SUBJECT: MATHEMATICS

TOPIC: ANGLES

CLASS: JSS1

OBJECTIVES

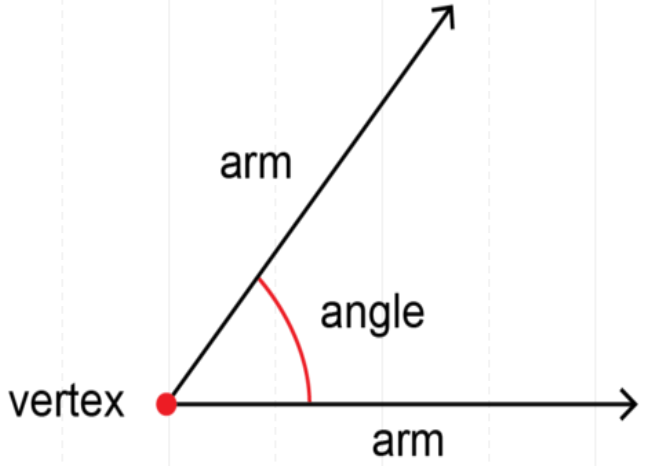
At the end of the lesson, learners should be able to:

- Measure angles;
- Identify vertically opposite, adjacent, alternate and corresponding angles ;

- State properties of angles;
- Identify angles at a point and angles on a straight line and state their properties.

ANGLES

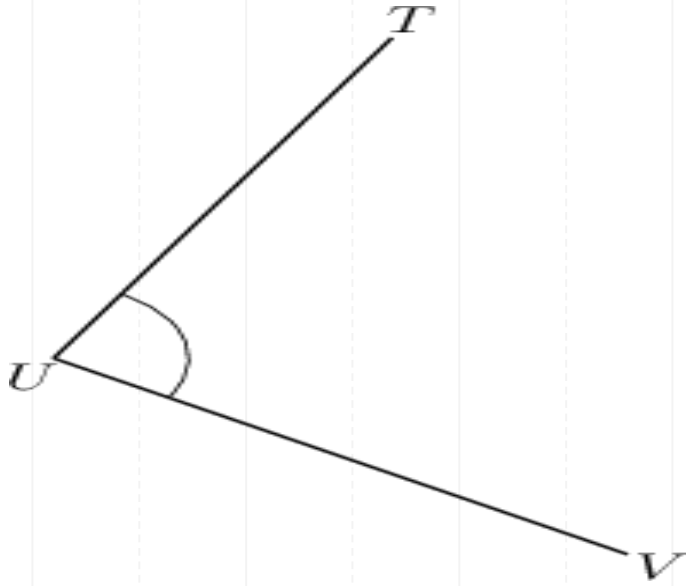
An angle is the figure formed by two lines sharing a common end point, called the **Vertex** (plural-Vertices)of the angle. An angle is also the amount of turns or rotation that separates two lines.



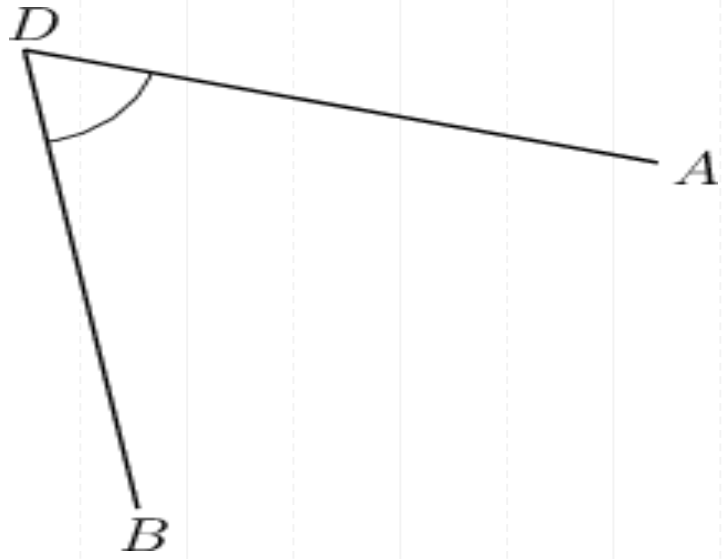
LABELING AND MEASURING ANGLES

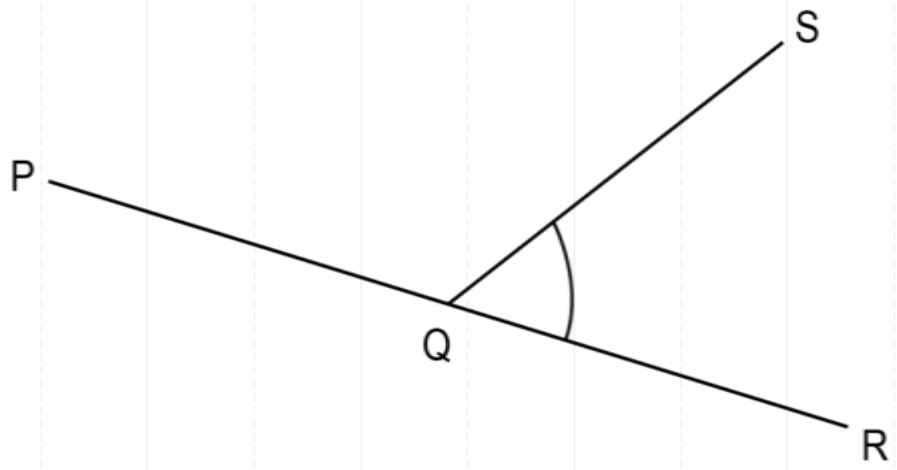
We measure angles in degrees. Before we can measure angles, we need to know how to label angles.

When we label an angle, we name the angle, so that we know which angle it is that we are talking about.

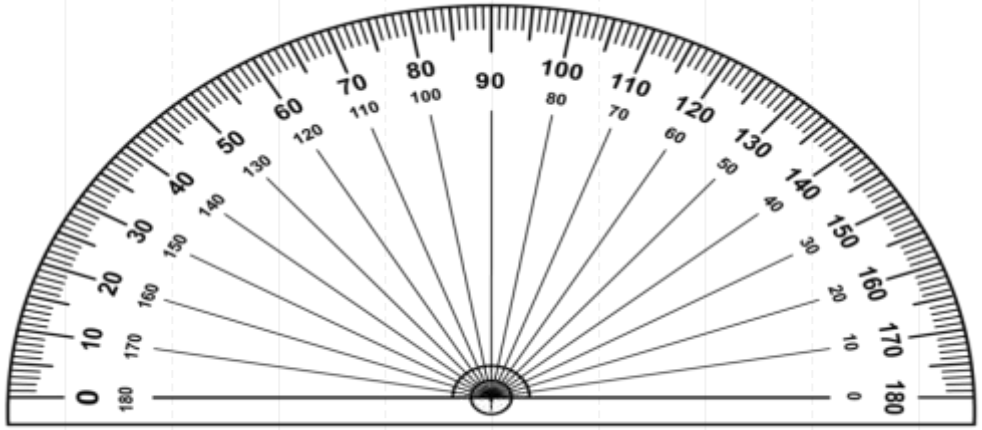


Consider the following diagrams, give the correct label for the marked angles





MEASURING ANGLES

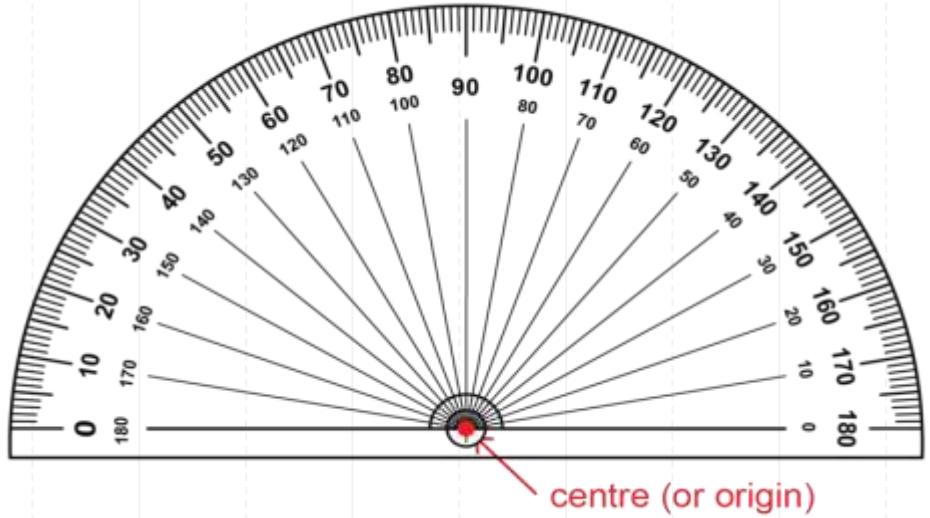


We measure angles in degrees. We use a protractor to measure an angle.

MEASURING ANGLES

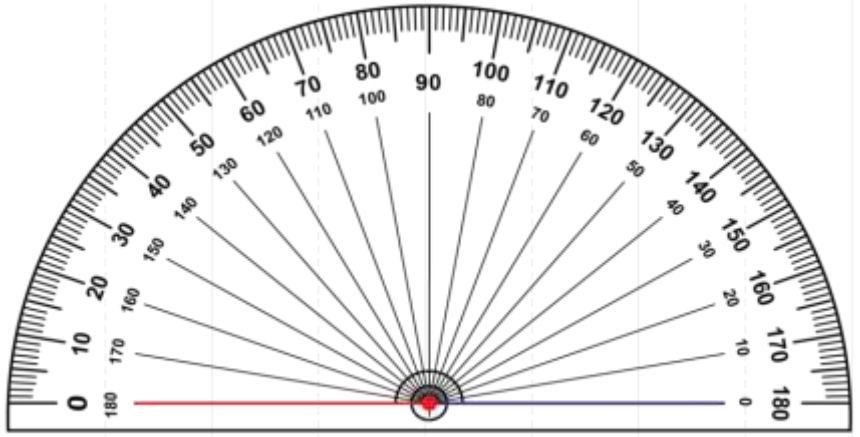
A protractor has a centre, which can also be called the origin.

- When you measure an angle you have to make sure that the centre (or origin) of the protractor is exactly on the vertex of the angle that you want to measure.

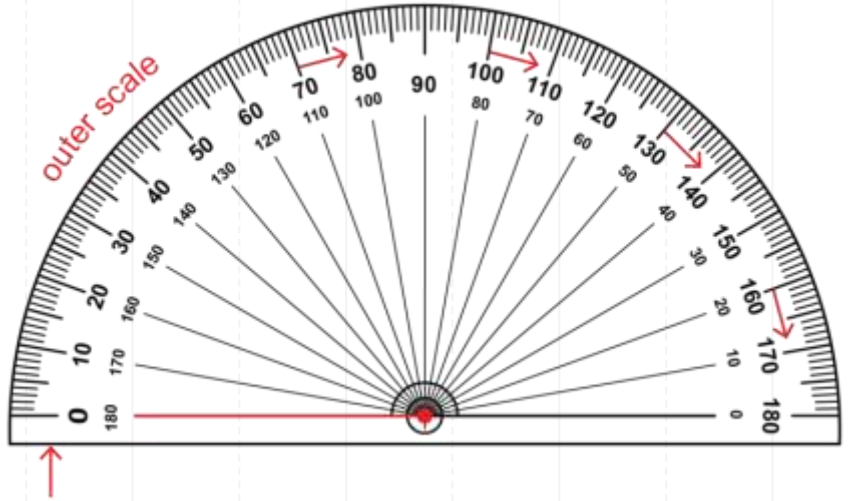


The centre (or origin) of a protractor is on the base line of the protractor.

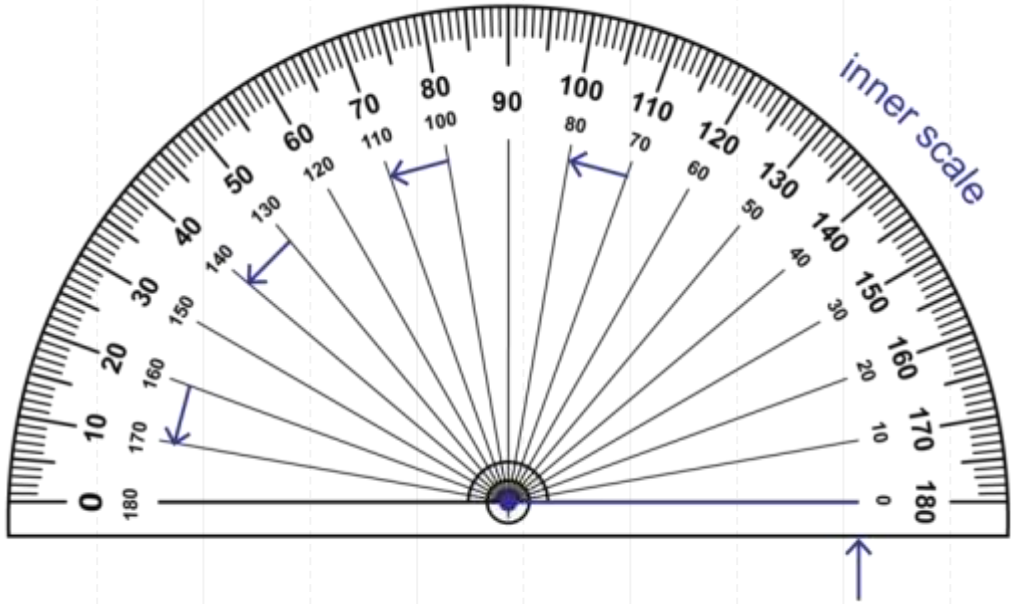
- When you measure an angle you also have to make sure that one side of the base line of the protractor is exactly on one of the arms of the angle that you want to measure.



- There are two zeroes on a protractor.
- If you begin measuring from the zero on the *left* hand side of the protractor, you use the *outer* scale on the protractor.



- If you begin measuring from the zero on the *right* hand side of the protractor, you use the *inner* scale on the protractor.



TYPES OF ANGLES

Different types of angles have different names. The names you may need to use when working with angles are given in the table below.

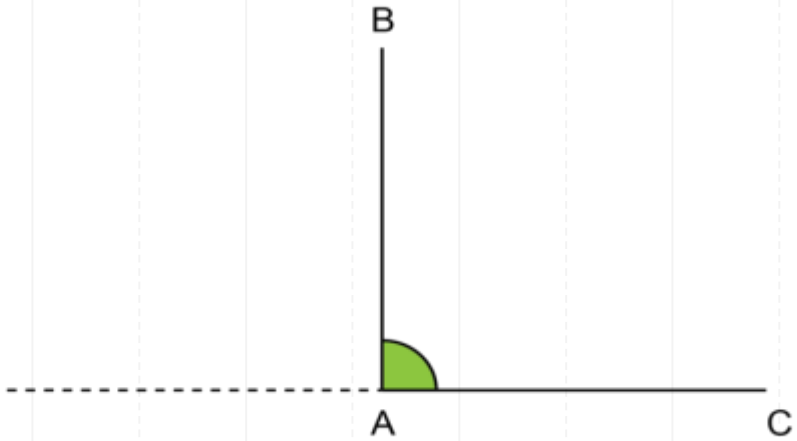
Name of angle	Size of angle
acute angle	between 0 and 90 degrees
right angle	90∘

obtuse angle	between 90◦ and 180◦
straight angle	180◦
reflex angle	between 180◦ and 360◦
revolution	360◦

EXAMPLES

Measuring A Right Angle

Use a protractor to measure the given angle in the diagram below.

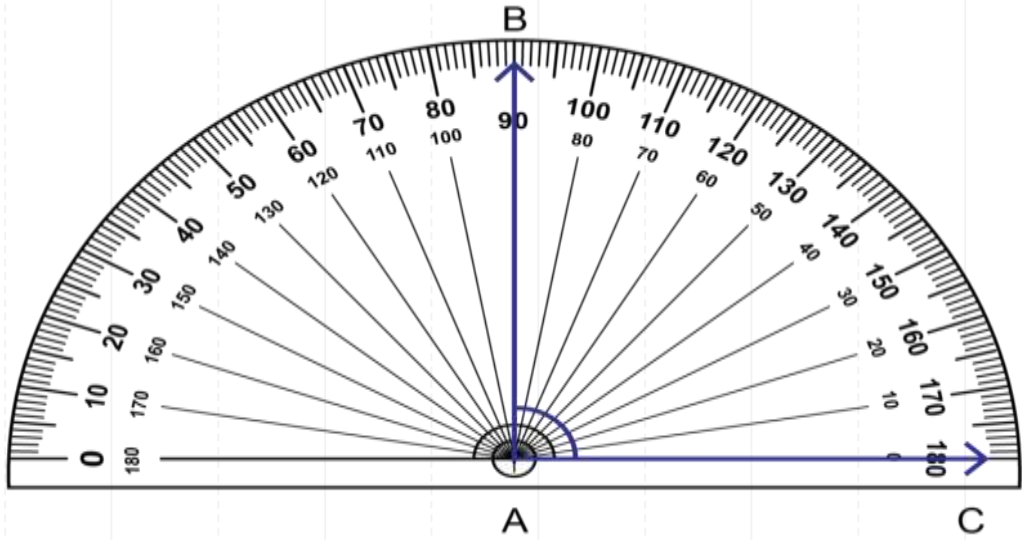


Solution

Step 1: Consider the diagram and estimate the size of the angle.

The diagram shows two arms: AC and AB. It seems as if they form a right angle, which is shaded green. A right angle is equal to 90∘.

Step 2: Place the protractor correctly on the angle.



- The centre of the protractor should be on the vertex of the angle.
- The base line of the protractor should be on one arm of the angle.

Step 3: Choose the scale you will use.

The arm on which the base line lies is to the right side of the protractor.

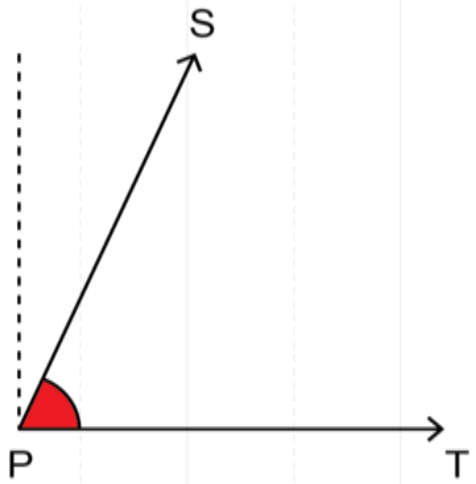
On the right side, it is the inner scale that starts from 0, so use the inner scale.

Step 4: Read off the size of the angle from the protractor, and give the answer. Name the angle correctly, and remember to include the degree symbol.

BA^C=90∘

Measuring an Acute angle

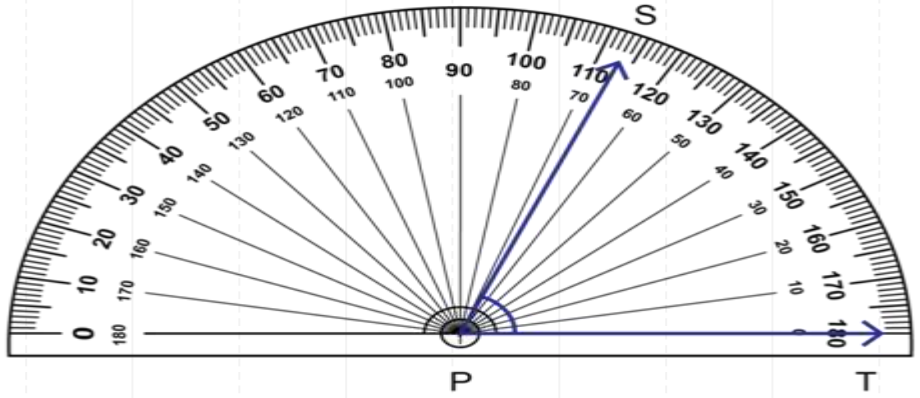
Use a protractor to measure the marked angle shown below.



Step 1: Consider the diagram and estimate the size of the angle.

- The angle shaded red is between two arms: PS and PT. It seems that the marked angle is an acute angle.
- An acute angle is between 0∘ and 90∘. This angle is nearer to 90∘ than to 0∘.

Step 2: Place the protractor correctly on the angle.



- The centre of the protractor should be on the vertex of the angle.
- The base line of the protractor should be on one arm of the angle.

Step 3: Choose the correct scale.

- The arm on which the base line lies is to the right side of the protractor, so use the inner scale.

Step 4: Read off the size of the angle from the protractor, and check against your estimation.

- 67∘ is an acute angle, and is closer to 90∘ than to 0∘

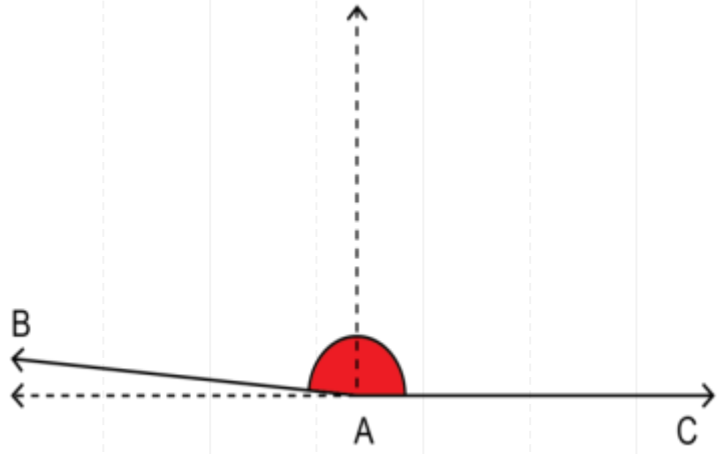
Step 5: Name the angle, and give the answer.

SP^T=67∘

Measuring An Obtuse Angle

Use a protractor to measure the marked angle shown below

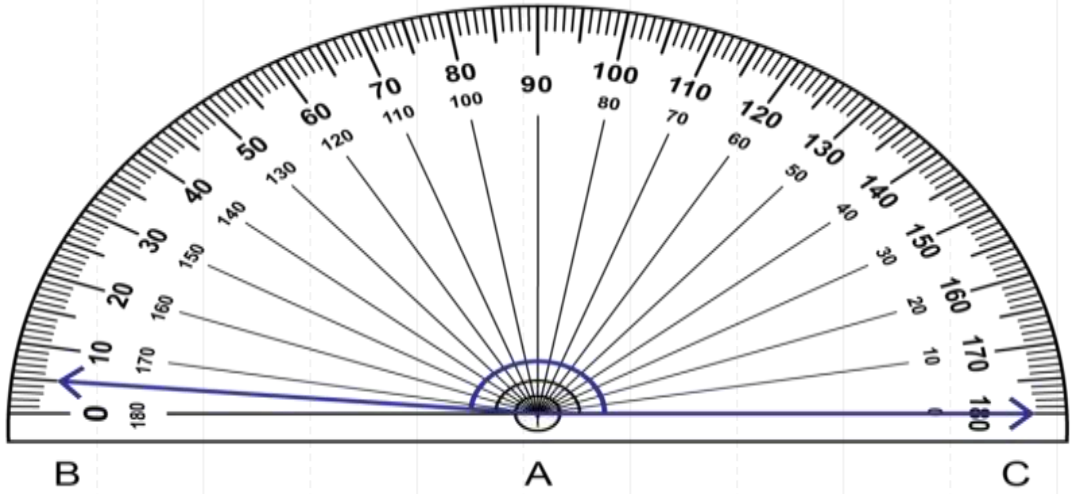
Hint: Use the dotted lines shown to help with your estimation. The dotted lines have a 90∘90∘ angle between them.



Solution

- The diagram shows two arms: AB and AC. It seems as if they form an obtuse angle, which is shaded red. An obtuse angle is between 90∘ and 180∘. This angle is almost a full straight angle, so it must be very close to 180∘.

- Next is to place the protractor correctly on the angle.



- The centre of the protractor should be on the vertex of the angle.
- The base line of the protractor should be on one arm of the angle.

Next is to choose the correct scale;

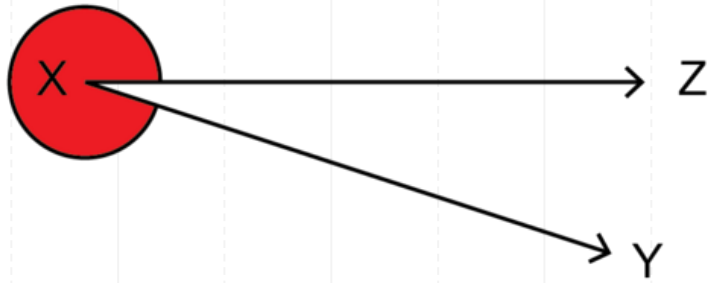
- The arm on which the base line lies is to the right side of the protractor, so use the inner scale.

Read off the size of the angle from the protractor, and check against your estimation.

- 175∘ is an obtuse angle, and is close to 180∘.
- **Name the angle, and give the answer.**
- BA^C=175∘

Measuring A Reflex Angle

Use a protractor and measure the angle shown below



Solution

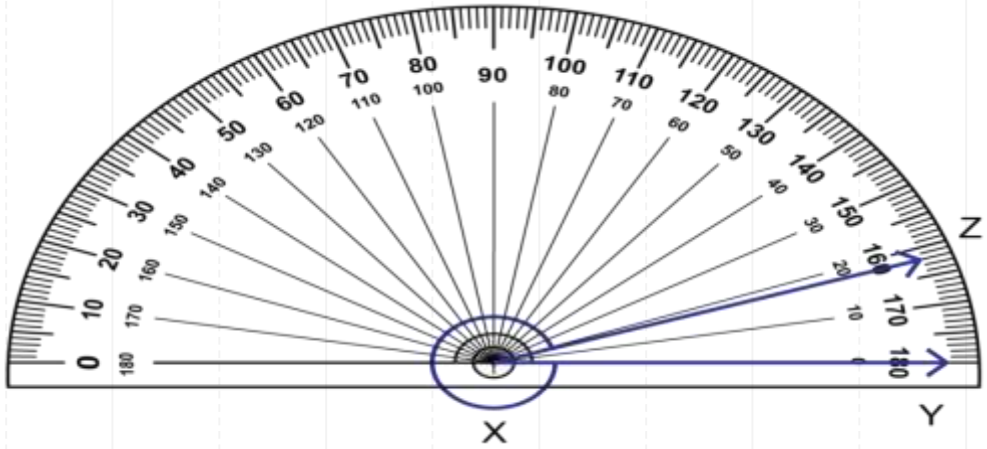
Step 1: Consider the diagram and estimate the size of the angle.

- The diagram shows two arms: XY and XZ. They form a reflex angle, which is shaded red.
- A reflex angle is between 180∘ and 360. This angle is very near to 360∘.

Step 2: Find a way to measure this reflex angle.

- An ordinary protractor can only measure angles between 0∘ to 180∘. We cannot measure a reflex angle with an ordinary protractor. We have to measure the angle that is not shaded and then subtract the answer from 360∘.

Step 3: Place the protractor correctly on the angle to measure.



- The centre of the protractor should be on the vertex of the angle.
- The base line of the protractor should be on one arm of the angle.

Step 4: Choose the scale and read off the size of the angle.

- The acute angle measures 18 degrees..

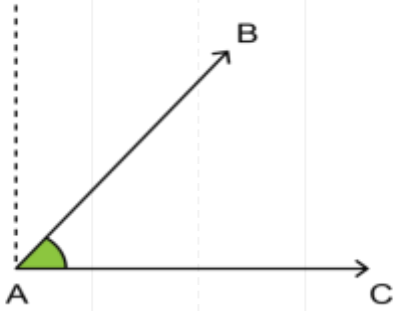
Step 5: Subtract the measured angle from 360∘ and give the correct answer.

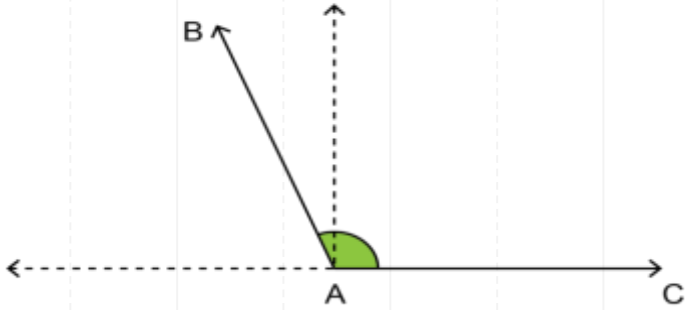
Check against your estimation, and name the reflex angle correctly.

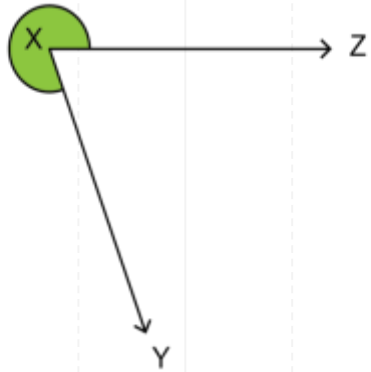
Answer is 360-18=342degrees.

Exercise

Use a protractor and measure the angles shown below.

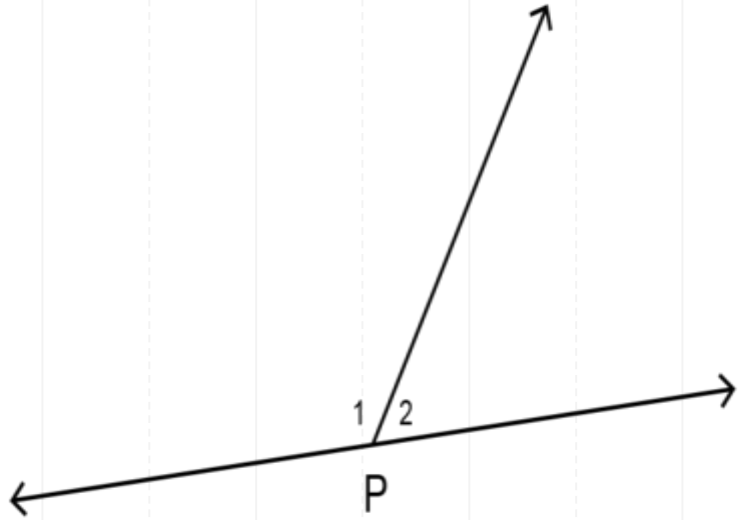






Angles On A Straight Line

A straight line is also called a straight angle. A straight angle is equal to 180∘. If a straight line is formed by more than one angle, the sum of those angles will be 180∘. We say the angles are **Supplementary angles.**



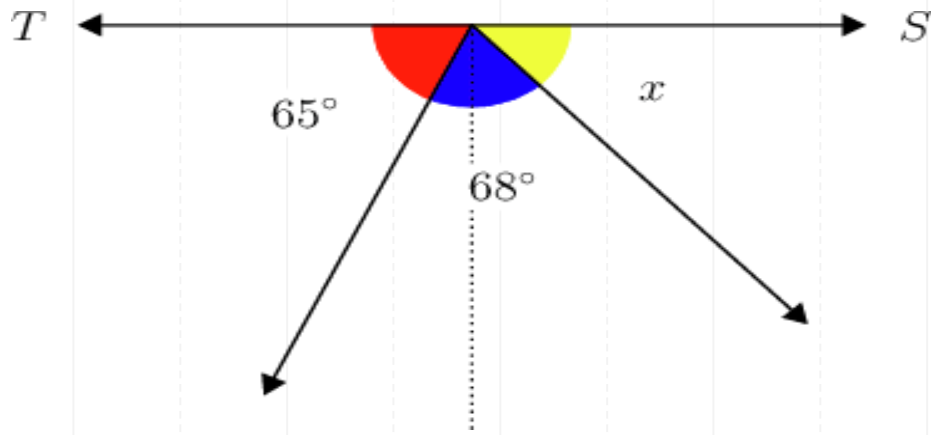
- In the diagram, the two angles are supplementary angles, because they form a straight line. P1 + P2= 180∘
- We can also say that the two angles in the diagram above are **adjacent angles**.

- Adjacent angles are next to each other. Two adjacent angles share the same vertex *and* they also share one common arm.

Note: not all adjacent angles are supplementary angles.

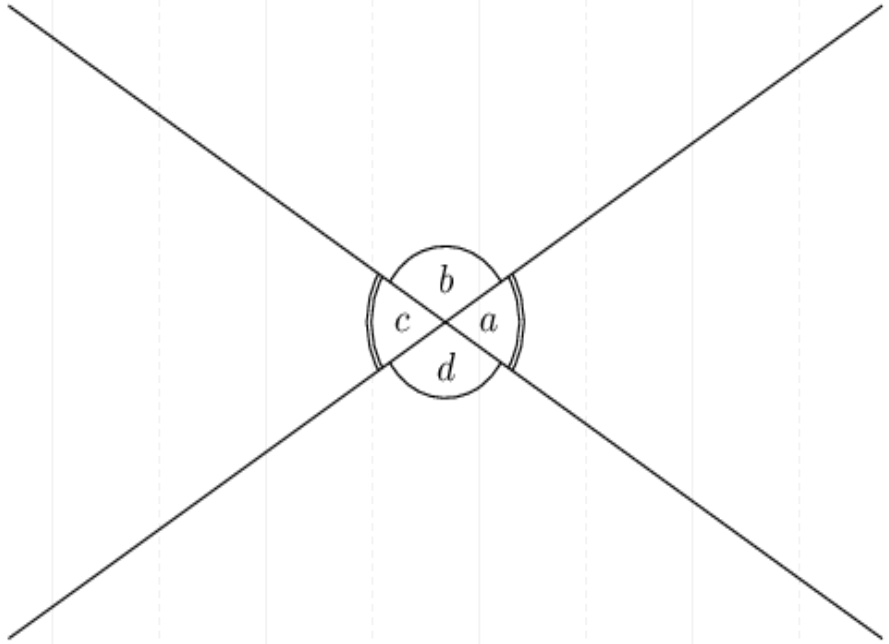
Worked Examples

Consider the diagram given below. You are given the following information: What is the value of x?



Angles At Intersecting Lines

- When two lines cross each other, we say the two lines are **intersecting** lines.
- The diagram shows two straight lines intersecting at a point, and forming the four angles <a, <b, <c and <d.



Two types of angles are formed by the intersecting lines.

Adjacent angles: Adjacent angles are angles that are next to each other. They have the same vertex and they share a common arm.

In the previous diagram the following angles are adjacent angles:

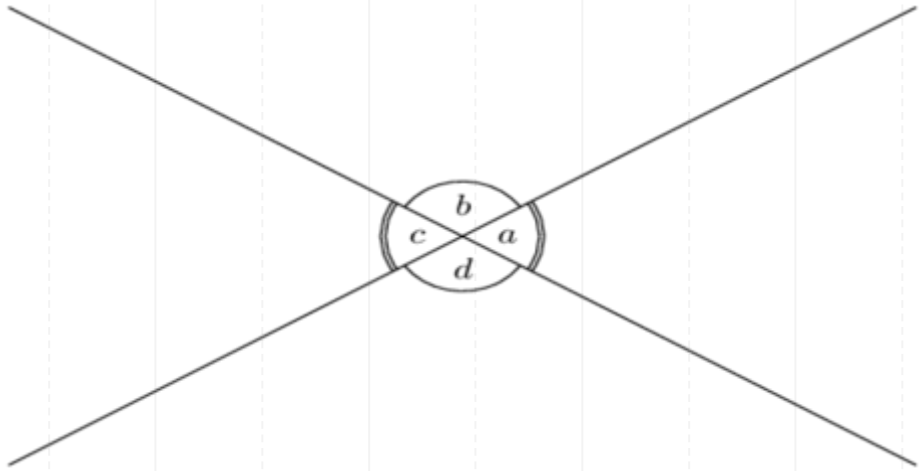
- <a and <b are adjacent
- <b and <c are adjacent
- <c and <d are adjacent
- <d and <a are adjacent

In each case, these pairs of adjacent angles form a straight line, so they are also supplementary.

Supplementary angles add up to 180∘. So, in this case we can also say:

- <a + <b = 180∘
- <b+ <c = 180∘
- <c + <d = 180∘
- <d + <a = 180∘

- The second type of angles formed are called “Vertically Opposite angles”
- Vertically opposite angles have the same vertex, but they are on *opposite* sides of the vertex.
- Vertically opposite angles are equal to each other.



In the diagram above:

- a^ = c^ because they are vertically opposite angles.
- b^= d^ because they are vertically opposite angles.

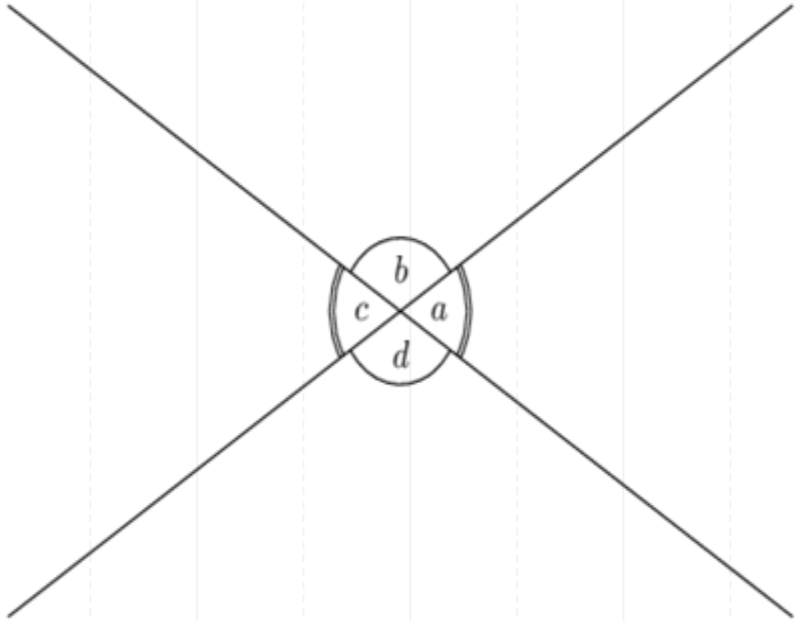
- **vertically opposite angles** by definition are angles on the opposite sides of a vertex formed by two intersecting lines. Vertically opposite angles are equal to each other.
- The four angles formed by two intersecting straight lines form a **revolution**. All the angles around one point form a revolution. One revolution is equal to **360∘**.

a + ˆb + ˆc + ˆd = 360◦

NOTE:

We can also use Greek letters to label angles:

- **We read α as "alpha ".**
- **We read β as "beta ".**
- **We read δ as “delta”.**

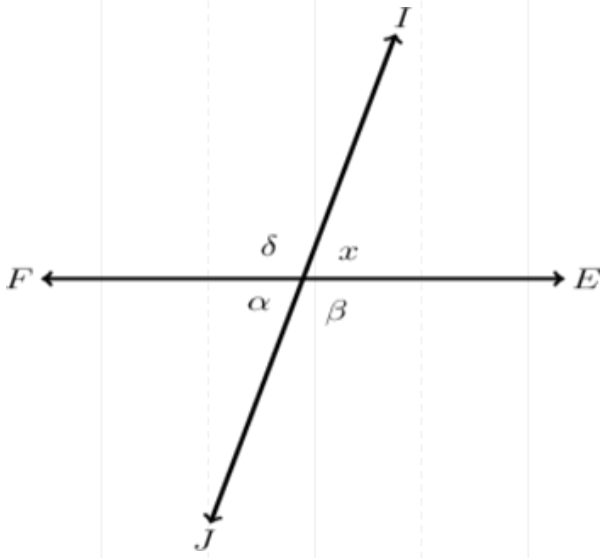


Identifying Types Of Angles At Intersecting Lines

The diagram shows line IJ intersecting line EF. The intersecting lines create four different angles. These angles are labeled with the variables α, β, δ, and x.

Questions:

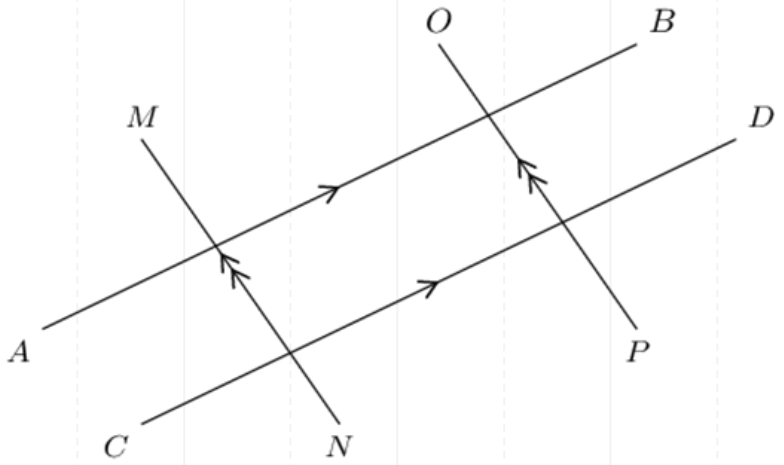
- Which angle or angles are adjacent to x^?
- Which angle is vertically opposite to x^?



Angles On Parallel Lines

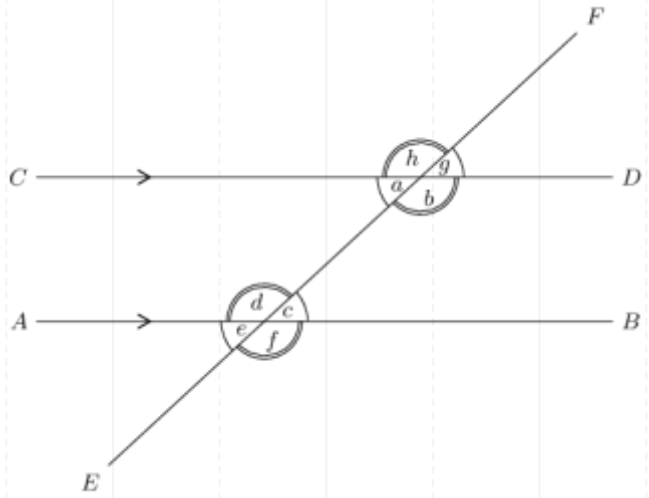
Parallel lines are always the same distance apart. We use arrow markings to indicate parallel lines, as shown below.

- In writing we use two vertical lines to indicate that two lines are parallel:
- AB∥CD and MN∥OP



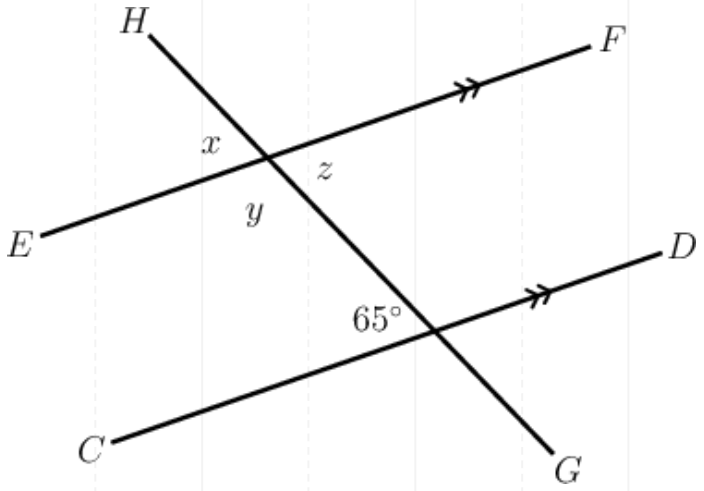
Transversal Line

A **transversal** is a line that crosses /intersects two or more parallel lines. In the diagram below, AB∥CD and EF is a transversal.



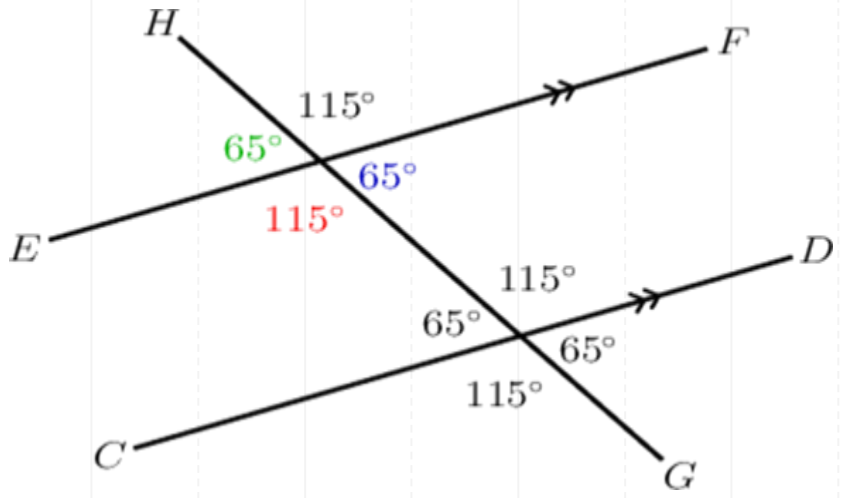
WORKED EXAMPLES

- The diagram shows that the transversal GHGH intersects the parallel lines CD and EF.
- The intersecting lines create angles. Some of these angles are labeled.



If the two lines are parallel, the four angles around the first intersection are the same as the four angles around the second intersection. We can use this to determine the unknown angles.

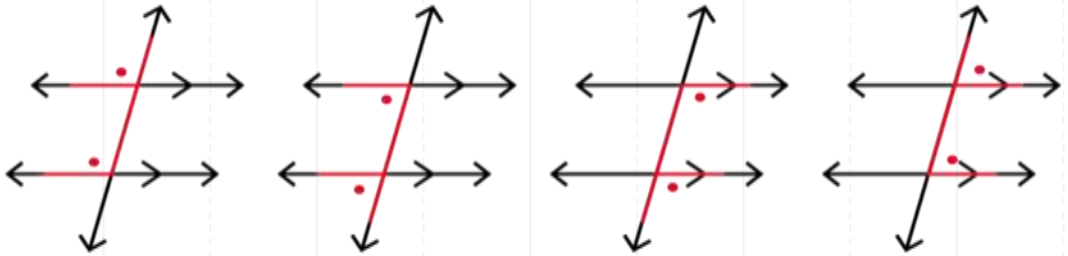
- x^ is in the same position as the angle of 65∘, so x=65∘.
- x^ and y^ are angles on a straight line, so y^ = 115∘.
- x^ and z^ are vertically opposite angles, so z^= 65∘



Corresponding Angles

Corresponding angles are in *matching* positions on the parallel lines. They are on the *same* side of the parallel lines, and on the *same* side of the transversal.

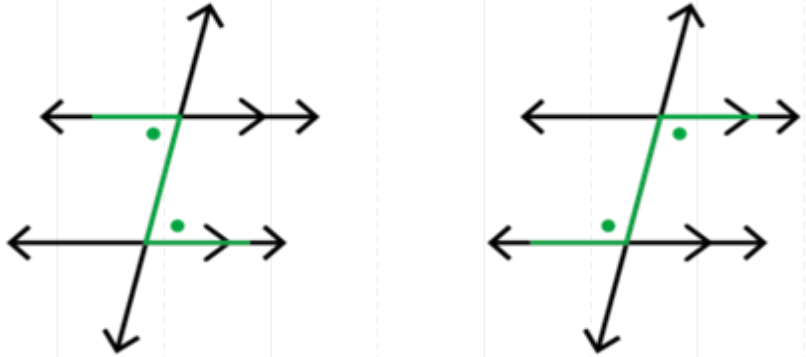
- If we colour the lines that make corresponding angles, we will see an "F " shape. This helps us to identify corresponding angles.
- Corresponding angles are equal, but *only* if the lines cut by the transversal are parallel.



Alternate Angles

- Alternate angles are both *inside* the parallel lines, but on *different* sides of the transversal.
- If we colour the lines that make alternate angles, we will see an "N " shape. This helps us identify alternate angles.

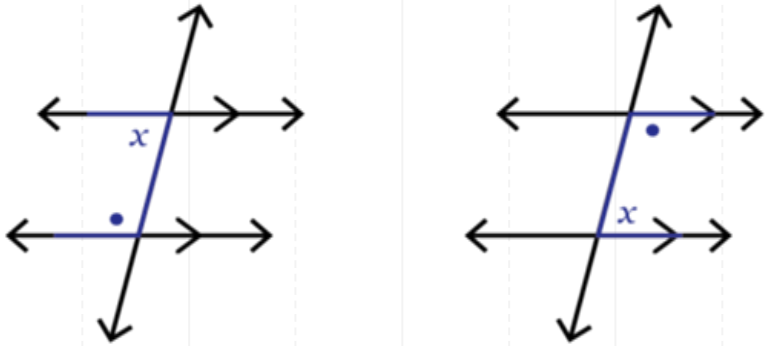
- Alternate angles are equal, but *only* if the lines cut by the transversal are parallel.



Co-interior Angles

- **Co-interior angles**: Co-interior angles are both *inside* the parallel lines, and on the *same* side of the transversal.
- If we colour the lines that make co-interior angles, we will see a "U " shape. This helps us identify co-interior angles.

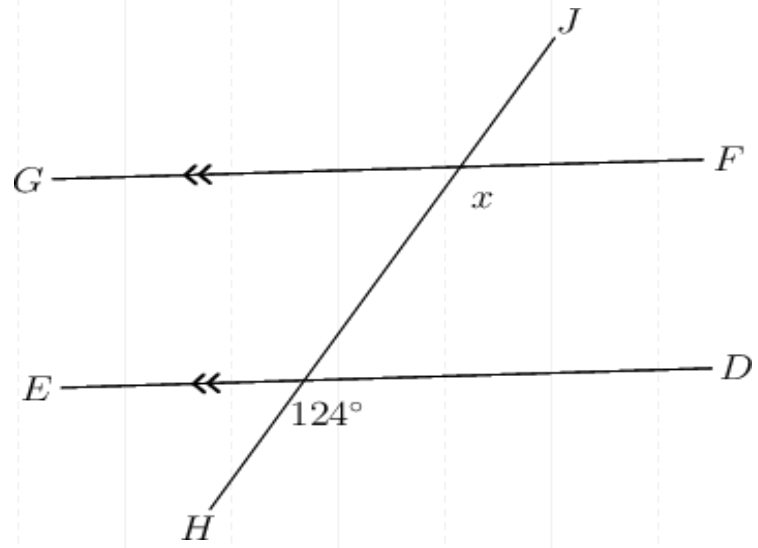
- Co-interior angles add up to 180∘, but *only* if the lines cut by the transversal are parallel.



Worked Examples

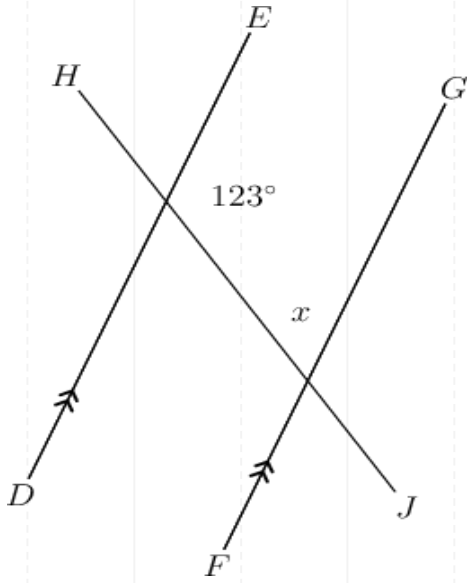
In the diagram below, DE∥FG and HJ is a transversal.

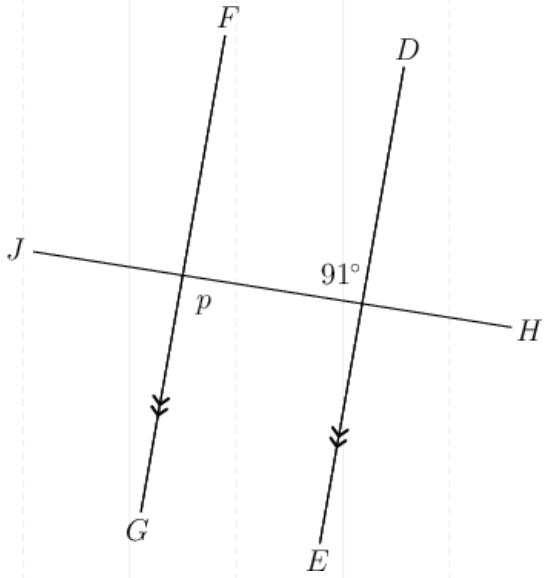
What is the value of x? (Give a reason for your answer.)

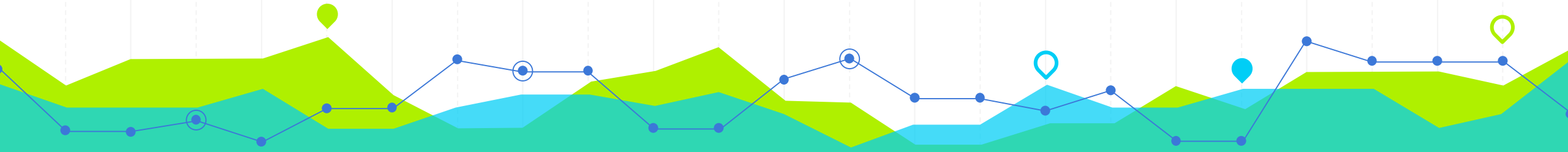


EVALUATION

- In the diagrams below, DE∥FG and HJ is a transversal.







THANK YOU FOR WATCHING!!