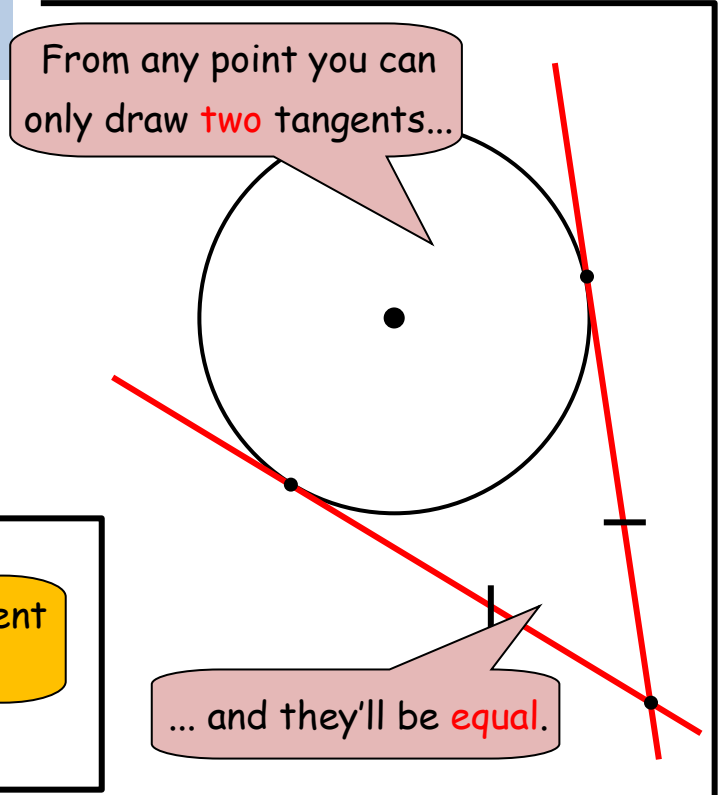
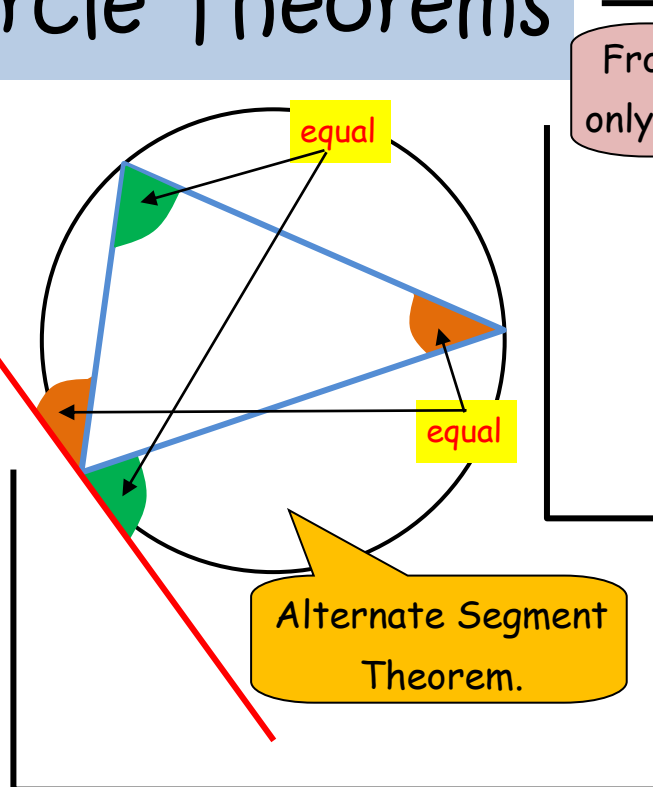
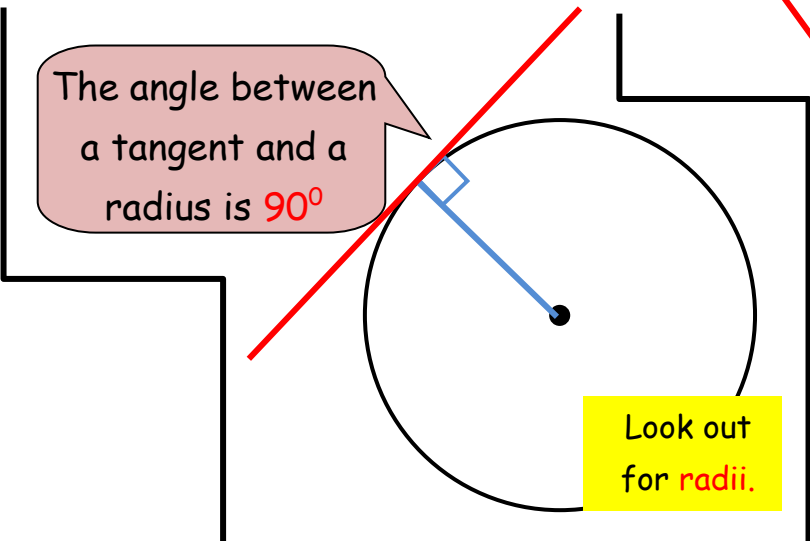
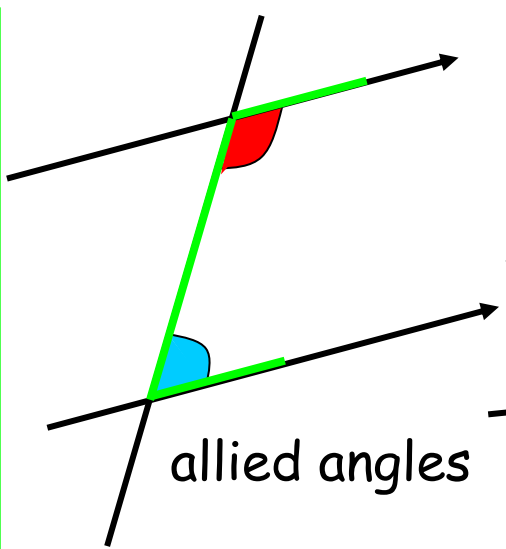


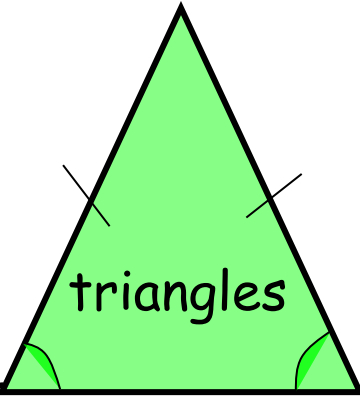
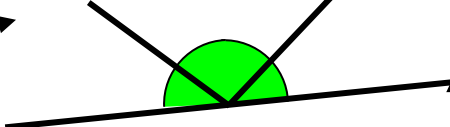
# Circle Theorems



180°

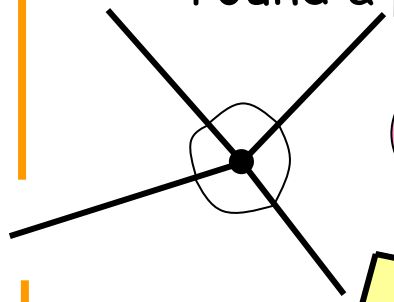


straight lines

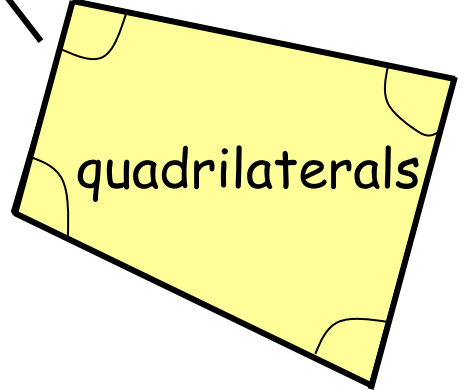


triangles

round a point



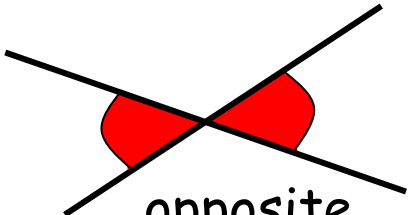
360°



quadrilaterals

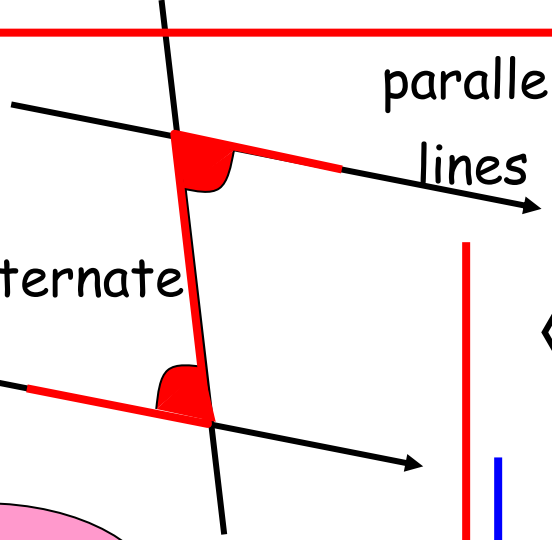
# Angle Rules

opposite

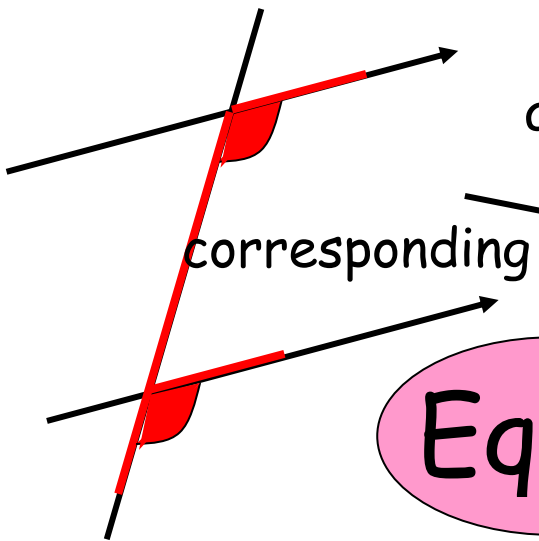


parallel lines

alternate

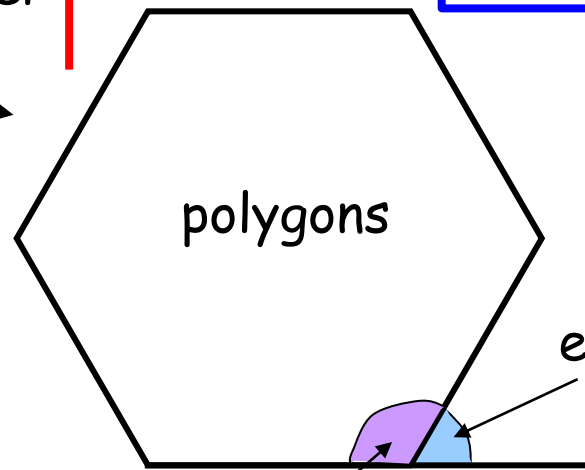


corresponding



Equal

polygons



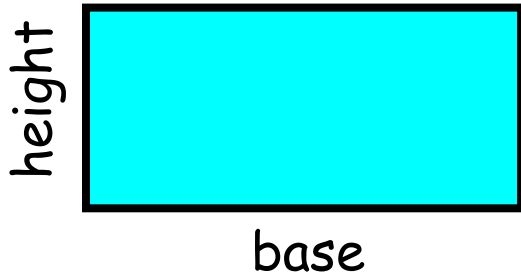
interior angle

exterior angle

angle sum =  $(n - 2) \times 180^\circ$

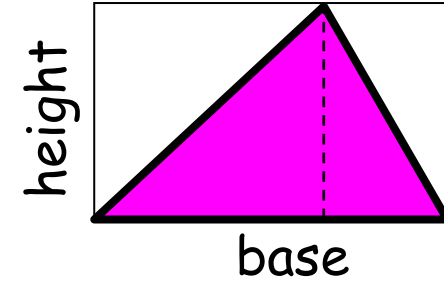
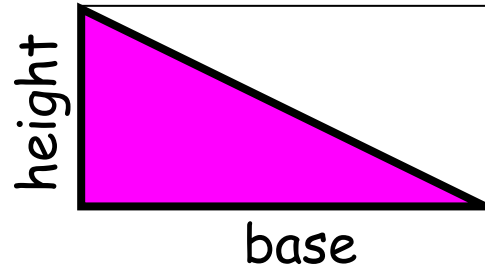
...add up to 360°

## rectangle



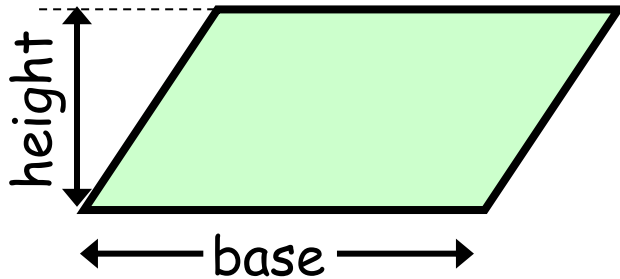
$$\text{Area} = \text{base} \times \text{height}$$

a **triangle** is half the area of a rectangle



$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$

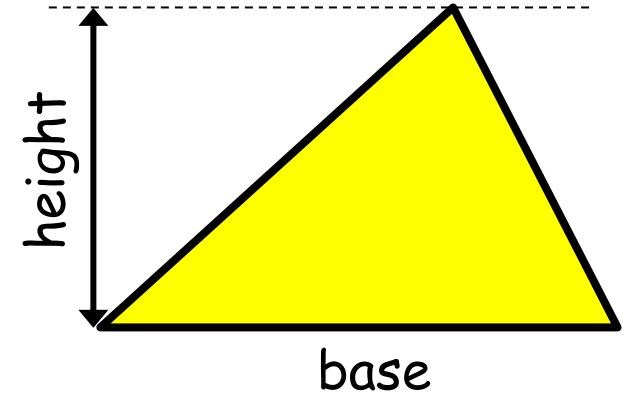
## parallelogram



$$\text{Area} = \text{base} \times \text{height}$$

# AREA

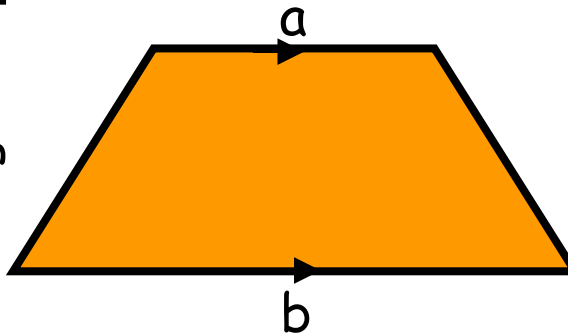
Always use the  
**perpendicular**  
height



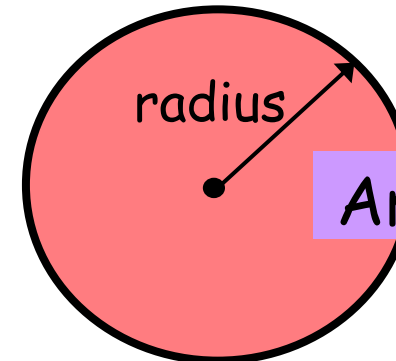
## trapezium

$$\text{Area} = \frac{(a + b) \times h}{2}$$

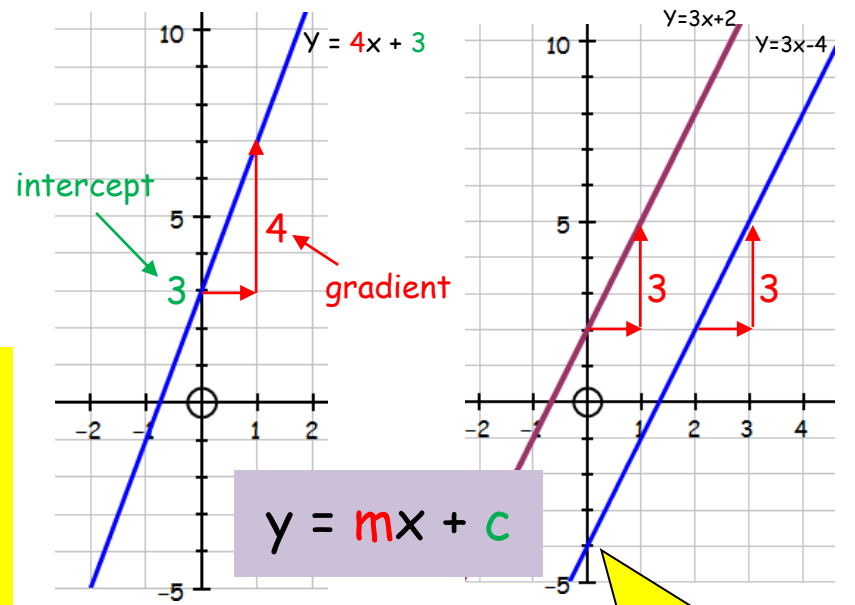
height



## circle

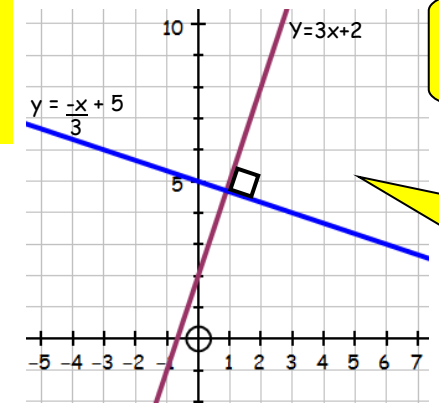


# Linear Graphs



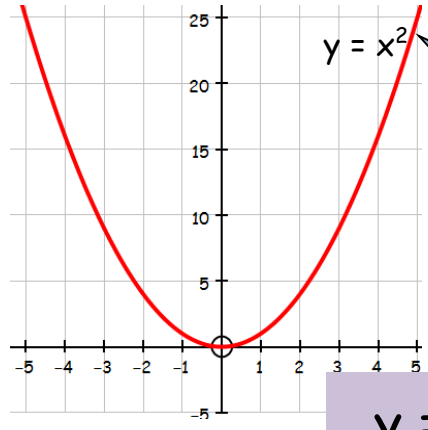
$$y = mx + c$$

Parallel lines have the same gradient.



Perpendicular lines have gradients with a product of -1.

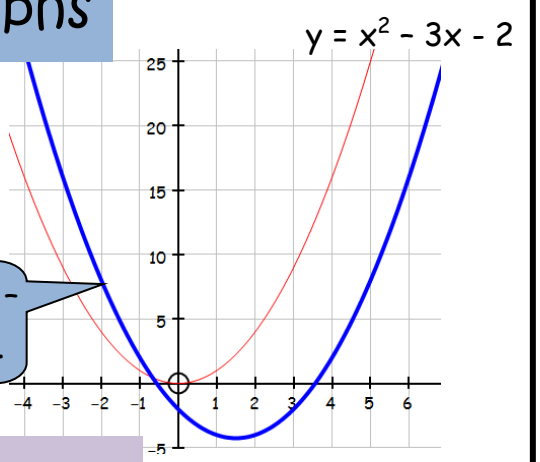
# Quadratic Graphs



Square numbers.

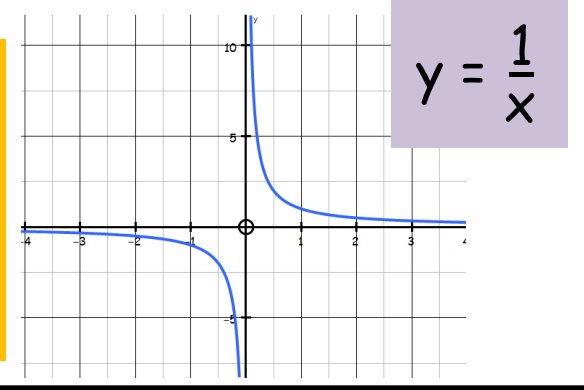
U shaped - parabola.

$$y = ax^2 + bx + c$$



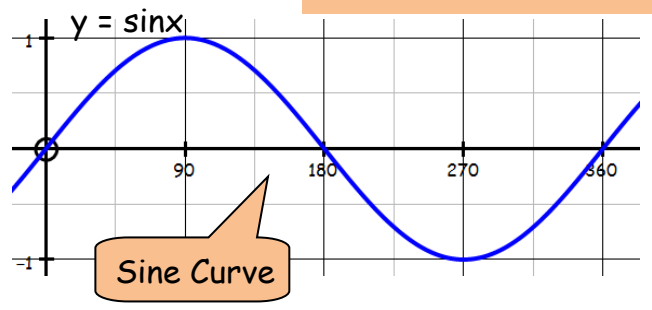
# GRAPHS

# Reciprocal

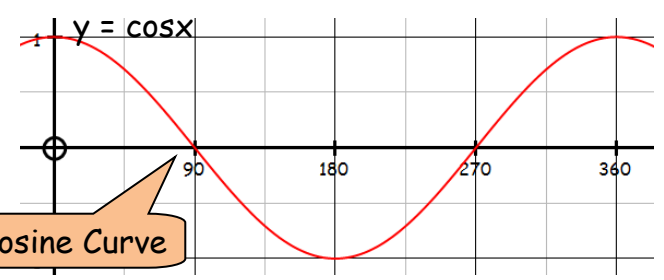


$$y = \frac{1}{x}$$

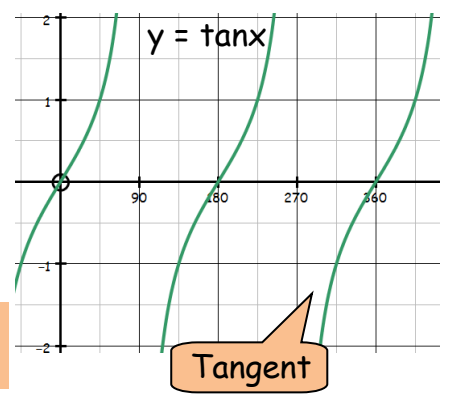
# Trigonometric Graphs



Sine Curve

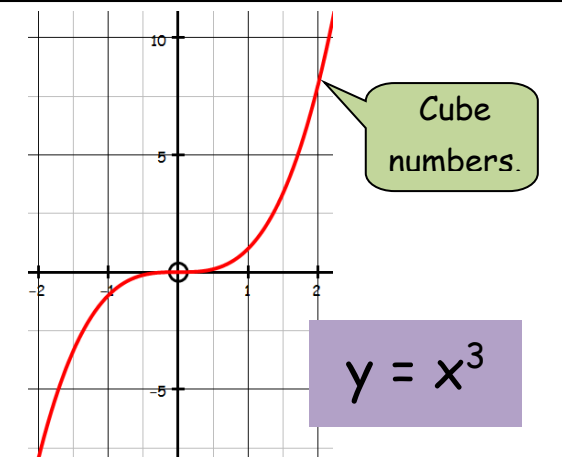


Cosine Curve



Tangent

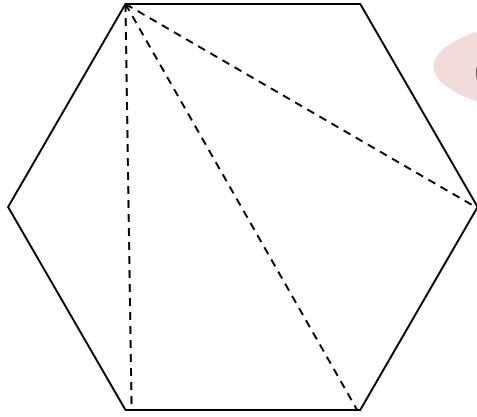
# Cubic Graphs



Cube numbers.

$$y = x^3$$

## Angle Sum



$$(n - 2) \times 180^\circ$$

number of  
triangles

$$4 \times 180^\circ = 720^\circ$$



triangle



quadrilateral

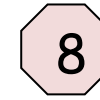


pentagon



hexagon

7 - heptagon



octagon



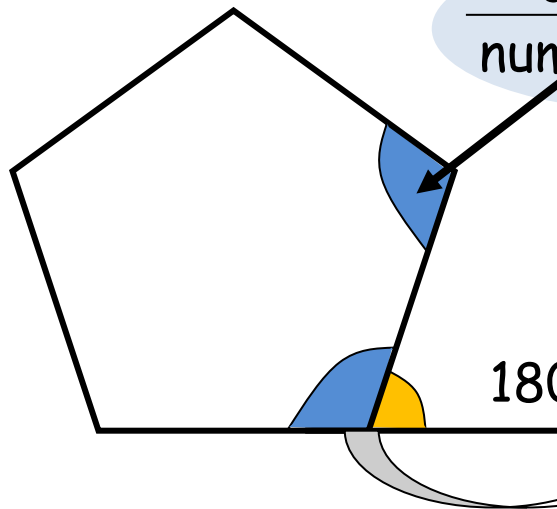
9 - nonagon

10 - decagon



# Polygons

## interior angle



$$\frac{\text{angle sum}}{\text{number of sides}}$$

OR

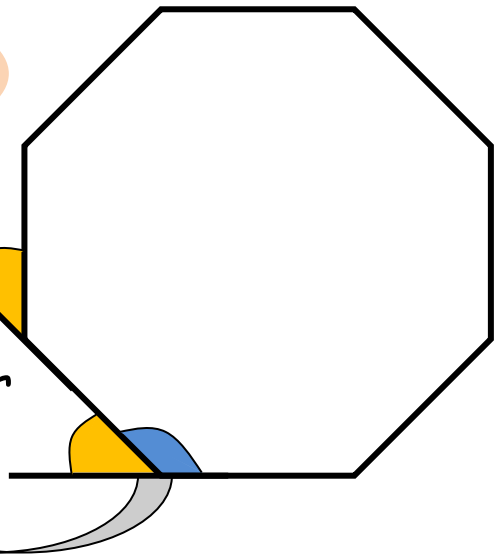
$$180^\circ - \text{exterior angle}$$

## exterior angle

$$\frac{360^\circ}{\text{number of sides}}$$

OR

$$180^\circ - \text{interior angle}$$



# Solving:

- Factorising
- Formula
- Completing the square
- Drawing a graph

**Factorising:**

easy...  $x^2 + 7x + 12 = 0$   
 $(x + 3)(x + 4) = 0$   
 $x = -3$  or  $x = -4$

brackets

... more difficult!

multiply

$$3x^2 - 5x + 2$$

$\frac{6}{1 \times 6}$

$2 \times 3$

$$3x^2 - 3x - 2x + 2$$

$$3x(x - 1) - 2(x - 1)$$

$$(3x - 2)(x - 1)$$

# Quadratic Equations

$$ax^2 + bx + c$$

**The formula:**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Completing the square:**

$$x^2 + 4x - 3 = 0$$

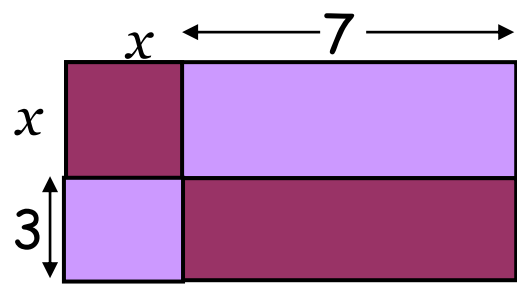
half of 4x

$$(x + 2)^2 - 4 - 3 = 0$$

subtract 2<sup>2</sup>

$$(x + 2)^2 - 7 = 0$$

$$x + 2 = \pm\sqrt{7}$$

$$x = \pm\sqrt{7} - 2$$


**Difference of Two Squares:**

$$x^2 - 16$$

$$(x - 4)(x + 4)$$

x squared subtract 4 squared

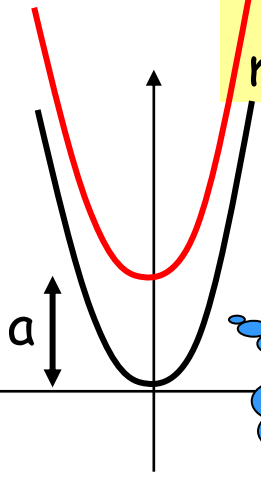
**Graphs:**

draw lines to find solutions

**Parabola - u shaped graph**

$$y = fx + a$$

plus a - up  
minus a - down

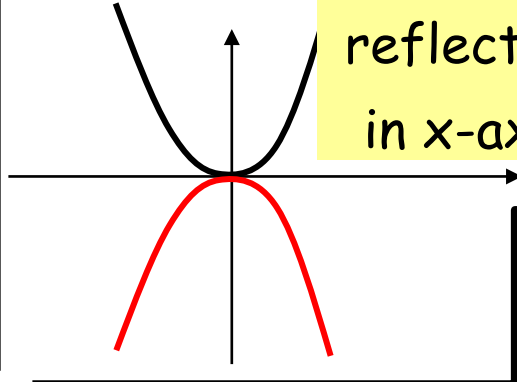


$\begin{pmatrix} 0 \\ a \end{pmatrix}$

$y=x^2$

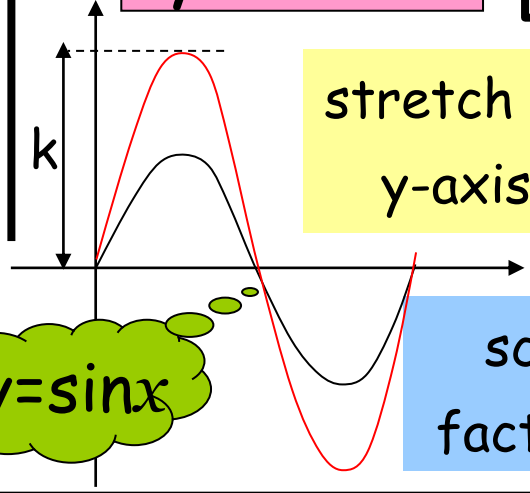
$$y = -fx$$

reflection  
in x-axis



$$y = kfx$$

stretch in  
y-axis



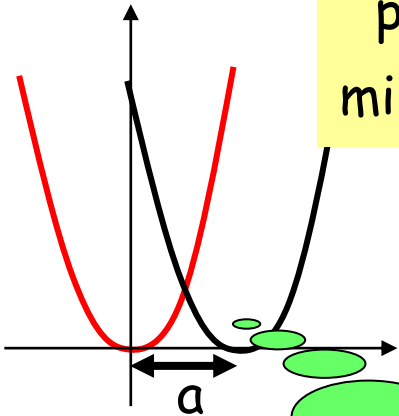
$y=\sin x$

scale  
factor k

# Transforming Curves

$$y = f(x + a)$$

plus a - left  
minus a - right

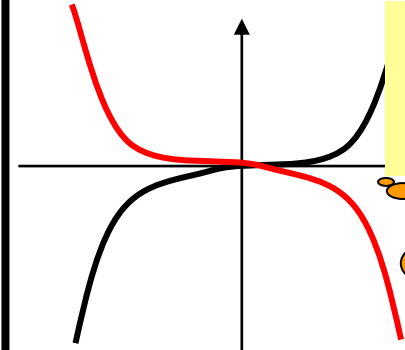


$\begin{pmatrix} -a \\ 0 \end{pmatrix}$

opposite to what u  
might think!

$$y = f(-x)$$

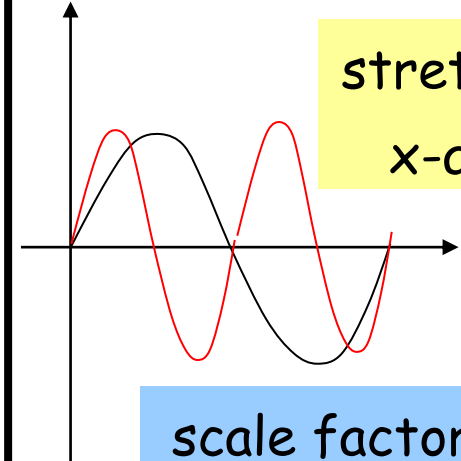
reflection  
in y-axis



$y=x^3$

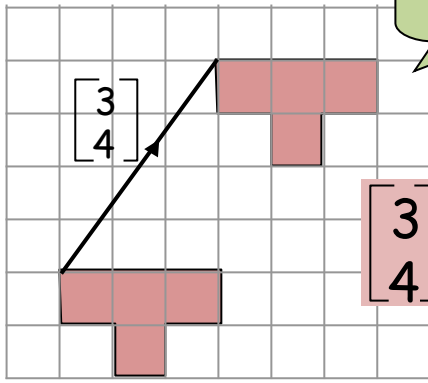
$$y = f(Kx)$$

stretch in  
x-axis



scale factor 1/k

# Translation



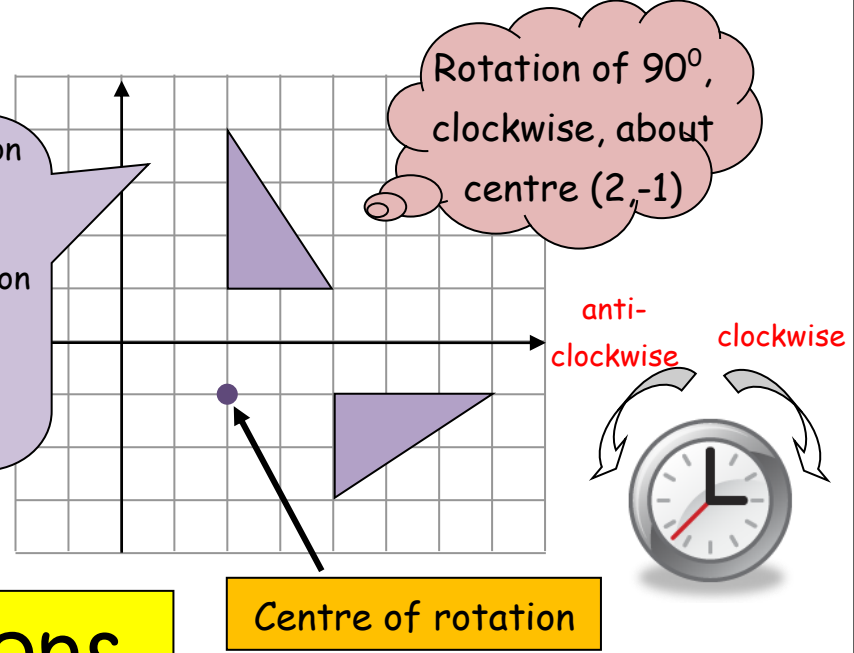
Describe with a vector

**3** ← squares right  
**4** ← squares up

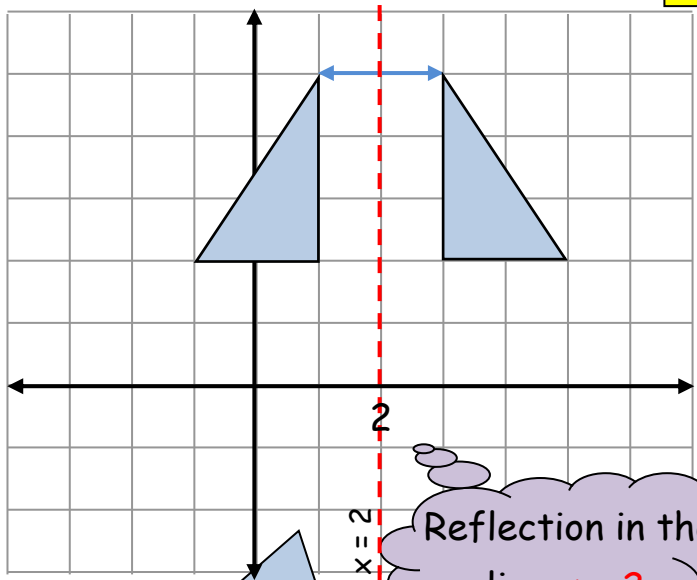
# Rotation

To describe a rotation you need:

- the angle of rotation
- the direction
- the coordinates of the centre



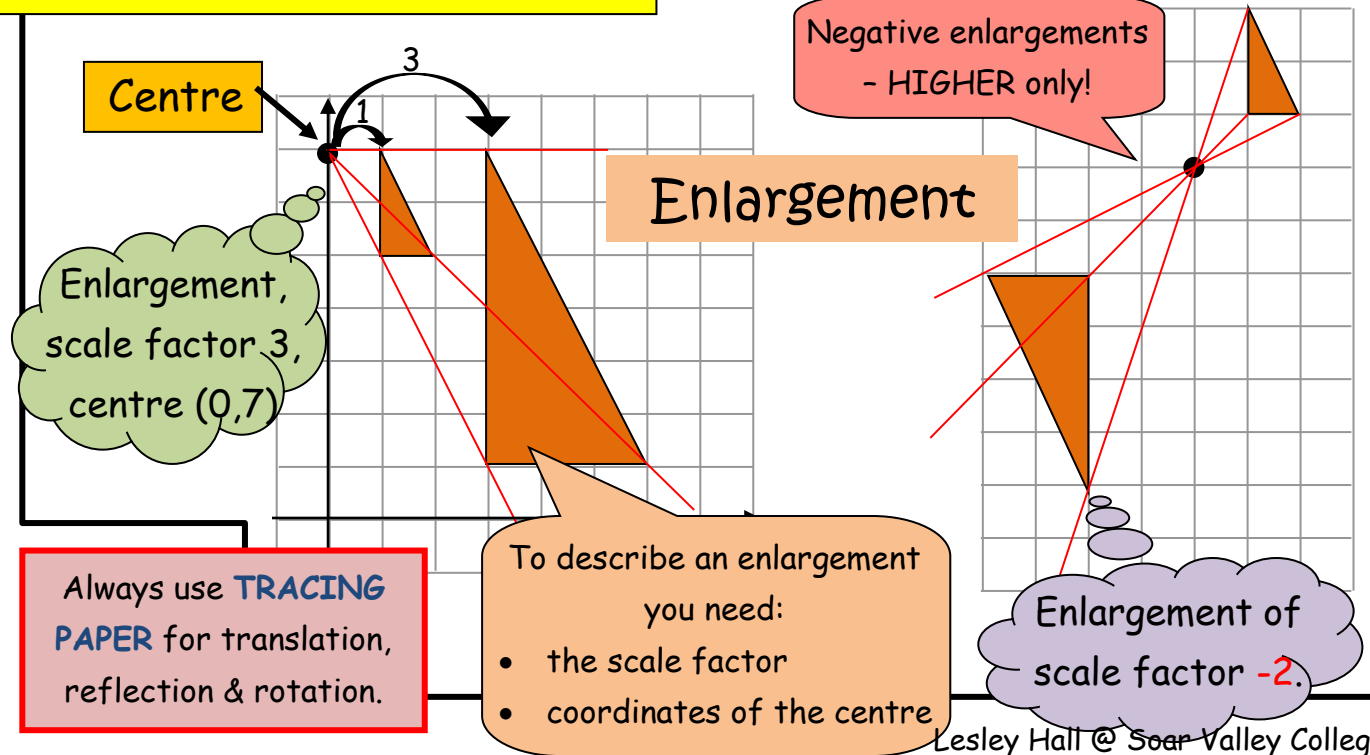
# Reflection



Describe by naming the line of symmetry

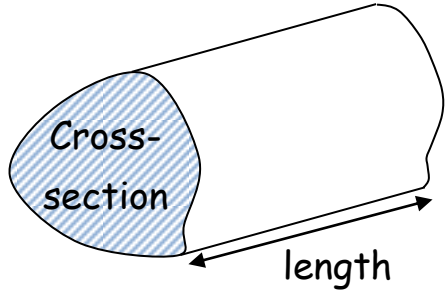
Reflection in the line  $x = 2$ .

# Transformations

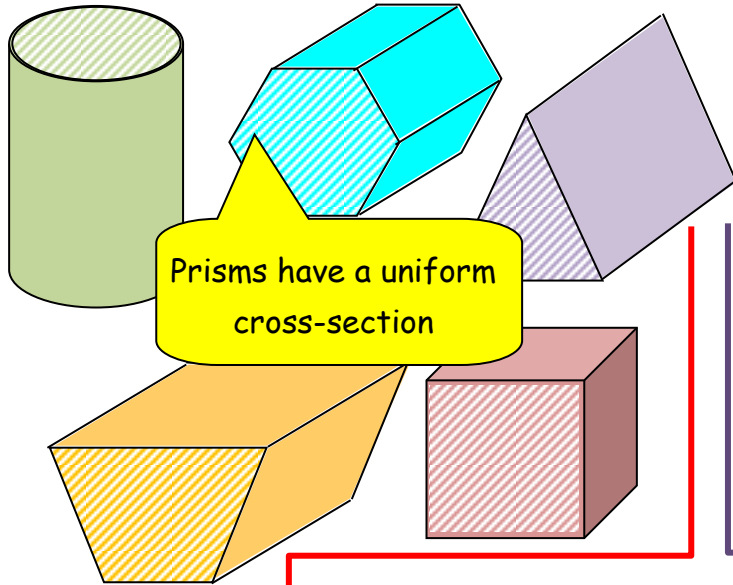




# Prisms

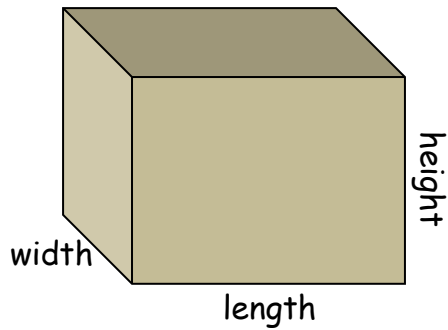


Prisms have a uniform cross-section



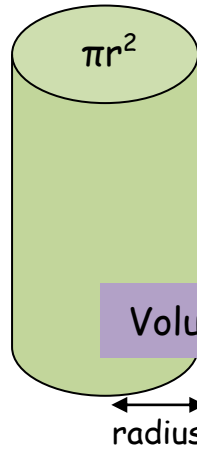
Volume = area of cross-section × length

# Cuboids



Volume = length × width × height

# Cylinders

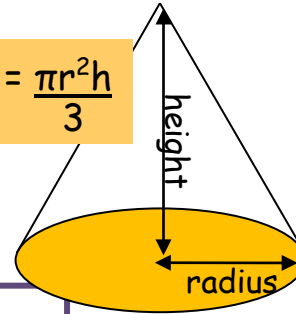


Volume = πr²h

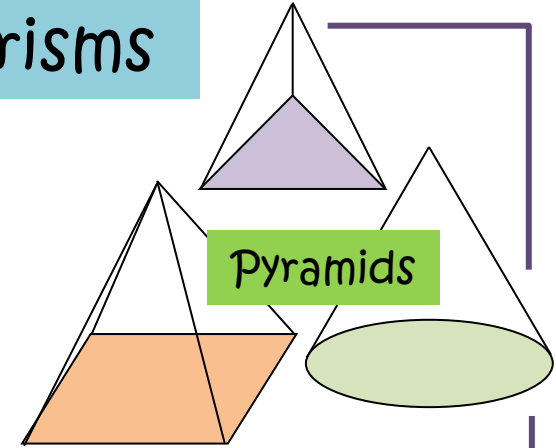
# Non-Prisms

## Cones

$V = \frac{\pi r^2 h}{3}$



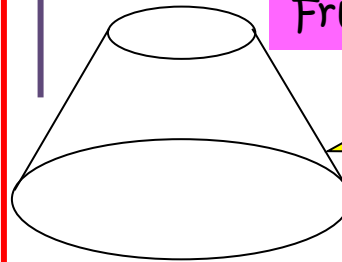
## Pyramids



Volume =  $\frac{\text{area of base} \times \text{height}}{3}$

a cone is one third of a cylinder

## Frustrums

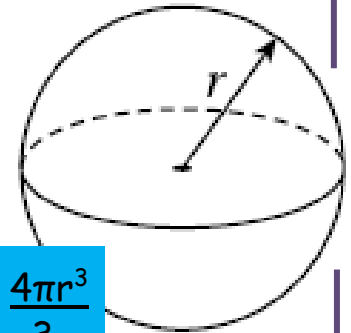


a frustrum is a pyramid with the top cut off.

You need to find the volume of both pyramids.

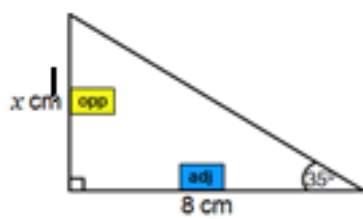
Often you need to use **similar shapes** in frustrum problems.

## Spheres



$V = \frac{4\pi r^3}{3}$

# Volume



$$\tan A = \frac{\text{opp}}{\text{adj}}$$

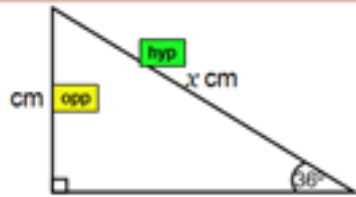
$$\tan 35^\circ = \frac{x}{8}$$

$$8 \times \tan 35^\circ = x$$

$$5.6016603 = x$$

$$5.6 \text{ cm} = x$$

Finding a side



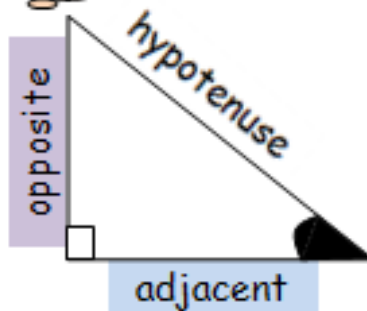
$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 36^\circ = \frac{11}{x}$$

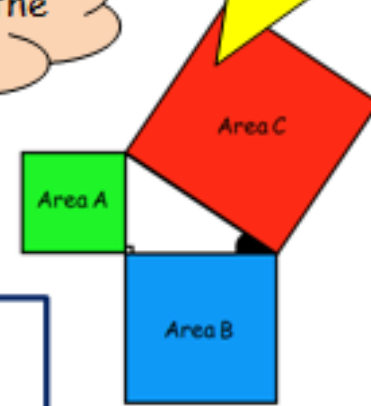
$$x = \frac{11}{\sin 36^\circ}$$

$$x = 18.7 \text{ cm}$$

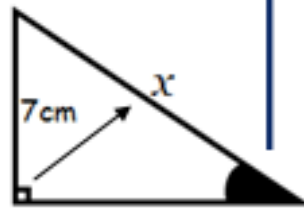
label the sides of the triangle



$$A^2 + B^2 = C^2$$



Pythagoras' Theorem



9cm

$$x^2 = 9^2 + 7^2$$

$$x^2 = 81 + 49$$

$$x^2 = 130$$

$$x = \sqrt{130} = 11.4$$

hypotenuse - ADD!  
shorter side - SUBTRACT!

# Trigonometry

$$\sin = \frac{\text{opp}}{\text{hyp}}$$

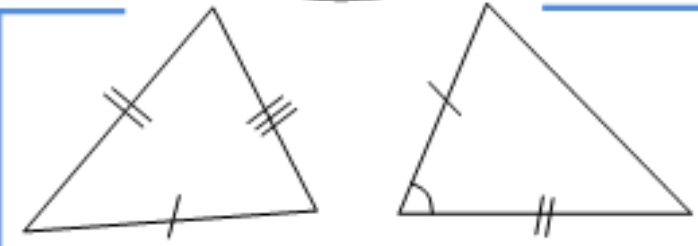
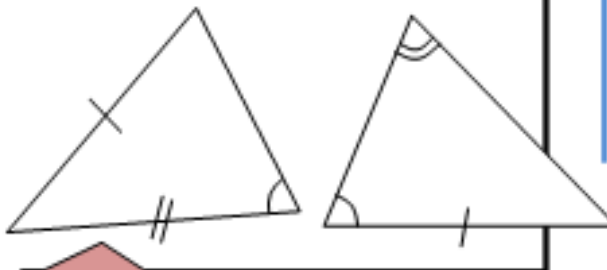
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

sides

## The Sine Rule

angles

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$



$$a^2 = b^2 + c^2 - 2bc \cos A$$

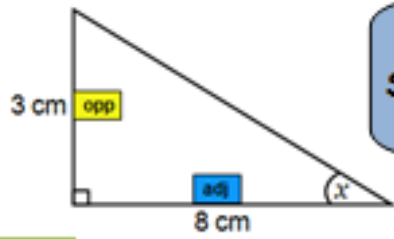
sides

## The Cosine Rule

angles

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Finding an angle



$$\tan x = \frac{\text{opp}}{\text{adj}}$$

$$\tan x = \frac{3}{8} = 0.375$$

$$x = \tan^{-1} 0.375$$

$$x = 20.556045$$

$$x = 20.6^\circ$$

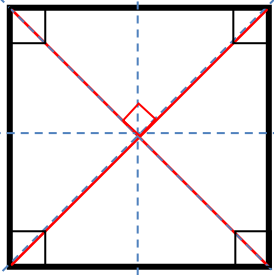
$$\cos = \frac{\text{adj}}{\text{hyp}}$$

$$\tan = \frac{\text{opp}}{\text{adj}}$$

Remember to use the formula page on your exam paper!

$$\text{Area of a triangle} = \frac{1}{2} ab \sin C$$

# Square



4 equal sides  
opposite sides  
are parallel

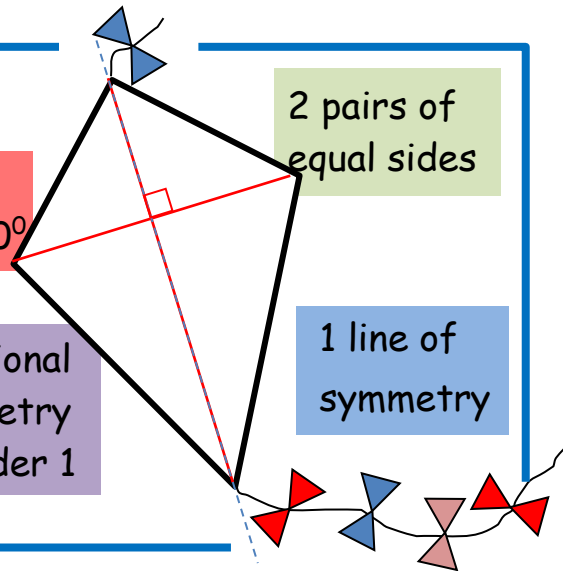
rotational  
symmetry  
of order 4

diagonals  
meet at  $90^\circ$

diagonals of  
equal length

4 lines of symmetry

# Kite



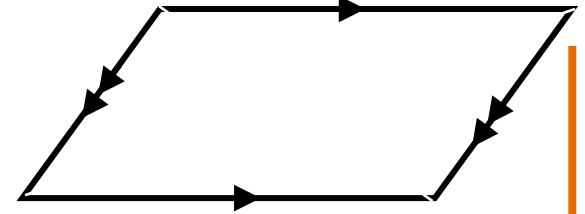
diagonals  
meet at  $90^\circ$

2 pairs of  
equal sides

rotational  
symmetry  
of order 1

1 line of  
symmetry

# Parallelogram



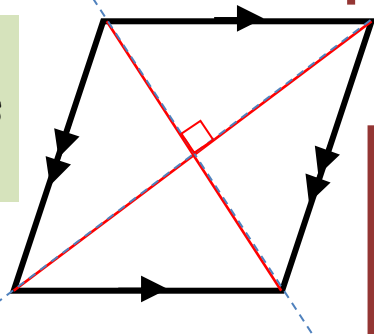
rotational  
symmetry  
of order 2

opposite sides  
are equal &  
parallel

no line symmetry

# Quadrilaterals

# Rhombus



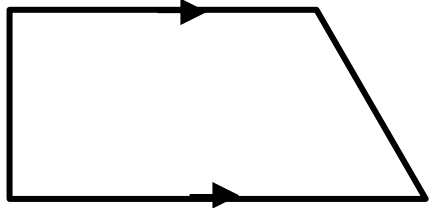
4 equal sides  
opposite sides  
are parallel

rotational  
symmetry  
of order 2

diagonals  
meet at  $90^\circ$

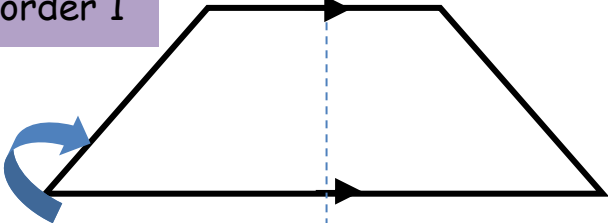
2 lines of symmetry

# Trapezium



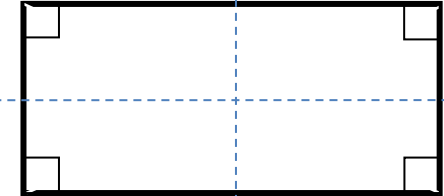
one pair of  
parallel sides

rotational  
symmetry  
of order 1



an isosceles trapezium has a line of symmetry

# Rectangle



opposite  
sides are  
equal &  
parallel

rotational  
symmetry  
of order 2

2 lines of symmetry

diagonals of  
equal length

angles in a quadrilateral  
add up to  $360^\circ$

# Length

10 millimetres = 1 Centimetre

100 Centimetre = 1 **METRE**

1000 **METRES** = 1 kilometre

Metric units

inches

feet

yards

**MILES**

Imperial units



# Units

1 inch = 2.5 cm



1 kg = 2.2 pounds

5 miles = 8 km

1 mile = 1.6 km



1 gallon = 4.5 litres



4 litres = 7 pints

1 litre = 1 3/4 pints

'A litre of water is a pint and three quarters'

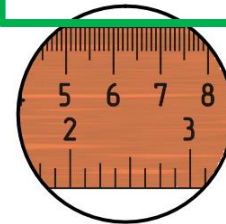
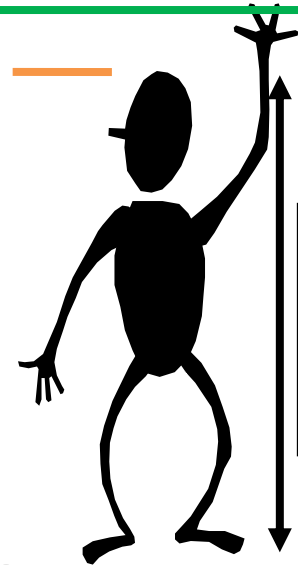
1 foot = 12 inches

That's 30cm – the length of a ruler!

3 feet = 1 yard

A yard is almost 1 metre (its 90cm).

An average man is about 1.7 or 1.8 metres tall. (6 foot)



# Mass

1000 grams = 1 **kilogram**

Imperial units

ounces

pounds (lbs)

Metric units



**STONES**

# Capacity

pints

Imperial units



gallons



Metric units



1000 millilitres = 1 **litre**

# Conversions

## on a calculator

39% of 82

$$0.39 \times 82$$

Change to a decimal and multiply

## fraction to %

$$\frac{15}{20} = \frac{75}{100} = 75\%$$

$\times \frac{5}{5}$

OR

$$15 \div 20 \times 100 = 75\%$$

# Percentages

%

increase £60 by 12%

$$12\% \text{ of } 60 = 0.12 \times 60 = \text{£}7.20$$

$$\begin{aligned} \text{New amount} &= \text{£}60 + \text{£}7.20 \\ &= \text{£}67.20 \end{aligned}$$

**ADD**

## decreasing

decrease £60 by 12%

$$12\% \text{ of } 60 = 0.12 \times 60 = \text{£}7.20$$

$$\begin{aligned} \text{New amount} &= \text{£}60 - \text{£}7.20 \\ &= \text{£}52.80 \end{aligned}$$

**SUBTRACT**

## without a calculator

50% - half

25% - half and half

75% - 50% + 25%

10% - divide by 10

5% - half 10%

20% - double 10%