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: $100 + 45 = 145 \quad 360 - 145 = 215$

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:

```
<table>
<thead>
<tr>
<th>a</th>
<th>72°</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td></td>
</tr>
</tbody>
</table>
```

$ a =$  
$ b =$  
$ c =$  
$ d =$  
$ e =$  
$ f =$  
$ 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.

1. 2.

3. 4.

5.