Term 1

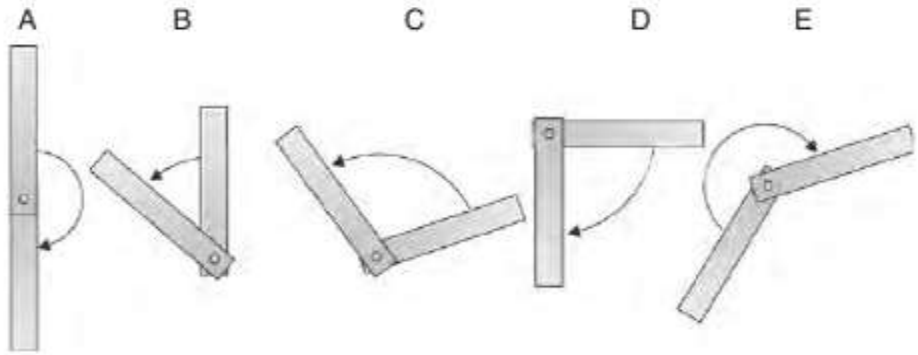
Unit 6 Measuring and drawing angles

In this unit you will:

- use a protractor to accurately measure and draw angles
- classify angles according to their size.

Getting started Looking at angles

1. Match each of the following angles with their names.



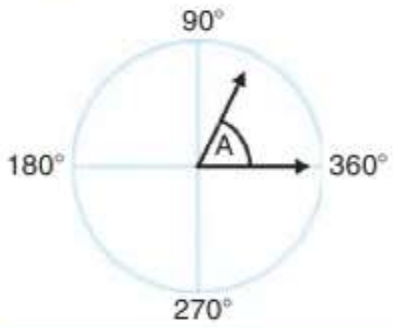
a) acute: less than a right angle
b) a right angle
c) obtuse: more than a right angle, but less than a straight angle
d) a straight angle
e) reflex: more than a straight angle, but less than a revolution.

2. Draw each of the following angles. Name each angle. Show the size of the angle with the curved line:

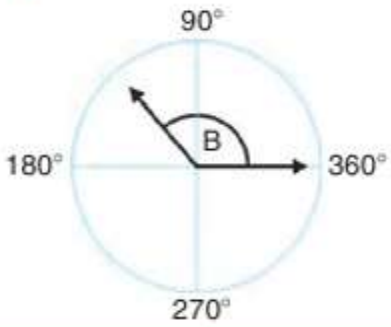
a) less than a straight angle, but more than a right angle
b) more than a straight angle, but less than a $\frac{3}{4}$ turn angle
c) less than a right angle
d) more than a $\frac{3}{4}$ turn angle, but less than a revolution.

3. Name the angles A, B, and C.

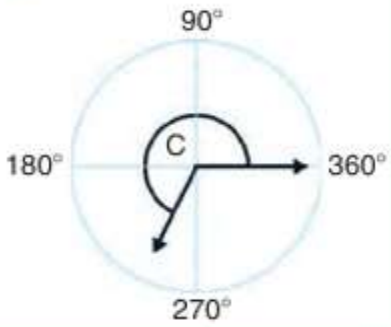
a)



b)



c)



Activity 6.1 What is an angle?

Drawing an angle

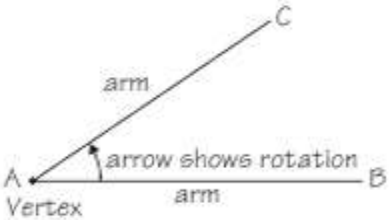
The line joining point A to point B is called the line segment AB.

Step 1: Draw a line segment on a piece of paper. Name it AB.

Step 2: Place your pencil on point A. Hold your ruler along the line AB.

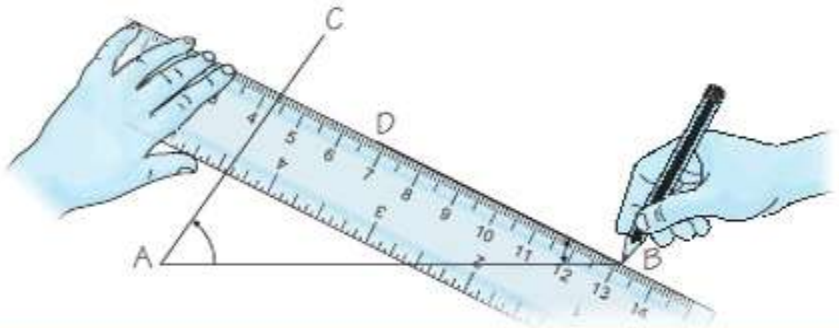
Step 3: Rotate your ruler a short distance anti-clockwise around the pencil. Draw a new line segment from A to C. Your drawing should look similar to this:

We name the angle you have drawn, BÂC or CÂB. We can also call it ∠A. This is because there are no other angles at the vertex A.



Step 4: Now place your pencil onto point B. Rotate your ruler clockwise around the pencil. Draw in a new line segment from B to D.

1. What letter marks the vertex of your new angle?
2. Name your new angle.

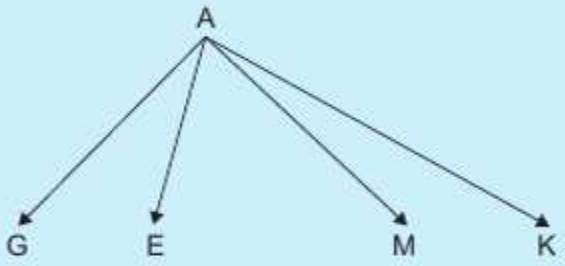


Key ideas

- We call the opening between two connected lines an *angle*. The angle measures the amount you rotated your ruler from the line AB to the line AC.
- We measure the size of an angle in degrees. The symbol for degrees is a tiny circle that we write after the number of units. For example, we write 60 degrees as 60°.
- We show rotation by drawing an arrow from the starting position to the end position around a point of rotation.
- We call the point A, where you placed your pencil and around which you rotated your ruler, the *vertex* of the angle. The lines AB and AC are the *arms* of the angle.
- We call the 180 angle units on the protractor *degrees*.
- We use three letters to name an angle. We use the letters that name the two arms, with the letter of the vertex in the middle. We call the angle you have drawn BÂC or CÂB. We call it ∠A if there are no other angles at the vertex.

Exercise 6.1 Naming angles

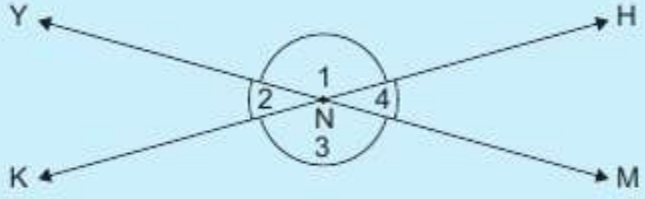
1. Name the angle formed between the following line segments. Use three letters.



a) GA and AE b) KA and AG c) EA and AM

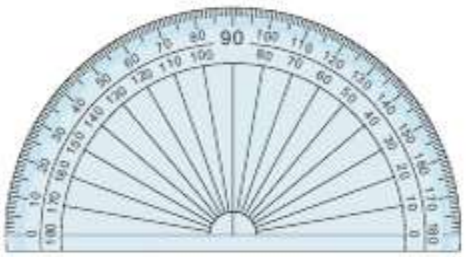
d) MA and AG e) GA and AK

2. Two crossing lines are shown. Write down the three-letter names for the angles marked 1 to 4:



Activity 6.2 Using a protractor to measure angles

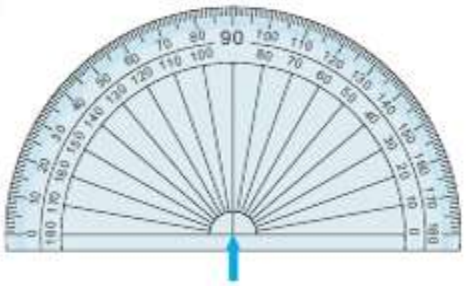
This is a semi-circular *protractor*. It is a half circle. It has been divided into 180 equal angle units. We call these units *degrees*.



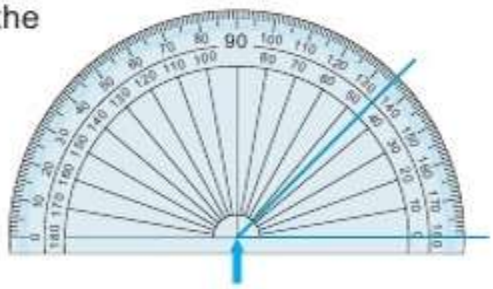
1. Why is the protractor marked in degrees from 0° to 180° in two rows?

Measuring an angle

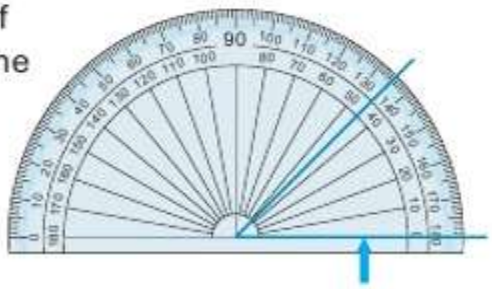
Step 1: Find the centre mark in the middle of the straight edge of the protractor.



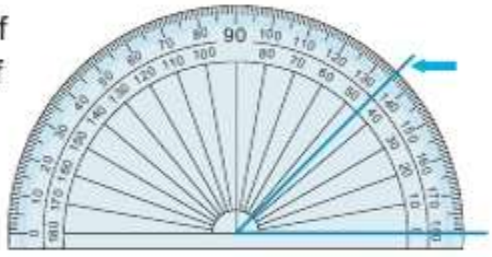
Step 2: Place the centre mark at the vertex of the angle you wish to measure. Like this:



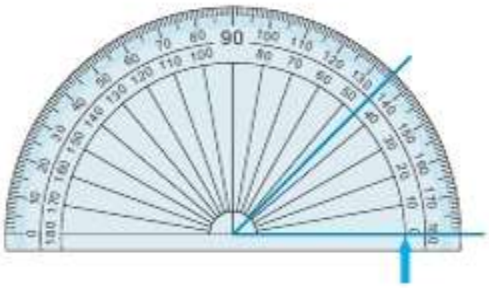
Step 3: Line up the zero on the straight edge of the protractor with one of the arms of the angle.



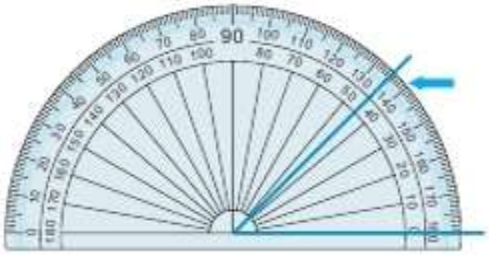
Step 4: Find the point where the second arm of the angle intersects the curved edge of the protractor. You may have to make the arms longer so that they reach past the protractor's edge.



Step 5: Read the number that is written on the protractor at the point of intersection. Always start at 0°. Count the tens on the inner circle of numbers: 0°; 10°; 20°; 30°; 40°...

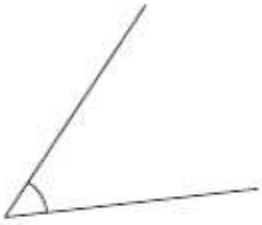


Now go to the outer circle of markings. Read the single degrees. You should get 5 degrees. The size of the angle is $40° + 5° = 45°$. This is the measure of the angle in degrees.

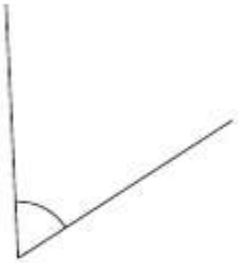


2. Measure the following angles. Use the steps on pages 59–60.

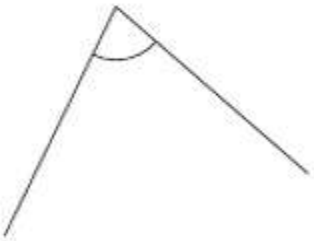
a)



b)

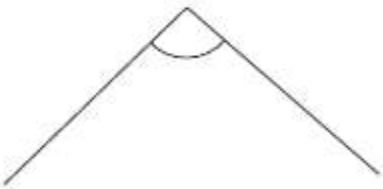


c)



d)

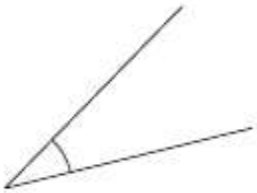
e)



f)

g)

h)



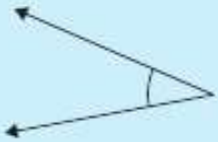
Key ideas

- A protractor has degree units. They are marked from right to left and from left to right.
- You must be sure about the direction of rotation you are measuring for a particular angle when you use the protractor. For example, the angle below is rotated anti-clockwise from 0° on the right. This means that the angle size is 50°. It is not 130°.
- You can measure any angle, as long as you place the vertex of the angle at the centre of your protractor.

Exercise 6.2 Measuring angles

Measure the size of each angle below. Use your protractor. Remember to place the vertex of the angle at the centre mark on the protractor.

1.



2.

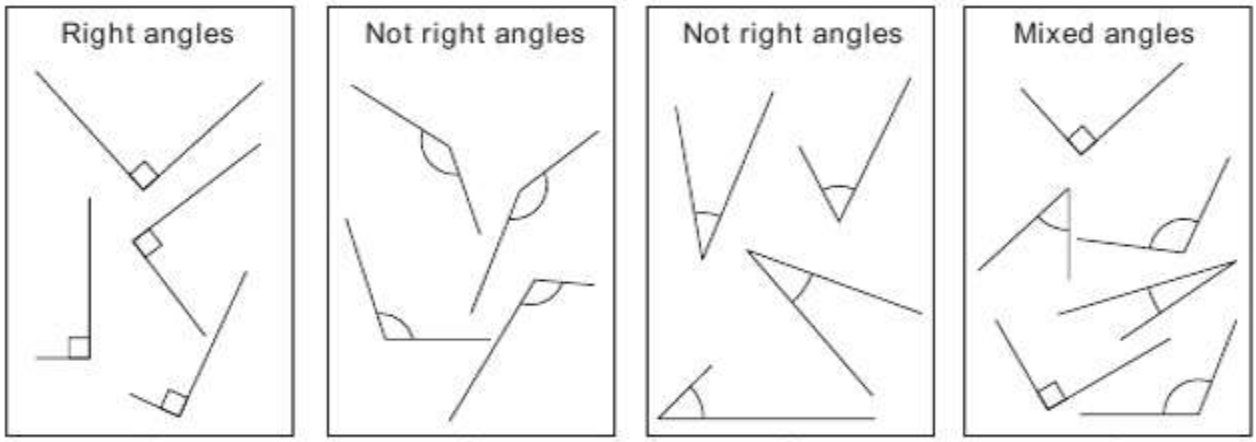
3.

4.

Activity 6.3 Sorting angles according to size

Work with a friend. Answer the questions.

1. Study the cards. They show right angles and angles that are not right angles.



   a) What is the difference between the right angles and the angles on Card 2?

   b) What is the difference between right angles and the angles on Card 3?

   c) How many right angles do you see on Card 4?

   d) Draw the angles on Card 4 that you can group with the angles on Card 2.

   e) Draw the angles on Card 4 that you can group with the angles on Card 3.

2. Look at the cards above. Describe a right angle.

3. We call the angles on Card 2 obtuse angles.

   a) Estimate the sizes of these angles.

   b) Describe obtuse angles. Use your own words.

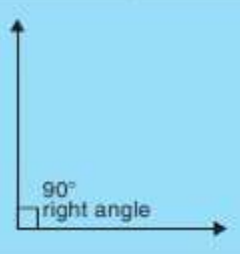
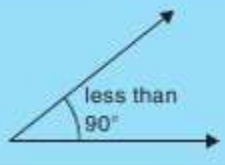
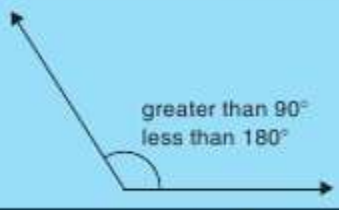
4. We call the angles on Card 3 acute angles.

   a) Estimate the sizes of these angles.

   b) Describe acute angles. Use your own words.

Key ideas

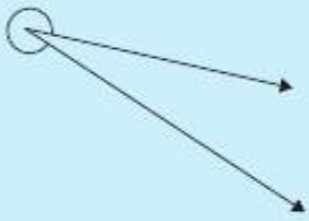
We can sort angles by comparing them to right angles or straight angles.

Angle type	Size	Drawing
Right angle	equal to 90°	
Straight angle	equal to 180°	
Acute angle	less than 90°	
Obtuse angle	greater than 90° but less than 180°	
Reflex angle	greater than 180° but less than 360°	

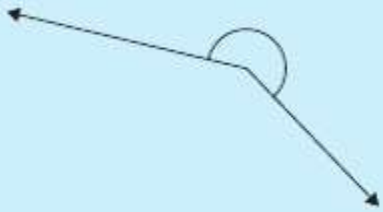
Exercise 6.3 Naming angles

1. Look at these two reflex angles. Answer the questions that follow.

i)



ii)



a) Estimate the sizes of these angles.

b) Describe the reflex angles above. Use your own words.

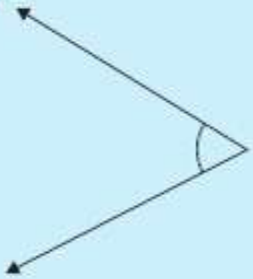
2. For each of the angles below:

   i) Identify the type of angle shown.

   ii) Estimate the size of the angle.

   iii) Measure the angle accurately. Use a protractor.

a)

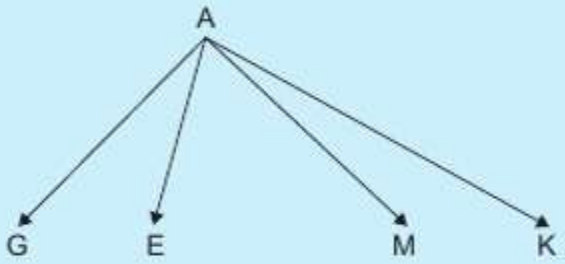


b)

c)

d)

3. Write down the letters of an angle that is:



a) a right angle b) an obtuse angle c) an acute angle

4. Complete this table:

Angle type	Angle size, in degrees	Angle shape
Acute angle	Between 0° and 90°	?
Right angle	?	

Obtuse angle	Between 90° and ?	
Straight angle	?	?
Reflex angle	?	?
Revolution	?	?

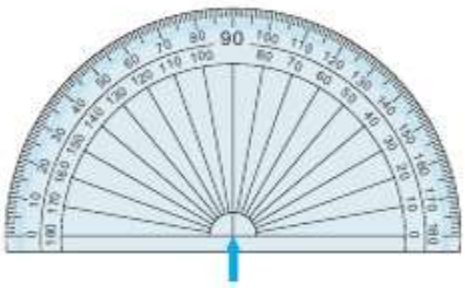
Activity 6.4 Drawing an angle of a particular size

We use a protractor to draw and measure angles.

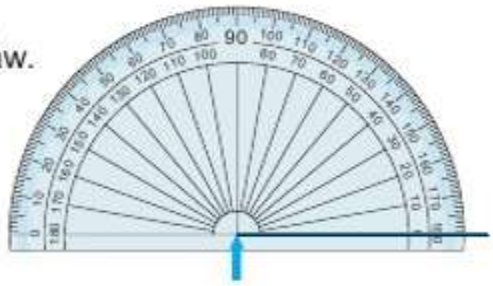
Drawing the angle DÊF = 50°

Step 1: Draw a straight line. Use your ruler. This line forms one side of your angle. Remember that you must name the vertex with the middle letter.

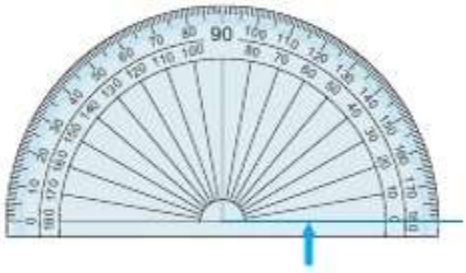
Step 2: Find the centre mark in the middle of the straight edge of the protractor.



Step 3: Place the protractor so that its centre mark is at the vertex of the angle you want to draw.

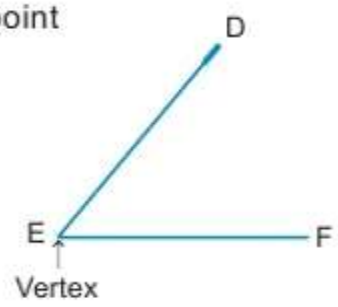


Step 4: Line up the zero on the straight edge of the protractor with your line.



Step 5: Always start at 0°. Use the inner circle. Count in tens around the curved edge of the protractor. Count from 0° to the size of the angle you want to make. Mark the point.

Step 6: Remove the protractor. Draw a line connecting your point to the vertex. You have formed an angle.



Exercise 6.4 Drawing angles

Draw the following angles. Follow the steps on pages 65–66.

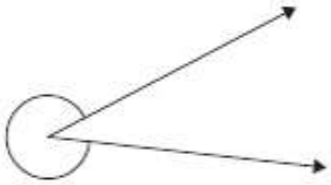
1. $D\hat{E}F = 176°$
2. $H\hat{I}J = 65°$
3. $K\hat{L}M = 43°$
4. $N\hat{O}P = 97°$
5. $Q\hat{R}S = 125°$
6. $T\hat{U}V = 14°$

Activity 6.5 Reflex angles

1. Measure this reflex angle. Follow the steps.

   Step 1: Measure the remaining part of the revolution.

   Step 2: Subtract this amount from 360°. You have found the size of the reflex angle.



2. Draw the reflex angles below. Follow these steps.

   Step 1: Subtract the reflex angle from 360°.

   Step 2: Draw the new angle.

   Step 3: Mark the rotation on your drawing. This shows the reflex angle.

   a) $H\hat{I}J = 195°$
   b) $A\hat{B}C = 315°$
   c) $K\hat{L}M = 343°$
   d) $D\hat{E}F = 276°$

Exercise 6.5 Drawing more angles

Draw the angles:

1. $A\hat{B}C = 61°$
2. $D\hat{E}F = 217°$
3. $H\hat{I}J = 134°$
4. $T\hat{U}V = 195°$
5. $X\hat{Y}Z = 348°$

Summary

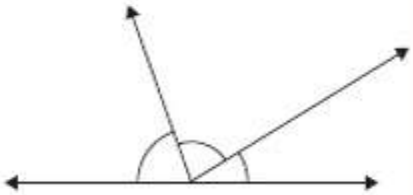
Measuring and drawing angles

- Angles are formed between any two lines that meet or cross.
- The *vertex* of the angle is the point at which the two lines meet.
- We can also call the two lines leading from the vertex the *arms* of the angle.
- An angle measures in *degrees* the amount of rotation from one arm to the other.
- We use a mathematical instrument called a *protractor* to measure angles. We call the units on the protractor *degrees*.
- We write degrees with a tiny circle after the number of units.
- We use three letters to name an angle. We use the letters that name the two arms, with the letter of the vertex in the middle. If there are no other angles at the vertex, we can also use the letter of the vertex to name the angle.

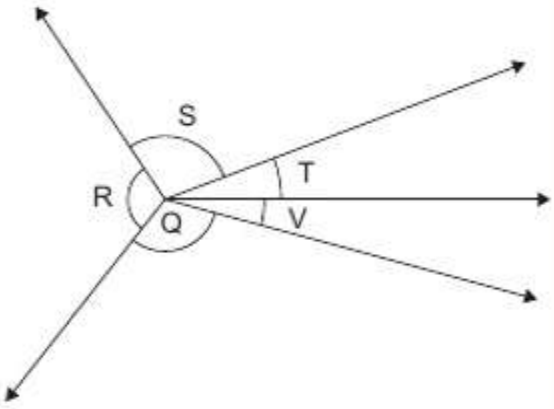
Check what you know

1. How many degrees make up each of the following?
   a) a full rotation
   b) a half rotation
   c) a quarter rotation
   d) a third of a full rotation

2. The angles shown here form a straight line. Do not measure the angles. What is the sum of these angles?



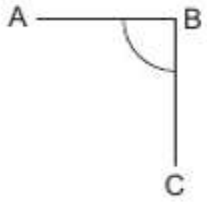
3. Angles are shown around point Q alongside. What do you think the sum of these angles will be? Explain. Check by measuring with a protractor.



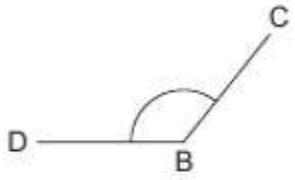
4. For each of the angles below:

- **i)** Use the letters shown to name the angle.
- **ii)** Identify the type of angle shown.
- **iii)** Estimate the size of the angle.
- **iv)** Measure the angle accurately with your protractor.

a)

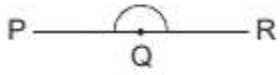


b)

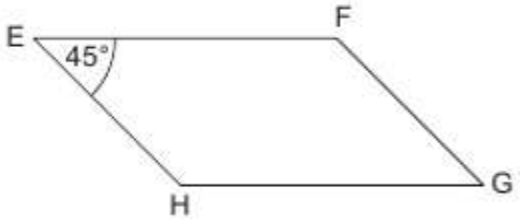


c)

d)



5. Look at the sketch. Only the size of angle FEH is given.



- **a)** What do you think the size of angle FGH is?
- **b)** Now measure angle FGH.