Introduction to Geometry (Ref: Croft & Davison Chs.21 & 25)

Geometry – Angles

If a rod, fixed at one end, is pivoted to form a circle, it will have moved through an angle of 360°. A degree is defined as $\frac{1}{360}$ of a revolution. Symbol(°) for degree

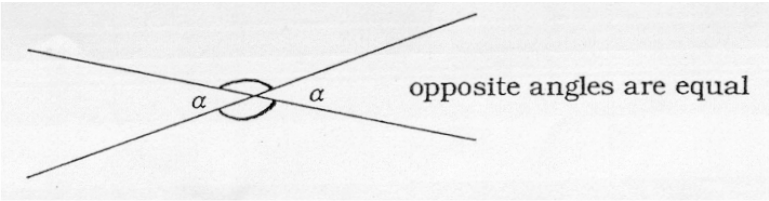
If a degree is divided into 60 equal parts, each one is a minute. Symbol(')

If a minute is divided into 60 equal parts, each one is a second. Symbol(")

Eg. 45° 12' 52"

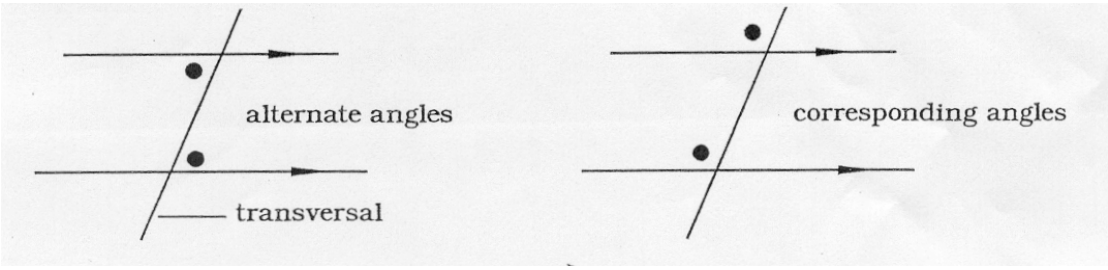
Lines and angles

When 2 straight lines cross, 2 pairs of opposite angles are formed. Opposite angles are equal in size

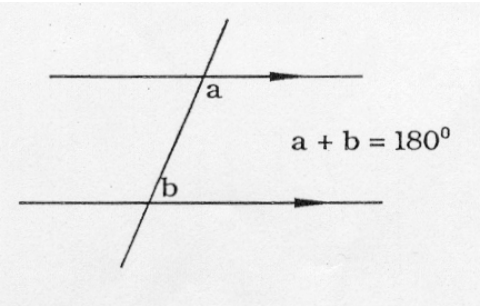


In geometry, angles or lines marked with the same symbol are the same size.

Parallel lines and transversal



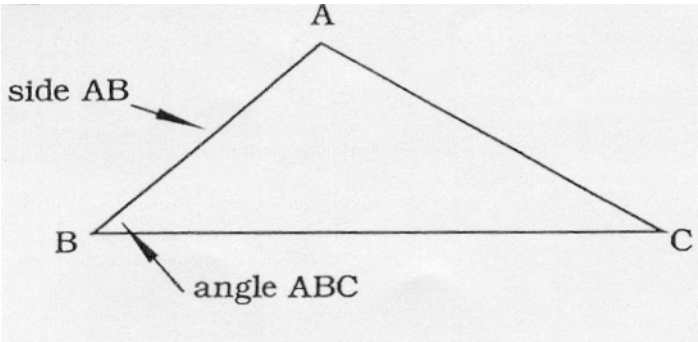
Parallel lines are lines that do not meet. The arrow heads on the lines show that they are parallel.
Alternate angles and corresponding angles within parallel lines are equal in size.



Angles that add up to 180° are called supplementary angles. Angles a and b above are supplementary. Whereas angles that add up to 90° are called complementary angles.

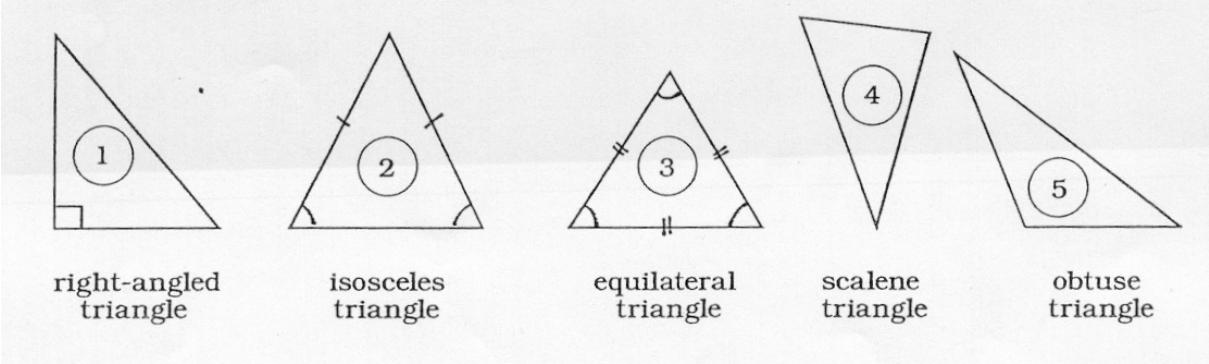
Triangles

A triangle is the shape formed when 3 separate straight lines are used to enclose an area. Sides are identified by letters at each end, angles by the bounding letters in order.



The three angles of any triangle add up to a total of 180°

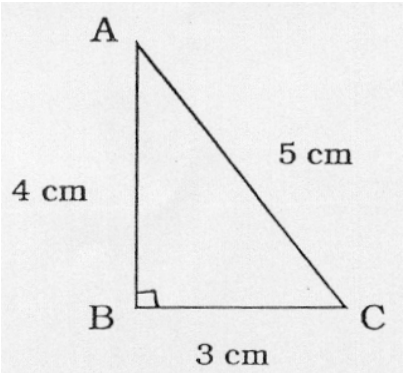
Types of triangle



1. Right-angled triangle - one angle exactly 90°
2. Isosceles triangle - two sides equal in length and the two angles at the base equal in size. The base is the non-equal side.
3. Equilateral triangle - all three sides equal in length and all three angles = 60°
4. Scalene triangle - all three sides different in length and all three angles different sizes
5. Obtuse triangle - one angle bigger than 90°

Pythagoras theorem

The sides of a right-angled triangle have a special relationship known as Pythagoras Theorem. This states that the square on the hypotenuse is equal to the sum of the square on the other two sides. The hypotenuse is the side opposite the right-angle, and will always be the longest.



$AC^2 = AB^2 + BC^2$

$5^2 \quad 4^2 + 3^2$

$25 = 16 + 9$

Pythagoras theorem can be used to determine whether or not a triangle is right-angled.

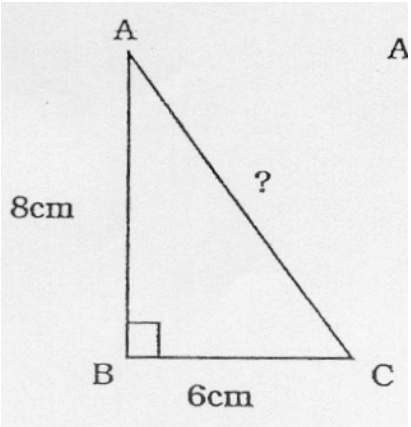
For example, triangle A has sides of 4cm, 8cm and 12cm in length. Triangle B has sides 5cm, 12cm and 13cm in length. Which of the triangles is right angled?

If a triangle has a right-angle, the longest side squared must equal the sum of the other two sides squared.

Triangle A	Triangle B
Does $12^2 = 8^2 + 4^2$	Does $13^2 = 12^2 + 5^2$
$144 \neq 64 + 16$	$169 = 144 + 25$
So triangle A is NOT right-angled	So triangle B is right-angled

The theorem can also be used to determine the length of an unknown side if the triangle is known to be right-angled.

For example, one side of a right-angled triangle is 6cm long, the second side is 8cm long. Calculate the length of the hypotenuse.



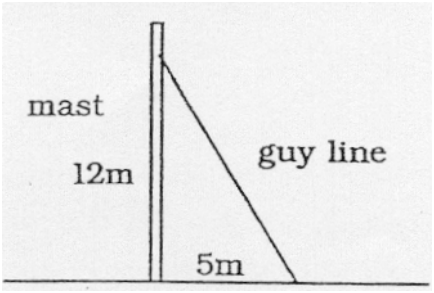
As triangle ABC is right-angled

$AC^2 = AB^2 + BC^2$
$AC^2 = 8^2 + 6^2$
$AC^2 = 64 + 36$
$AC^2 = 100$
so $AC = \sqrt{100} = 10\text{cm}$

If the length of the hypotenuse is already known, the unknown length is calculated by subtracting the square of the shorter side from the square of the hypotenuse before finding the square root.

The Pythagoras theorem can be used to solve practical problems provided a right-angled triangle can represent the information given.

For example, a guy line used to steady a mast. The anchor point on the mast is 12m from the ground, and the line is attached to a point on the ground 5m from the base of the mast. How long must the guy line be?



(length of guy)^2 $= 12^2 + 5^2$
$= 144 + 25$
$= 169$

Length of guy $= \sqrt{169} = 13\text{m}$

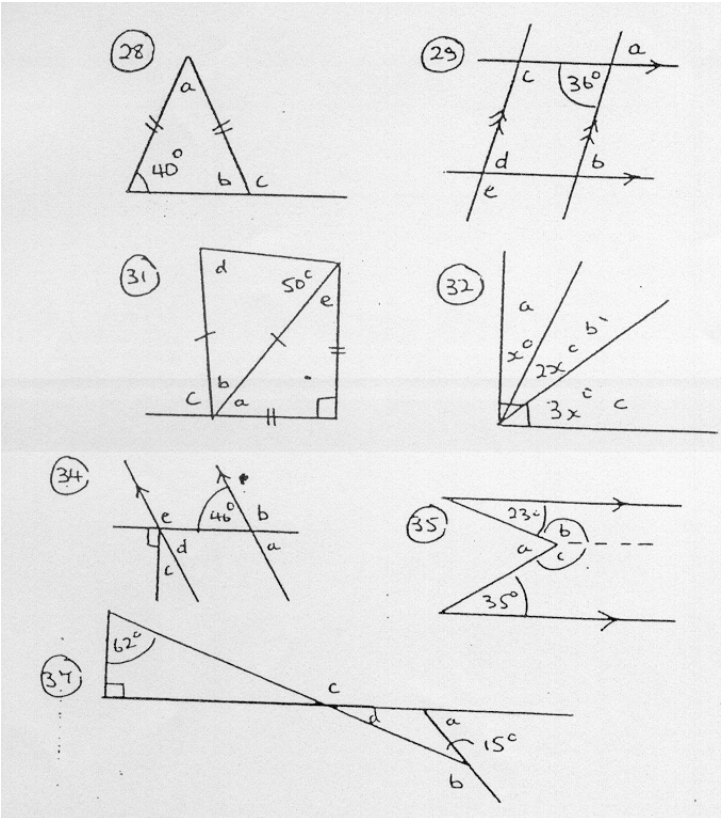
Introduction to Geometry Worksheet 1

Each of the following gives two angles of a triangle. Determine the third.

1. 26°, 48°
2. 81°, 17°
3. 64°, 71°
4. 28°12', 62°21'
5. 108°42', 12°36'
6. 100°14', 68°49'

Which of the following triangles are right-angled?

7. Triangle with sides of 7cm, 11.3cm, 18cm
8. Triangle with sides of 26cm, 24cm, 10cm
9. Triangle with sides of 19.36cm, 16.8cm, 9.2cm
10. Triangle with sides of 35.4cm, 47.2cm, 59cm

Introduction to Geometry Worksheet 2

Determine the size of all the lettered angles in each of the following diagrams.