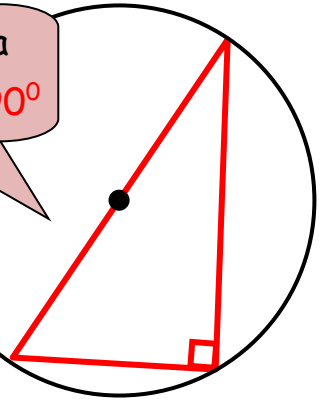
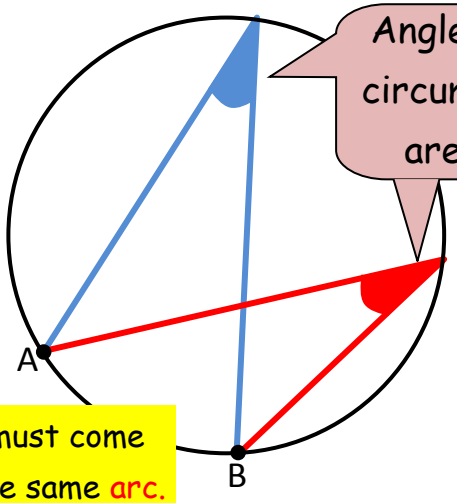
Circle Theorems

The angle in a semi-circle is 90^0

Look out for a diameter.

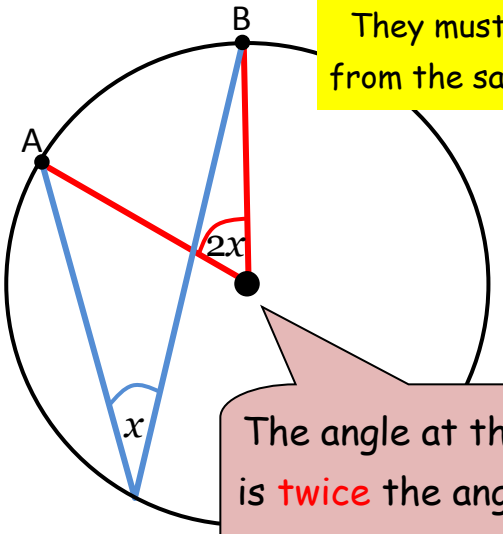


Angles at the circumference are equal.



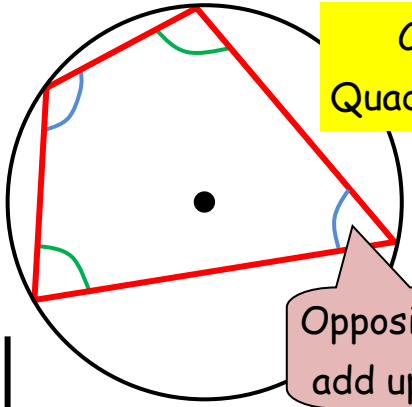
They must come from the same arc.

They must come from the same arc.



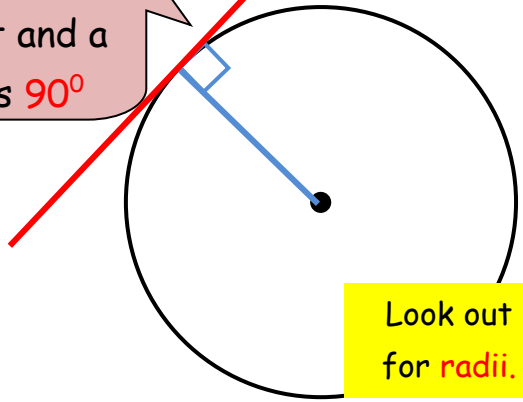
The angle at the centre is twice the angle at the circumference.

Cyclic Quadrilateral

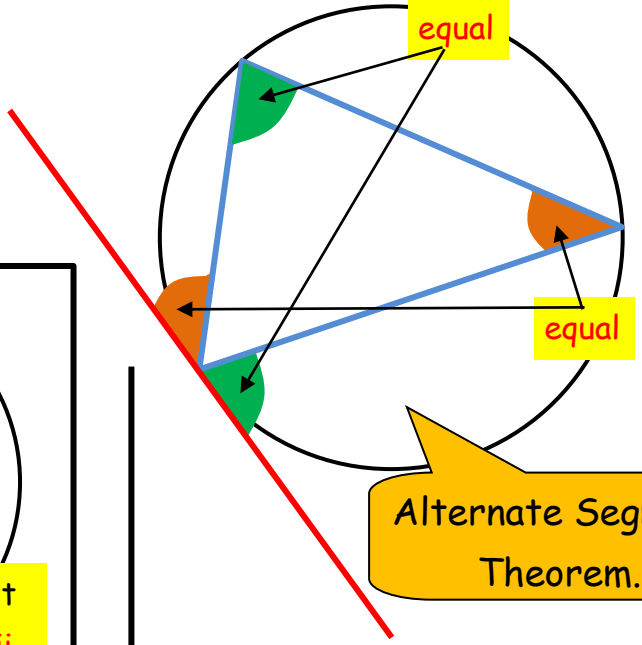


Opposite angles add up to 180^0

The angle between a tangent and a radius is 90^0

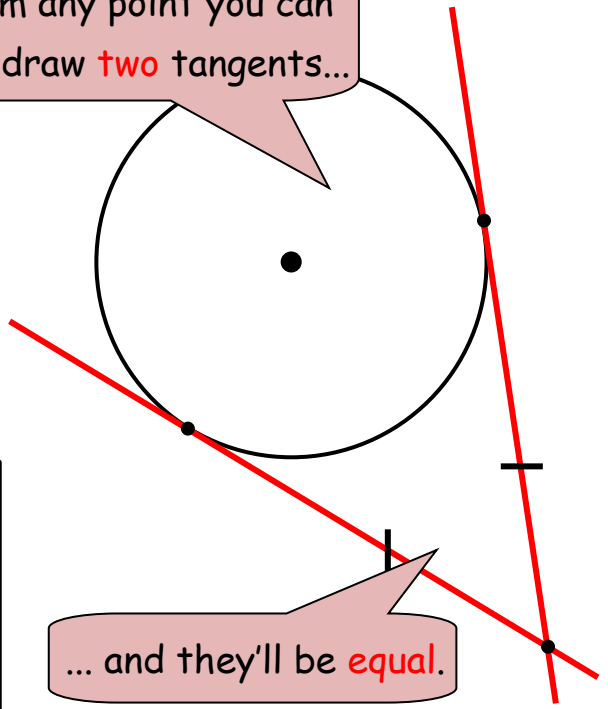


Look out for radii.



Alternate Segment Theorem.

From any point you can only draw two tangents...

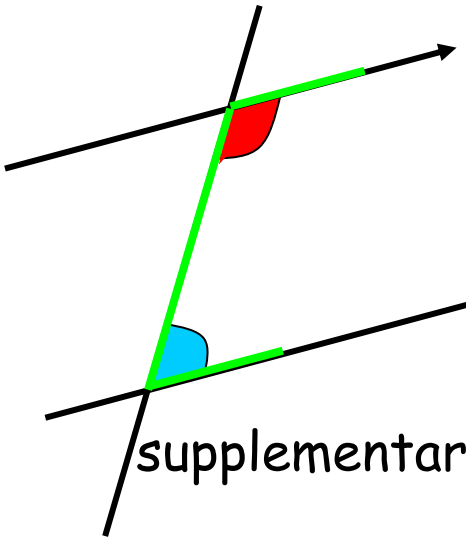


... and they'll be equal.

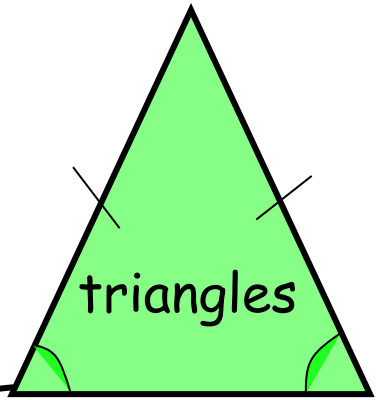
Angle Rules

180^0

straight lines



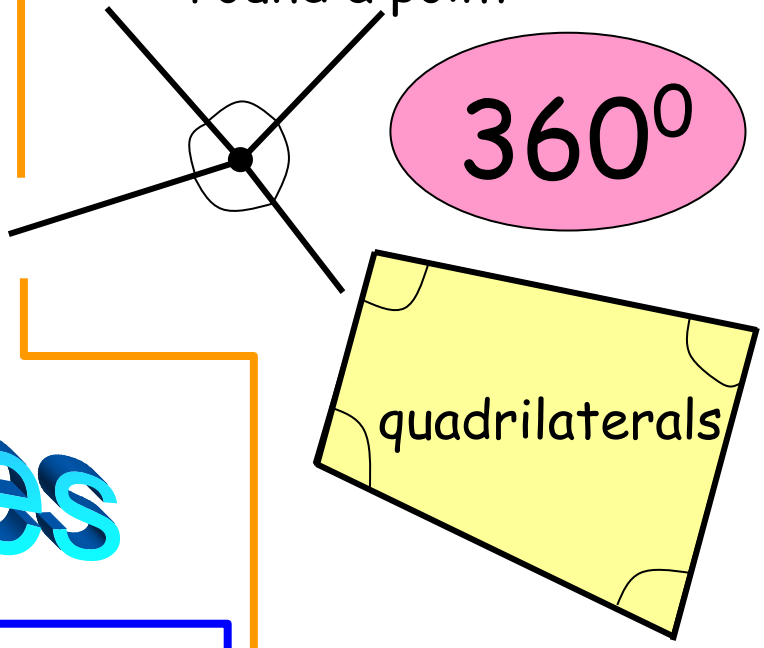
supplementary



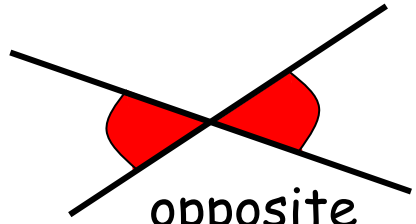
triangles

round a point

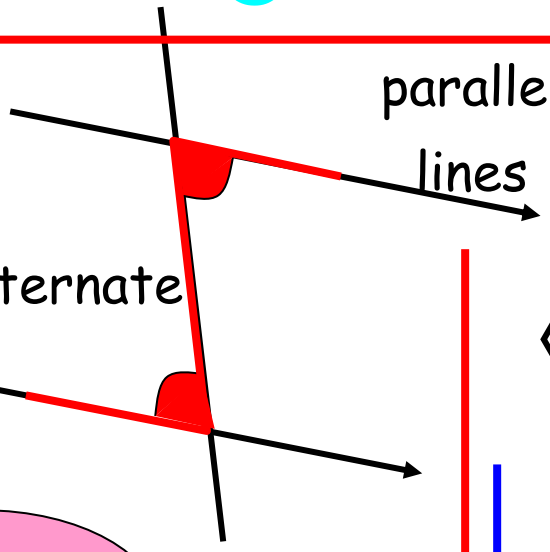
360^0



quadrilaterals

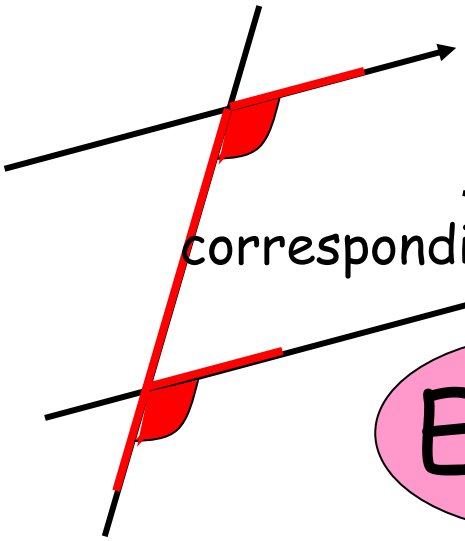


opposite



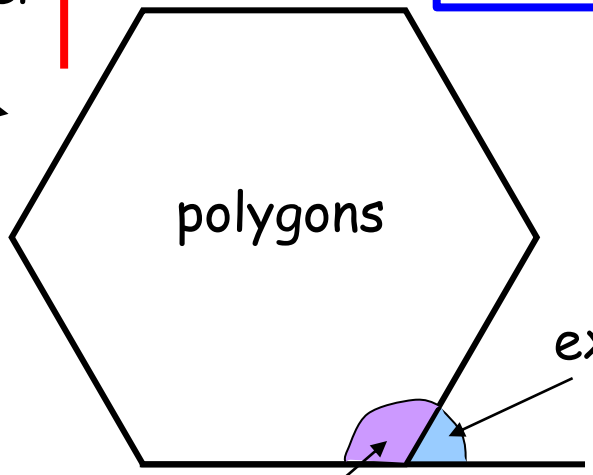
parallel lines

alternate



corresponding

Equal



polygons

angle sum = $(n - 2) \times 180^0$

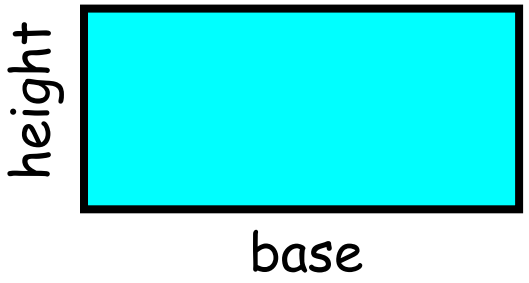
exterior angle

interior angle

...add up to 360^0

AREA

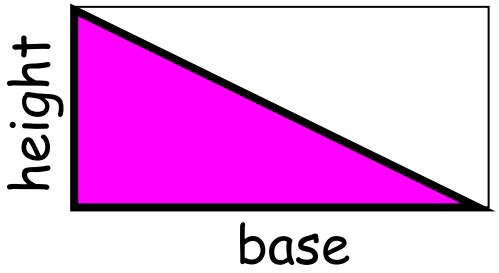
rectangle

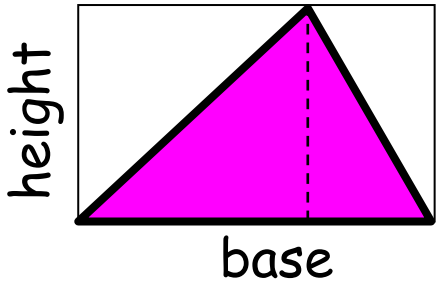


Area = base x height

triangle

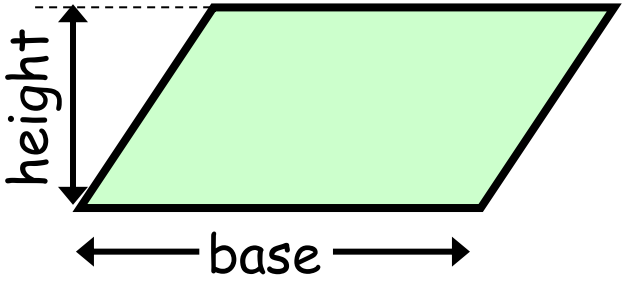
a triangle is half the area of a rectangle





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

parallelogram

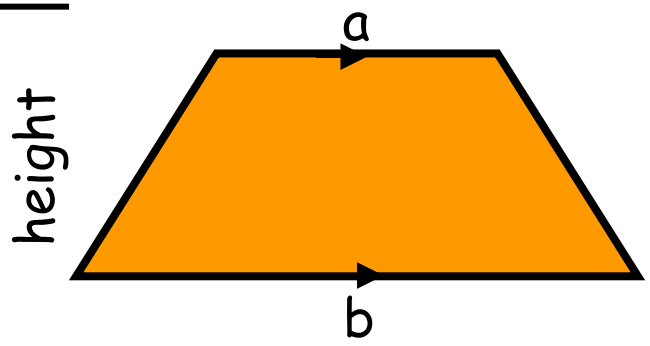


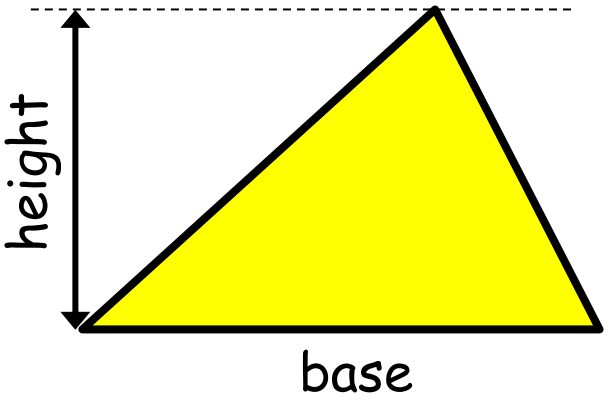
Area = base x height

Always use the perpendicular height

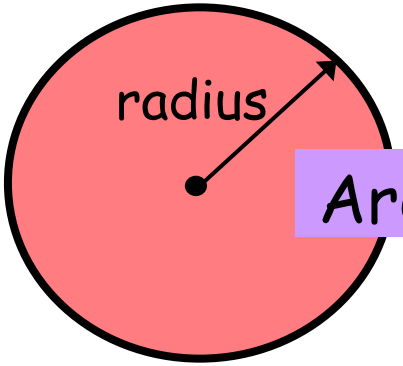
trapezium

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





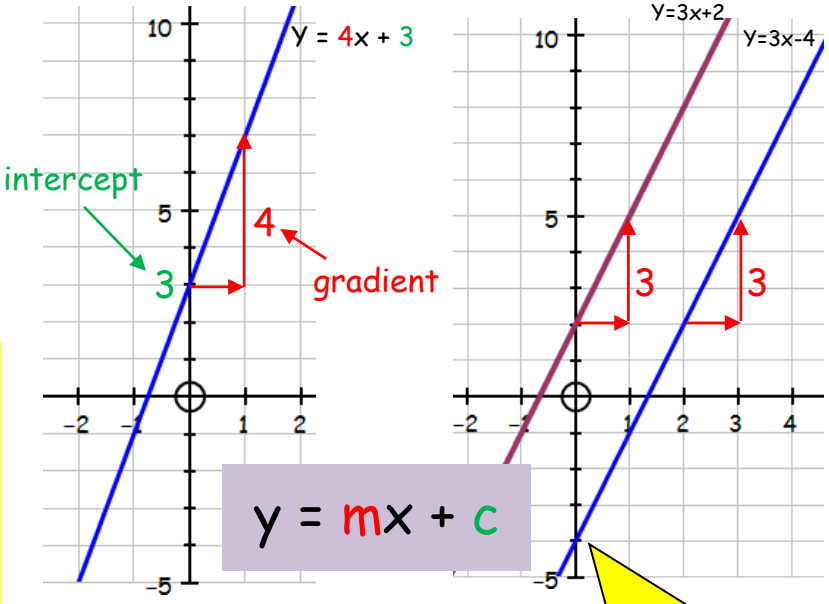
circle



$$\text{Area} = \pi r^2$$

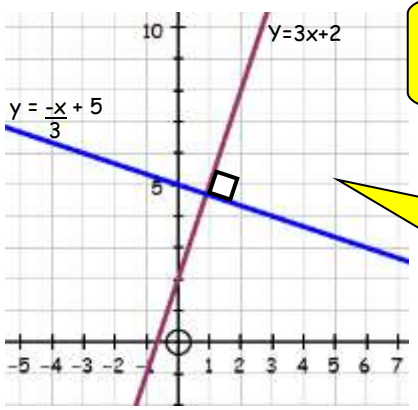
GRAPHS

Linear Graphs



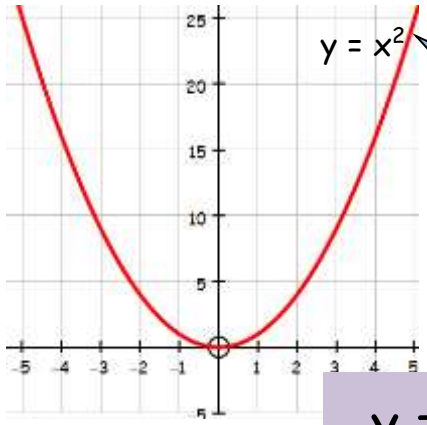
$y = mx + c$

Parallel lines have the same gradient.

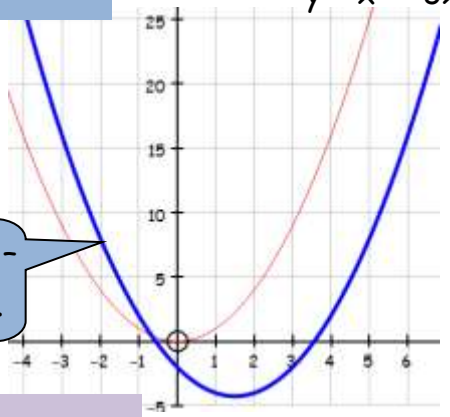


Perpendicular lines have gradients with a product of -1.

Quadratic Graphs



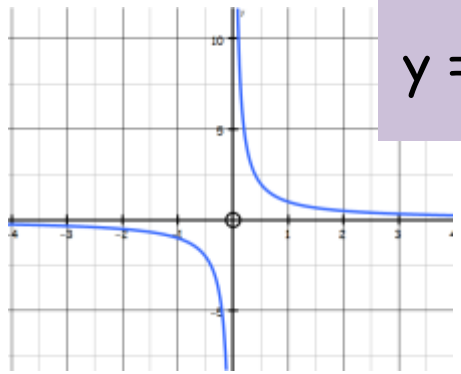
Square numbers.



U shaped – parabola.

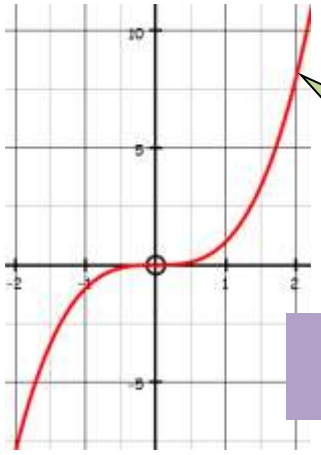
$y = ax^2 + bx + c$

Reciprocal



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

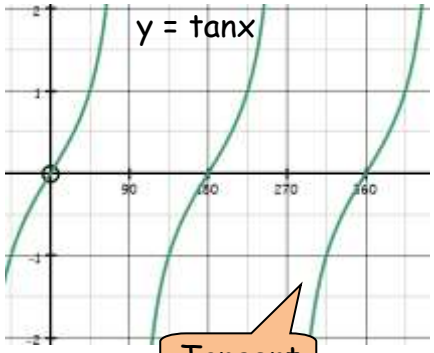
Cubic Graphs



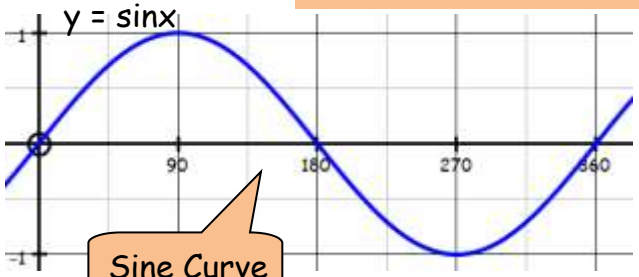
Cube numbers.

$y = x^3$

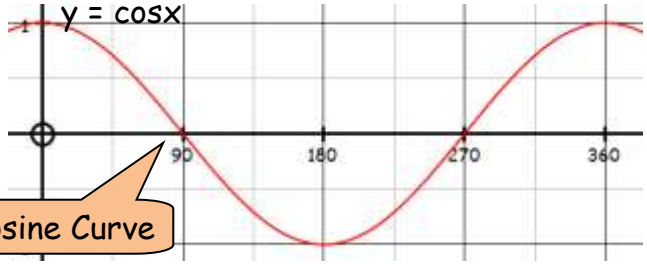
Trigonometric Graphs



Tangent



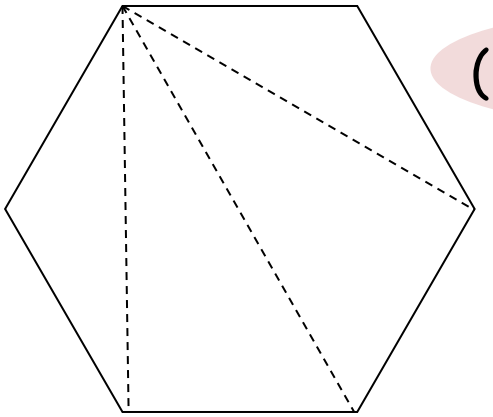
Sine Curve



Cosine Curve

Polygons

Angle Sum



$(n - 2) \times 180^0$

number of triangles

$4 \times 180^0 = 540^0$

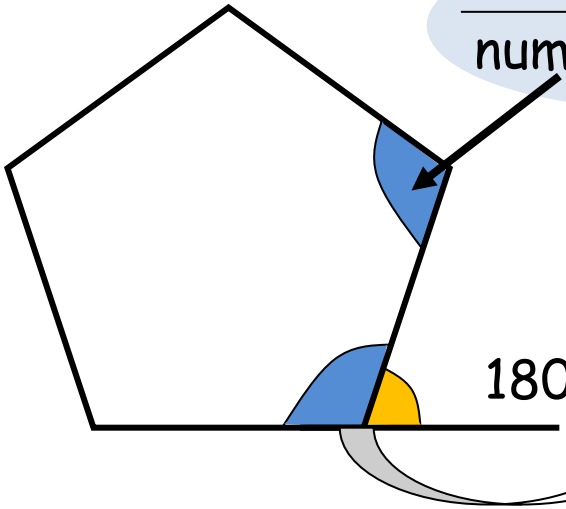
- 3 triangle
- 4 quadrilateral
- 5 pentagon
- 6 hexagon
- 7 - heptagon
- 8 octagon
- 9 - nonagon
- 10 - decagon

interior angle

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

OR

180^0 - exterior angle

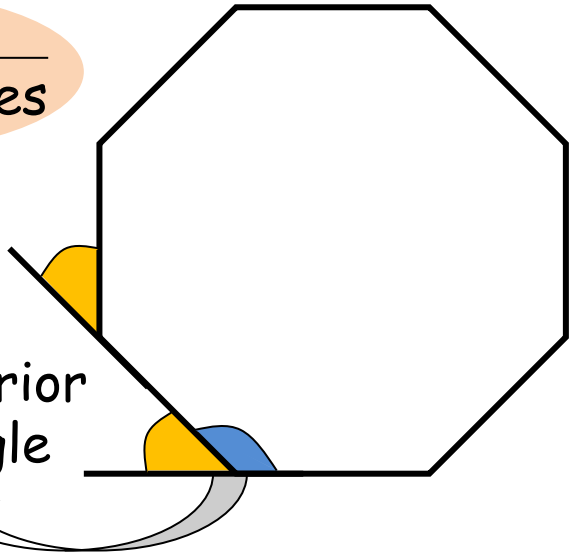


exterior angle

$$\frac{360^0}{\text{number of sides}}$$

OR

180^0 - interior angle



Solving:

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

Quadratic Equations

$ax^2 + bx + c$

Factorising:

brackets

easy…

$x^2 + 7x + 12 = 0$

$(x + 3)(x + 4) = 0$

$x = -3$ or $x = -4$

… more difficult!

multiply

6

1x6

2x3

$3x^2 - 5x + 2$

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

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

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

The formula:

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

Completing the square:

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

half of 4x

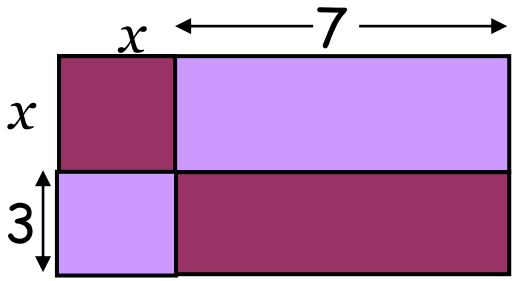
$(x + 2)^2 - 4 - 3 = 0$

subtract 2^2

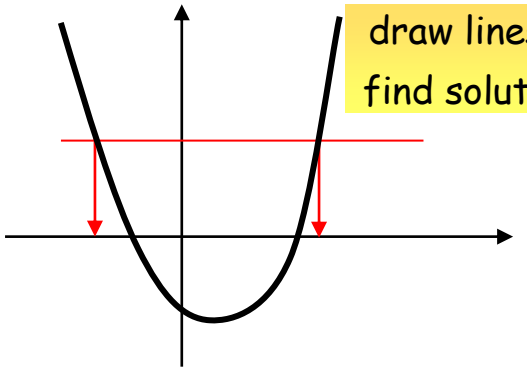
$(x + 2)^2 - 7 = 0$

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

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



Graphs:



draw lines to find solutions

Parabola – u shaped graph

Difference of Two Squares:

$x^2 - 16$

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

x squared subtract 4 squared

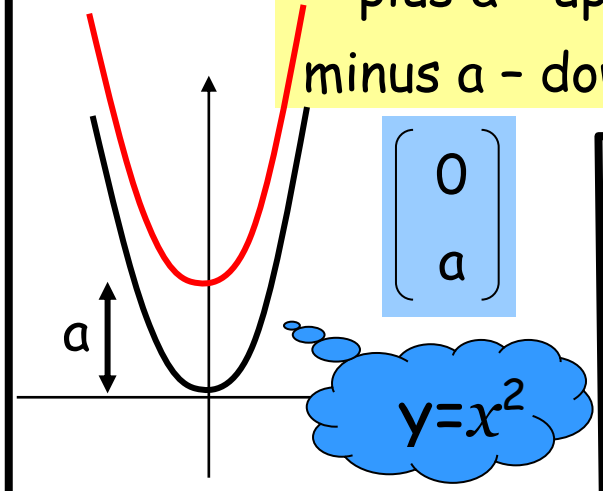
Transforming Curves

$y = fx + a$

plus a - up

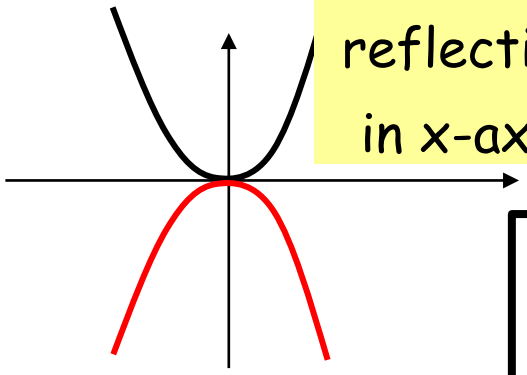
minus a – down

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



$y = -fx$

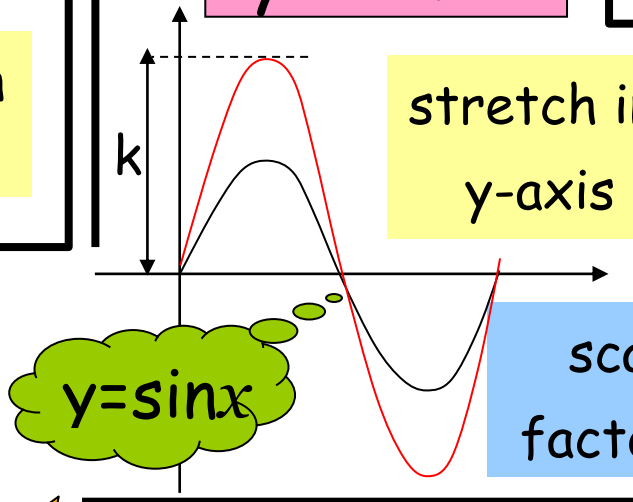
reflection in x-axis



$y = kfx$

stretch in y-axis

scale factor k

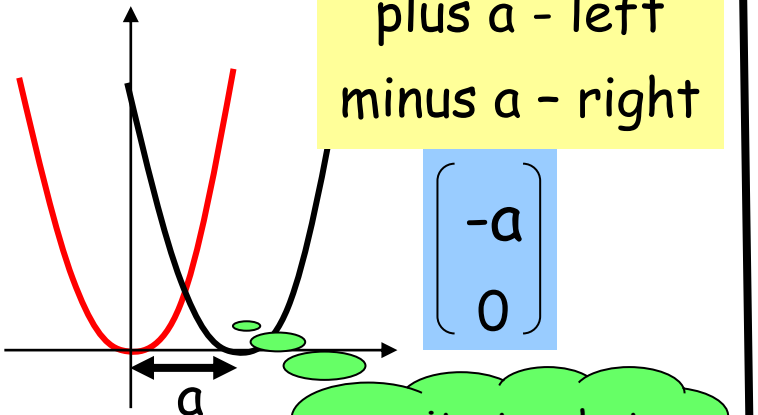


$y = f(x + a)$

plus a - left

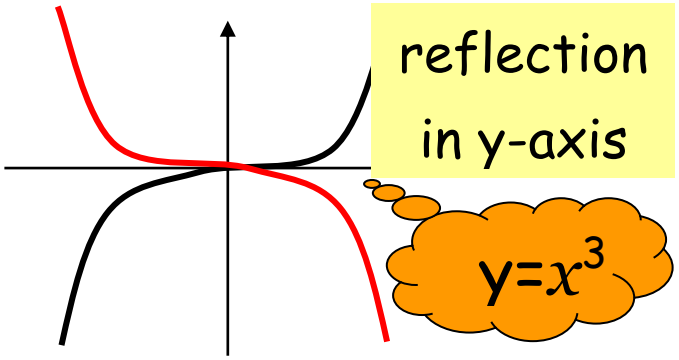
minus a – right

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



$y = f(-x)$

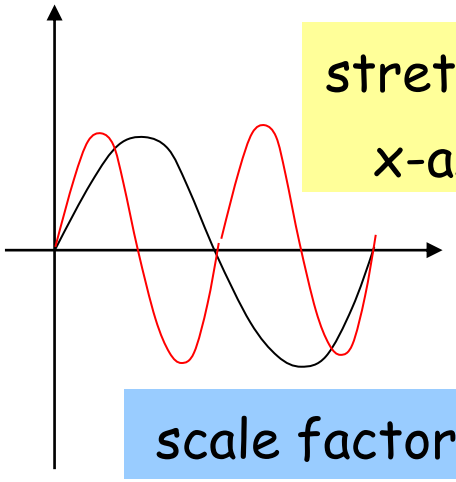
reflection in y-axis



$y = f(Kx)$

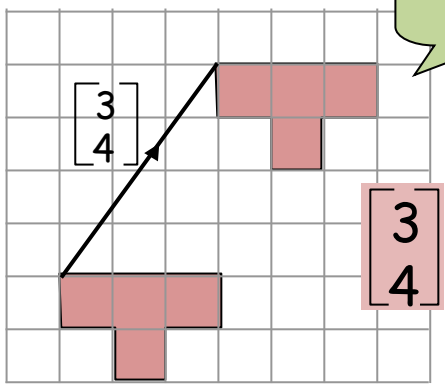
stretch in x-axis

scale factor 1/k



Transformations

Translation



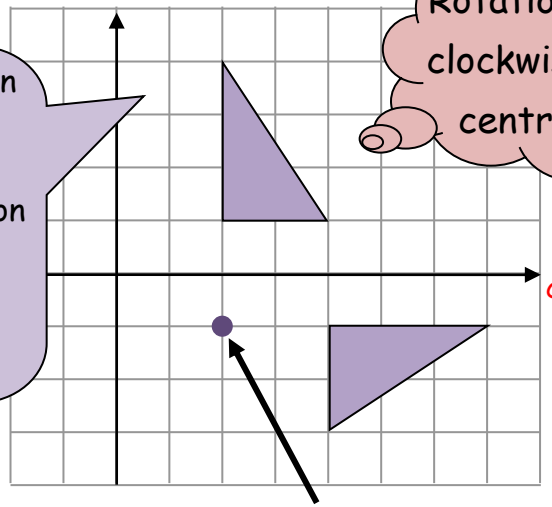
Describe with a vector

$\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ ← squares right
← squares up

Rotation

To describe a rotation you need:

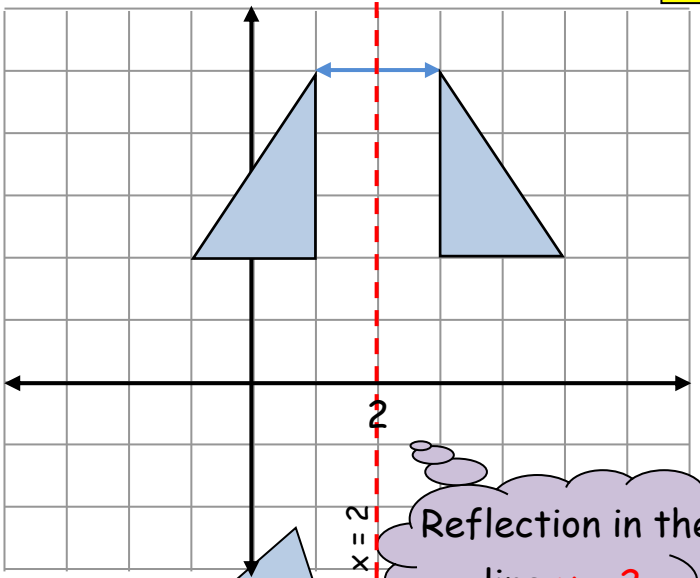
- the angle of rotation
- the direction
- the coordinates of the centre



Rotation of 90°, clockwise, about centre (2, -1)

Centre of rotation

Reflection

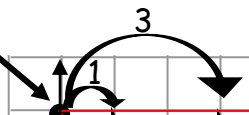


Reflection in the line x = 2.

Describe by naming the line of symmetry

Enlargement

Centre



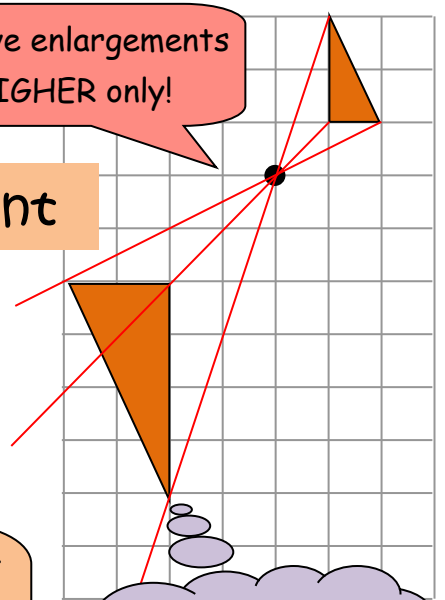
Enlargement, scale factor 3, centre (0,7)

Always use TRACING PAPER for translation, reflection & rotation.

To describe an enlargement you need:

- the scale factor
- coordinates of the centre

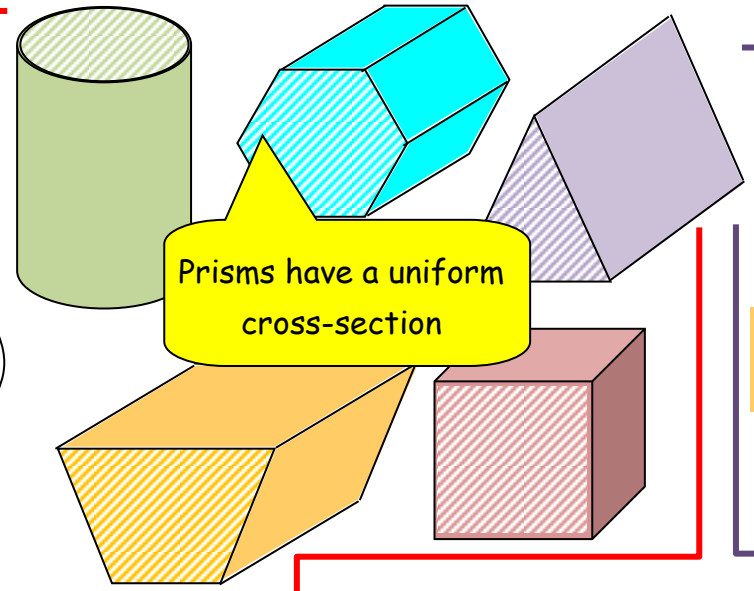
Negative enlargements - HIGHER only!



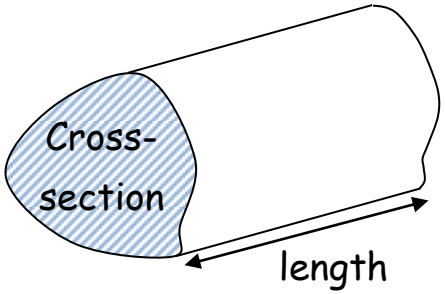
Enlargement of scale factor -2.

Volume

Prisms



Prisms have a uniform cross-section

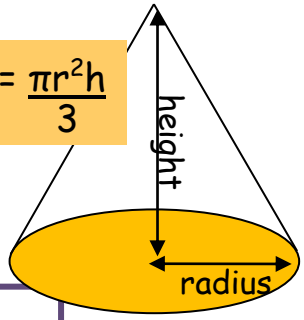


Volume = area of cross-section × length

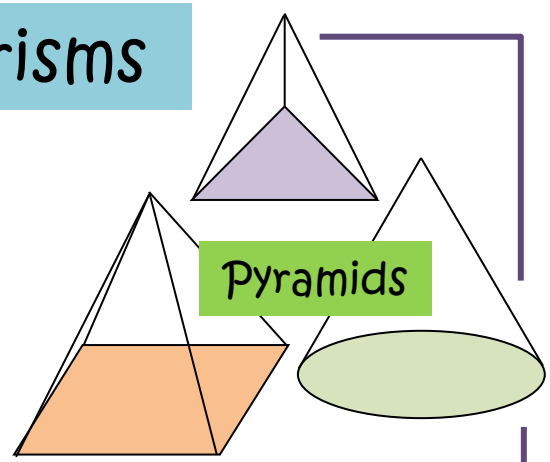
Non-Prisms

Cones

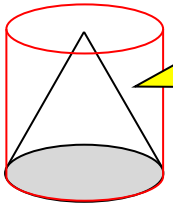
$V = \frac{\pi r^2 h}{3}$



Pyramids

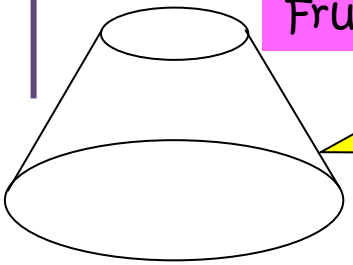


Volume = $\frac{\text{area of base} \times \text{height}}{3}$



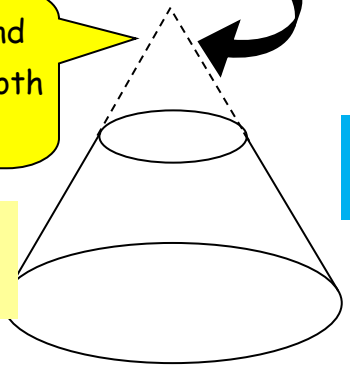
a cone is one third of a cylinder

Frustrums



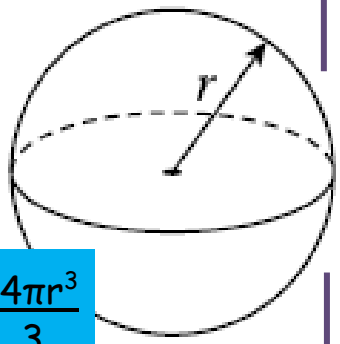
a frustrum is a pyramid with the top cut off.

You need to find the volume of both pyramids.



Often you need to use similar shapes in frustrum problems.

Spheres

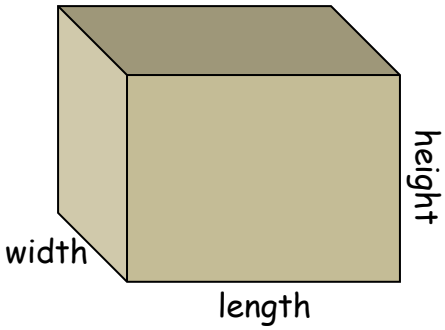


$V = \frac{4\pi r^3}{3}$

cylinders

Volume = $\pi r^2 h$

cuboids



Volume = length x width x height