PA .

Step 2: Place the point of the [compass](#) at P and draw an [arc](#) that cuts the arm at Q .

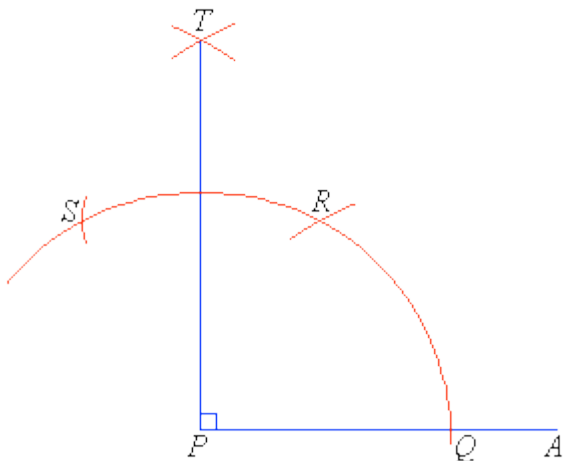
Step 3: Place the point of the compass at Q and draw an arc of [radius](#) PQ that cuts the arc drawn in Step 2 at R .

Step 4: With the point of the compass at R , draw an arc of radius PQ to cut the arc drawn in Step 2 at S .

Step 5: With the point of the compass still at R , draw another arc of radius PQ near T as shown.

Step 6: With the point of the compass at S , draw an arc of radius PQ to cut the arc drawn in step 5 at T .

Step 7: Join T to P . The angle APT is 90° .



Example 1

- Use a ruler and compass only to construct a triangle ABC with $AB = 5$ cm, $\angle BAC = 60^\circ$ and $AC = 4.5$ cm.
- Measure the size of $\angle ABC$ and the size of $\angle ACB$. Hence, calculate the angle sum of triangle ABC .
- Measure BC to the nearest millimetre. Hence, find the perimeter of triangle ABC in millimetres.

Solution:

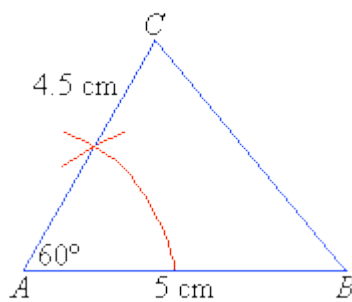
- a. **Step 1:** Draw a line, AB , 5 cm long.

Step 2: Use the compass to construct a 60° angle at A .

Step 3: Use the ruler to find C such that AC is 4.5 cm long.

Step 4: Join B to C .

The $\triangle ABC$ is the required triangle.



- b. Using a protractor, we find that:

$$\angle ABC = 55^\circ$$

$$\angle ACB = 65^\circ$$

$$\begin{aligned}\therefore \text{Angle sum of the triangle } ABC &= 60^\circ + 55^\circ + 65^\circ \\ &= 180^\circ\end{aligned}$$

- c. Using the ruler, we find that:

$$BC = 48 \text{ mm}$$

$$\begin{aligned}\therefore \text{Perimeter} &= AB + BC + CA \\ &= 5 \text{ cm} + 48 \text{ mm} + 4.5 \text{ cm} \\ &= 50 \text{ mm} + 48 \text{ mm} + 45 \text{ mm} \\ &= 143 \text{ mm}\end{aligned}$$

Activities

1. Construct the following angles using a ruler and compass:
 - a. 30°
 - b. 45°
 - c. 135°
 - d. 225°
 - e. 120°
 - f. 150°
 - g. 210°
 - h. 245°
2. Use a ruler and compass to construct the triangle PQR with $PQ = 8$ cm, $PR = 7.5$ cm and $\angle QPR = 60^\circ$.
3. Use a ruler and compass to construct a square $ABCD$ of side 6 cm.
- 4a. Use a ruler and compass to construct a triangle PQR with $PQ = 7$ cm, $\angle QPR = 30^\circ$ and $\angle PQR = 60^\circ$.
 - b. Calculate the size of $\angle PRQ$ and check your answer with a protractor.
 - c. Measure PR and QR to the nearest millimetre. Hence find the perimeter of triangle PQR in millimetres.
- 5a. Use a ruler and compass to construct a triangle ABC with $AB = 8$ cm, $BC = 6$ cm and $\angle ABC = 90^\circ$.
 - b. Measure the size of $\angle BAC$ and hence calculate the size of $\angle ACB$.
 - c. Measure AC to the nearest millimetre. Hence find the perimeter of triangle ABC in millimetres.
- 6a. Use a ruler and compass to construct a trapezium $PQRS$ with $PQ = 8$ cm, $PS = 7$ cm, $QR = 7$ cm, $\angle QPS = 60^\circ$ and $\angle PQR = 60^\circ$.
 - b. Measure RS to the nearest millimetre. Hence find the perimeter of the trapezium $PQRS$.
- 7a. Use a ruler and compass to construct a triangle PQR with $PQ = 6$ cm, $\angle QPR = 30^\circ$ and $\angle PQR = 120^\circ$.
 - b. Calculate the size of $\angle PRQ$ and check your answer with a protractor.
 - c. Measure PR and QR to the nearest millimetre. Hence find the perimeter of triangle PQR in millimetres.
- 8a. Use a ruler and compass to construct a trapezium $DEFG$ with $DE = 6.5$ cm, $\angle DEF = 90^\circ$, $EF = 5.5$ cm, $\angle EFG = 90^\circ$ and $\angle EDG = 60^\circ$.
 - b. Calculate the size of $\angle DGF$ and check your answer with a protractor.
 - c. Calculate the sum of the interior angles of the trapezium.
 - d. Measure DG and FG to the nearest millimetre. Hence find the perimeter of trapezium $DEFG$ in millimetres.