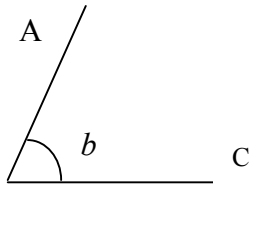
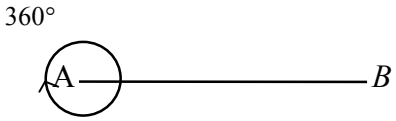
Properties of Angles

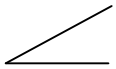
When two lines meet an angle is formed.
Angles are measured in degrees using a protractor.
65 degrees is written 65°.
The angle of b° shown below is called the angle ABC because we can draw the angle by starting at A, moving to B and then to C.



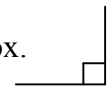
The total angle swept out by the line AB when it is rotated until it comes back to its original position is 360°.



An angle that is less than 90° is called acute.

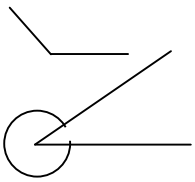


An angle which is exactly 90° is called a **right angle** and often denoted by a box.
The lines are at right angles or perpendicular.



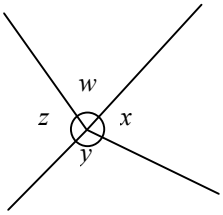
An angle of more than 90° but less than 180° is called **obtuse**.

An angle of more than 180° but less than 360° is called **reflex**.

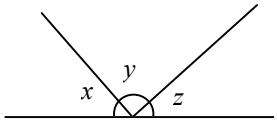


Properties of Angles and Straight Lines

1. *The total angle at a point is 360°*
$w + x + y + z = 360^0$

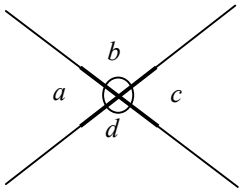


2. *The total angle on a straight line is 180°*
In the diagram, $x + y + z = 180^0$



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

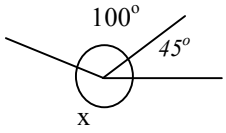
In the diagram,
- angles a and c are equal,
- angles b and d are equal.



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°



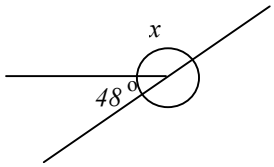
Angle x must be 215° because
100 + 45 +215 = 360

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

2. Angles that fit on a straight line add up to 180 °

Angle x must be 132° because
48 + 132 = 180

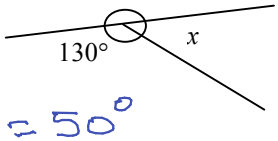
Work this out as: 180 – 48 = 132



Exercise 1

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

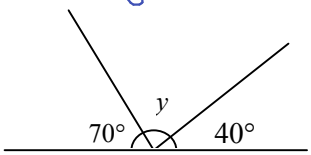
1.



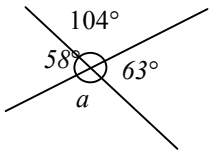
$x = 50^\circ$

2.

$y = 70^\circ$

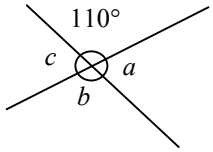


3.



$a = 135^\circ$

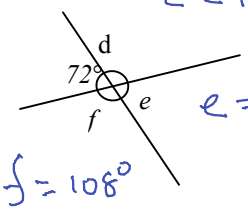
4.



$a = 70^\circ$
$b = 110^\circ$
$c = 70^\circ$

5.

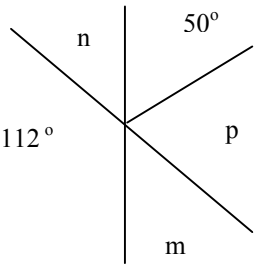
$d = 108^\circ$



$e = 72^\circ$
$f = 108^\circ$

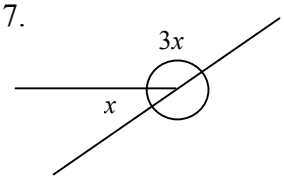
6.

$n = 68^\circ$



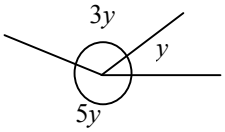
$p = 62^\circ$
$m = 68$

7.



$x + 3x = 180$
$4x = 180$
$x = \frac{180}{4} = 45^\circ$

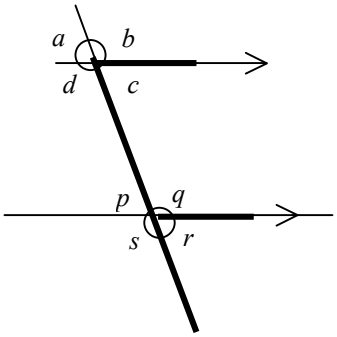
8.



$3y + y + 5y = 360$
$9y = 360$
$y = \frac{360}{9} = 40^\circ$

Angles between parallel lines

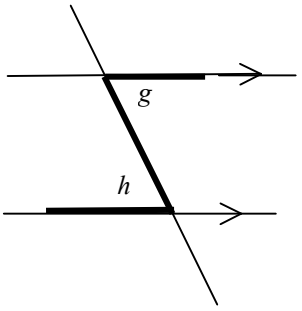
1. *If parallel lines are cut by another line, corresponding angles are equal.*
In the diagram, the parallel lines are arrowed.



- 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.

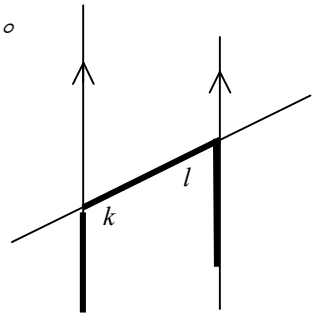
2. *Alternate angles between parallel lines are equal*



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°*

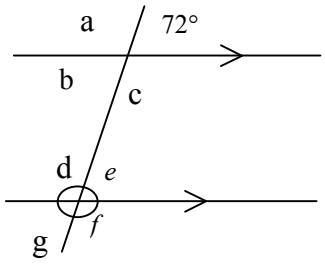


In the diagram, $k + l = 180°$.

They are called **interior angles**.

Worked Example 1.

Find the angles marked with letters in this diagram:



a = 108°
b = 72°
c = 108°
d = 108°
e = 72°
f = 108°
g = 72°

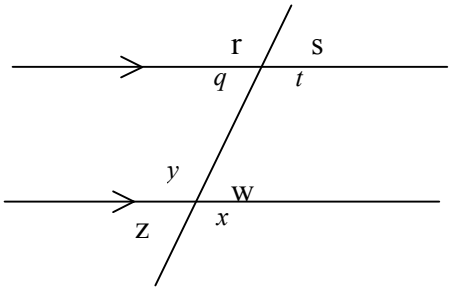
Worked Example 2.
Look at this diagram, write as many pairs as you can of

(a) vertically opposite

q and s y and x
r and t z and w

(b) corresponding

s and w q and z
r and y t and x



(c) alternate

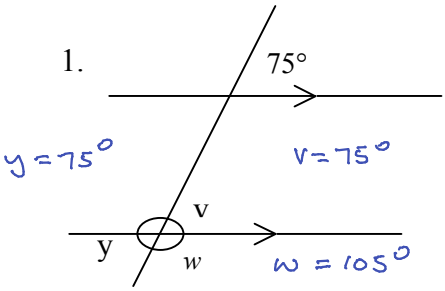
y and t
q and w

(d) interior angles

q and y w and t

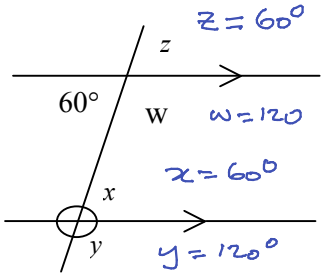
Exercise 2
In the diagrams below, find the size of each lettered angle.

1.



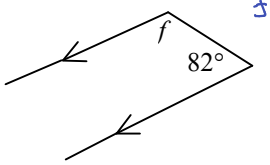
$y = 75^\circ$ $v = 75^\circ$ $w = 105^\circ$

2.



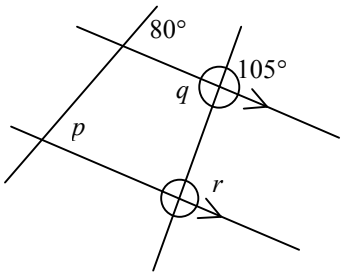
$z = 60^\circ$ $w = 120$ $x = 60^\circ$ $y = 120^\circ$

3.



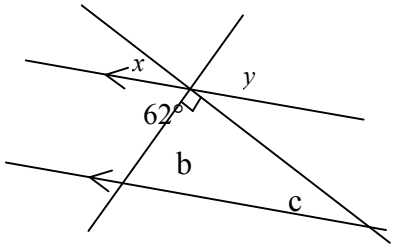
$f = 180 - 82 = 98^\circ$

4.



$q = 105^\circ$ $r = 105^\circ$ $p = 80^\circ$

5.



$b = 62^\circ$ $c = 28^\circ$
$y = 62^\circ$
$x = 28^\circ$