

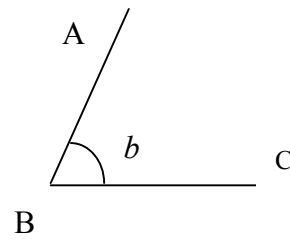
## Properties of Angles

When two lines meet an angle is formed.

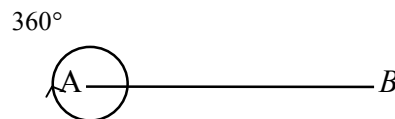
Angles are measured in degrees using a protractor.

65 degrees is written  $65^\circ$ .

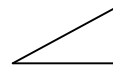
The angle of  $b^\circ$  shown below is called the angle  $ABC$  because we can draw the angle by starting at  $A$ , moving to  $B$  and then to  $C$ .



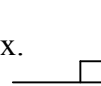
The total angle swept out by the line  $AB$  when it is rotated until it comes back to its original position is  $360^\circ$ .



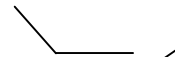
An angle that is less than  $90^\circ$  is called acute.



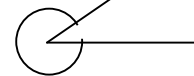
An angle which is exactly  $90^\circ$  is called a **right angle** and often denoted by a box. The lines are at right angles or perpendicular.



An angle of more than  $90^\circ$  but less than  $180^\circ$  is called **obtuse**.

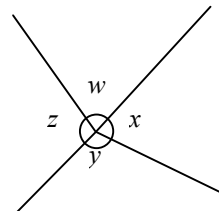


An angle of more than  $180^\circ$  but less than  $360^\circ$  is called **reflex**.

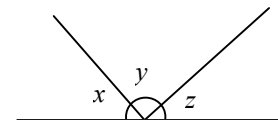


## Properties of Angles and Straight Lines

1. The total angle at a point is  $360^\circ$   
 $w + x + y + z = 360^\circ$



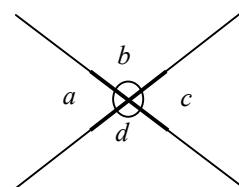
2. The total angle on a straight line is  $180^\circ$   
 In the diagram,  $x + y + z = 180^\circ$



3. When two straight lines cross, vertically opposite angles are equal.

In the diagram,

- angles  $a$  and  $c$  are equal,
- angles  $b$  and  $d$  are equal.

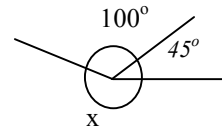


O is called a **vertex**, so these pairs of equal angles are called **vertically opposite**. Look for angles in an 'X' shape.

## Examples

1. Angles that fit round a point add up to  $360^\circ$

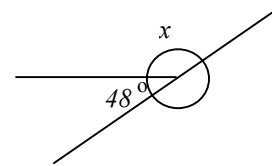
Angle  $x$  must be  $215^\circ$  because  
 $100 + 45 + 215 = 360$



Work this out as:  $100 + 45 = 145$        $360 - 145 = 215$

2. Angles that fit on a straight line add up to  $180^\circ$

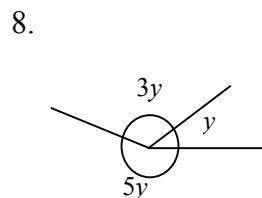
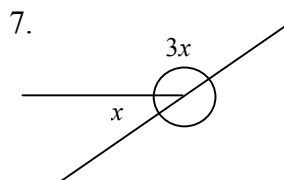
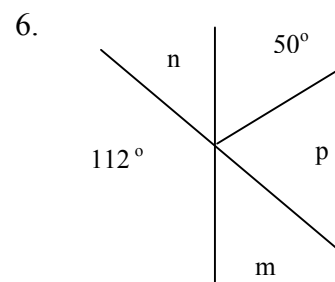
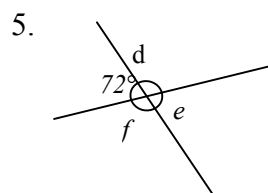
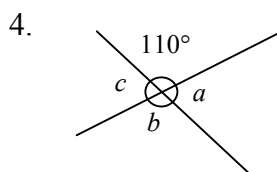
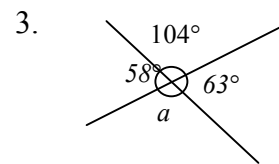
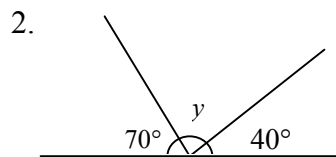
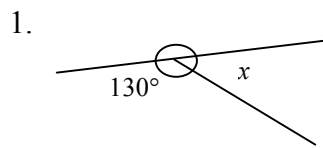
Angle  $x$  must be  $132^\circ$  because  
 $48 + 132 = 180$



Work this out as:  $180 - 48 = 132$

## Exercise 1

In the diagrams below, find the size of each lettered angle.

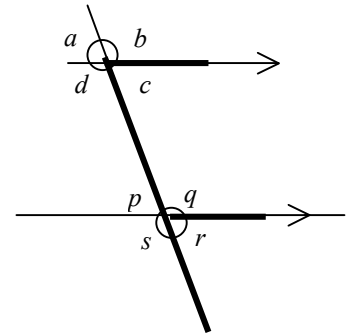


## Angles between parallel lines

1. *If parallel lines are cut by another line, corresponding angles are equal.*  
In the diagram, the parallel lines are arrowed.

- angles  $a$  and  $p$  are equal,
- angles  $b$  and  $q$  are equal,
- angles  $c$  and  $r$  are equal,
- angles  $d$  and  $s$  are equal.

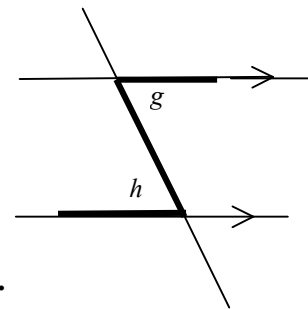
These pairs of angles are called **corresponding angles**.  
Look for an 'F' shape.



2. *Alternate angles between parallel lines are equal*

In the diagram,  $g = h$ .

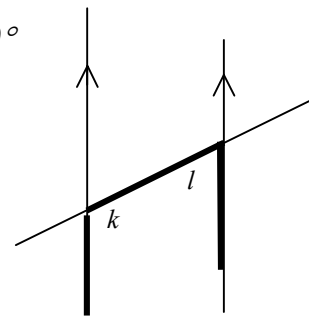
They are on different sides of the line crossing the parallels. This is why they are called **alternate angles**.  
Look for a 'Z' shape.



3. *Interior angles between parallel lines add up to  $180^\circ$*

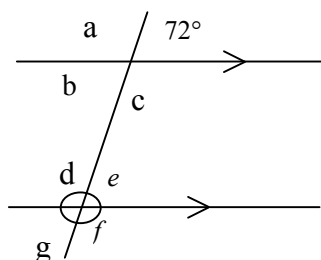
In the diagram,  $k + l = 180^\circ$ .

They are called **interior angles**.



### Worked Example 1.

Find the angles marked with letters in this diagram:



**a =**  
**c =**

**b =**

**d =**  
**f =**

**e =**  
**g =**

**Worked Example 2.**

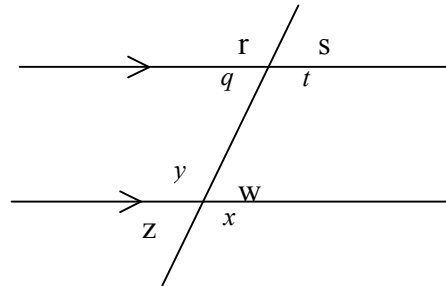
Look at this diagram, write as many pairs as you can of

(a) vertically opposite

(b) corresponding

(c) alternate

(d) interior angles



**Exercise 2**

In the diagrams below, find the size of each lettered angle.

