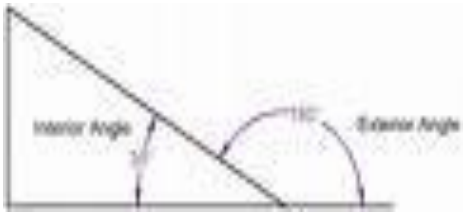
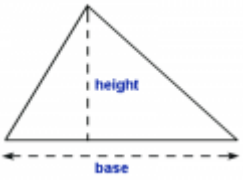
Exterior + Interior = 180

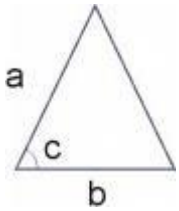


Total of exterior angles is 360



Area of triangle = ½ x base x height

REMEMBER TO MULTIPLY BY ½!!!

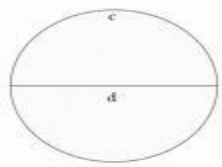


Area = ½ ab sin C

You must have 2 sides and angle between

Circumference of circle = πd

(C = πd- Cherry pies -delicious!)



Area of circle = πr^2

(A = πr^2 – Apple pies r 2!)

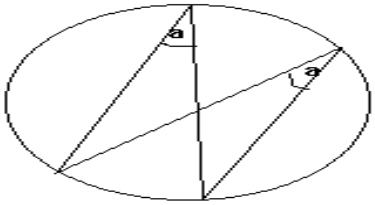
If two shapes are **congruent** then they are exactly the same shape and size

e.g. congruent triangles will fit on top of each other

$1m^3$ = 1m x 1m x 1m

= 100cm x 100cm x 100cm = $1000000cm^3$

= 1000mm x 1000mm x 1000mm = $1,000,000,000mm^3$

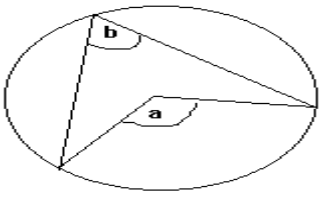


Angles at the circumference in the same segment of a circle are equal

Constructing a triangle given 3 sides

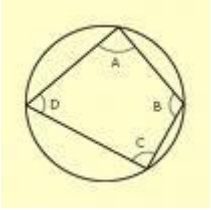
1. Draw one side
2. Use a ruler to set compasses to length of each of the other 2 sides in turn and draw arcs from ends of original side
3. join up ends of line to point where arcs intersect

ALWAYS LEAVE CONSTRUCTION LINES IN!!



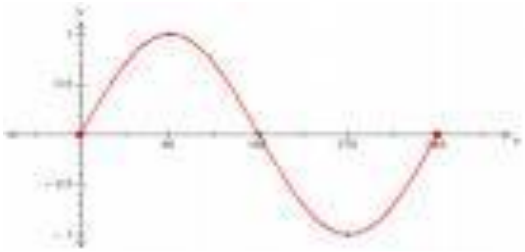
Angle at centre is twice angle at circumference

Sum of opposite angles in a cyclic quadrilateral is 180



So a+c = 180 b+d = 180

SIN X



Has a period of 360

COS X

Has a period of 360

START WITH f(x)

f(x) +a	Move a units up
f(x) - a	Move a units down
af(x)	Vertical stretch scale factor a
-f(x)	Upside down, reflection in x axis

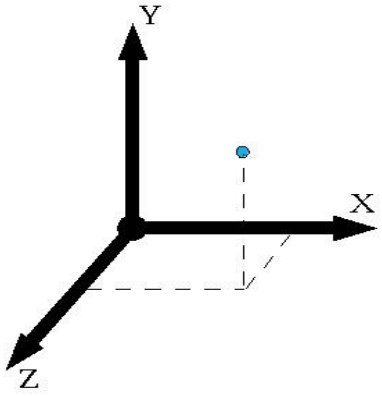
OUTSIDE BRACKET, VERTICAL TRANSFORMATION

START WITH f(x)

f(x +a)	Move a units right
f(x-a)	Move a units left
f(ax)	Horizontal stretch scale factor 1/a
f(-x)	reflection in y axis

INSIDE BRACKET, HORIZONTAL TRANSFORMATION

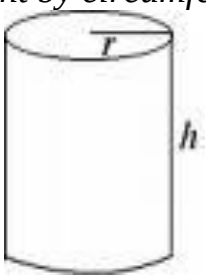
3D COORDINATES
These identify a point in space



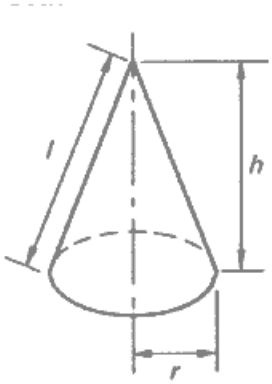
Give coordinates in order (x,y,z)

SINE RULE TO FIND A SIDE $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ TO FIND AN ANGLE $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	Triangles must meet one of four conditions to be congruent SSS SAS ASA RHS Make sure you state clearly why sides or angles are the same e.g. corresponding, opposite, alternate
Equal vectors are parallel and of the same length. Parallel vectors are multiples of each other ie a+b, 2a+ 2b 2a – b and 4a – 2b	When translating, give your answer as a vector! 2 to the right 3 up is 3 to the left 4 down
A tangent is a straight line that touches a curve or circle just once!! Tangents are perpendicular to a radius drawn to the point where it meets the circle	If the length increases by a scale factor x, then the area increases by a scale factor x^2 and the volume by scale factor x^3 e.g. double all lengths, the area will quadruple and the volume will multiply by eight!

Volume of cylinder = $\pi r^2 h$
(area of cross section x length)
Surface area of a cylinder = $2\pi r^2 + 2\pi rh$
(imagine net- 2 circles and a rectangle with dimensions height by circumference)

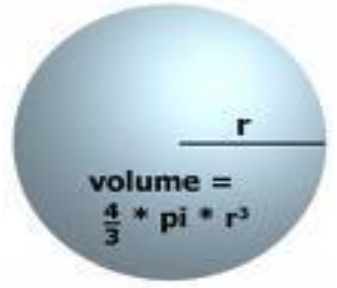


Volume of cone = 1/3 $\pi r^2 h$
On formula sheet
Curved Surface area of cone = πrl
On formula sheet
Total Surface area of cone = $\pi r^2 + \pi rl$



volume = $(1/3)\ \pi r^2 h$
total surface area = $\pi r(l + r)$

Volume of sphere = 4/3 πr^3
On formula sheet
Surface area of sphere = $4\pi r^2$
On formula sheet



To work out the slant height ***l*** of a cone, use Pythagoras

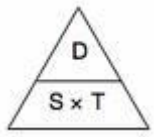
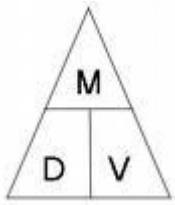
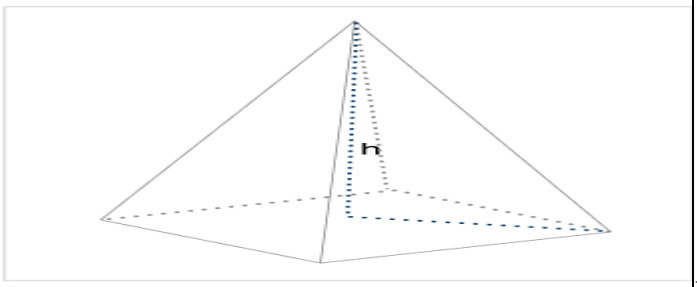
Ie radius = 3, height = 4

Then slant height is
$\sqrt{3^2 + 4^2} = 5$

DIMENSIONAL ANALYSIS
3 lengths multiplied together- VOLUME
2 lengths multiplied together – AREA
Lengths added together – LENGTH

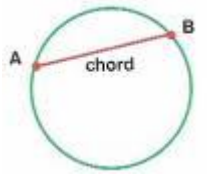
e.g. a, b, c are lengths
ab- AREA
abc- VOLUME
a + b- LENGTH

In similar triangles, sides are in proportion but **angles are the same**!!

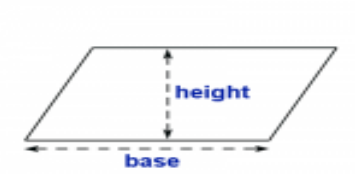
 Speed = distance / time Use formula triangle	 Density = mass/volume Use formula triangle
The sum of the angles of a regular polygon is 180(n – 2) where n is number of sides	top of a shape is removed- a **frustum** is left to calculate the volume, work out the volume of the original cone and take away the part you remove!
 Volume of pyramid = 1/3 Ah When A = area of cross section h is perpendicular height	3 SIDES USE COSINE RULE 2 SIDES AND ANGLE BETWEEN USE COSINE RULE REST OF TIME USE SINE RULE!!
When enlarging by a negative scale factor draw lines from the corners of the shape through the centre of enlargement, then do the enlargement on the other side of the centre.	When reflecting, make sure you don't confuse y = -1 and x = -1. Y = -1 is HORIZONTAL X = -1 is VERTICAL

To construct a perpendicular bisector

1. Start with a line
2. Open compasses to about ¾ of line length
3. Centre compasses on each end of the line, from each end draw arcs on both sides of line
4. Join up points where arcs cross

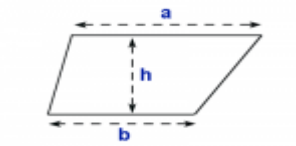


A CHORD IS A LINE THAT JOINS UP 2 POINTS ON THE CIRCUMFERENCE



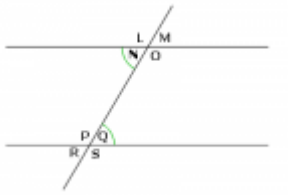
Area of parallelogram =

base x perpendicular (vertical) height.



Area of trapezium = ½ (a+b) h or

average top and bottom then multiply by height



Here m= q, r= n etc CORRESPONDING ANGLES
L+n = 180, o +q = 180 COINTERIOR ANGLES
N= q, p = o ALTERNATE ANGLES
M=N OPPOSITE ANGLES

When describing a **rotation**, you must give the angle,
direction
centre of rotation
MAKE SURE YOU ACTUALLY SAY ROTATION!

e.g. rotation, 90 degrees anti clockwise centre (0,0)

When describing a **reflection** you must give the line the shape or curve is reflected in!

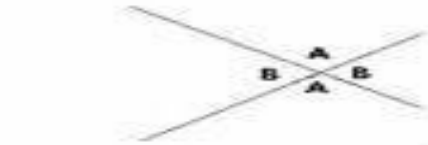
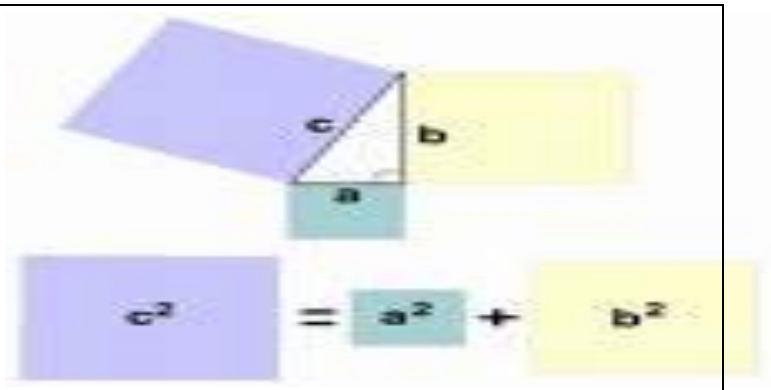
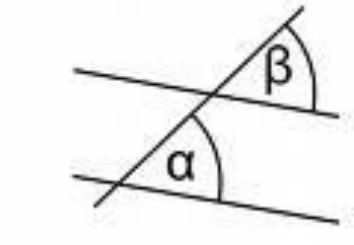
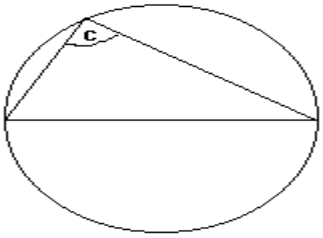
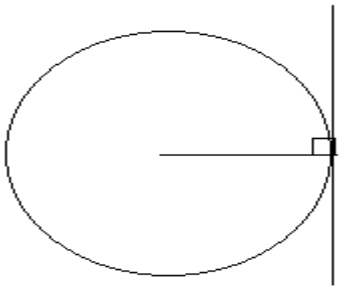
e.g. reflection in the line y = x

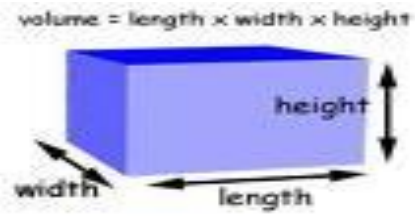
Be careful: y=2 is line where y coordinate is 2- it is HORIZONTAL, not vertical.

To find a centre of rotation,

USE TRACING PAPER!!

Try a few points and see which work!

VERTICALLY OPPOSITE ANGLES ARE  EQUAL	
When describing an enlargement, you must give scale factor of enlargement and centre of enlargement. e.g. enlargement scale factor 2, centre (1,1)	CORRESPONDING ANGLES ARE  EQUAL
Bearings are From North 3 figures Measured clockwise	Angle in a semi circle from a diameter is a right angle 
The angle that a tangent makes with a radius is a right angle 	3 hours 20 minutes is not 3.2 hours It is 3 hours and $\frac{20}{60}$ of an hour which is $3\frac{1}{3}$ hours or 3.333333333333333333333333333 hours



Volume of a cuboid = length x width x height

Surface area of a cuboid = 2lw + 2wh + 2lh
(2 rectangles with each set of dimensions)

In any Right angled Trig question

1. label the sides
2. decide which formula triangle to use (SOH CAH or TOA
3. Cover up what you need
4. Use a calculator

Is a triangle with sides $\sqrt{3}+1$, $\sqrt{3}-1$ and $\sqrt{8}$ right angled?

Well, does Pythagoras work?

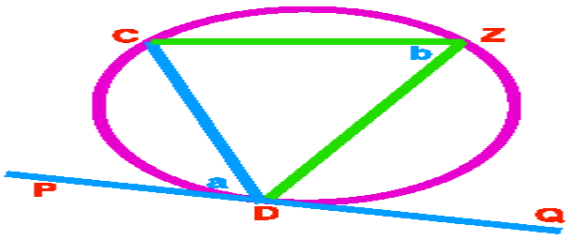
$$(\sqrt{3}+1)^2 = 3+2\sqrt{3}+1 = 4+2\sqrt{3}$$

$$(\sqrt{3}-1)^2 = 3-2\sqrt{3}+1 = 4-2\sqrt{3}$$

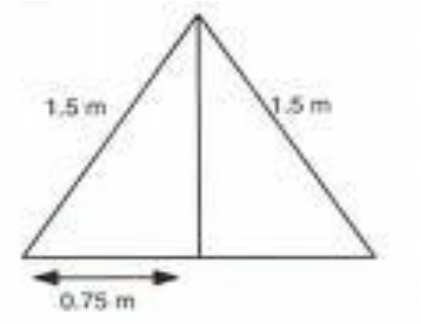
$(\sqrt{3}+1)^2+(\sqrt{3}-1)^2 = 8$ so hypotenuse would be $\sqrt{8}$ so it is right angled

To construct an angle bisector

1. Start with the given angle
2. open compasses to radius shorter than arms of the angle
3. Centre compasses on point where arms meet and draw an arc on both arms
4. From both these arcs draw arcs that intersect
5. Join up point where arms meet to where arcs meet- this cuts angle in half!



The alternate segment theorem; the angle between a tangent and a chord is equal to the angle in the alternate segment. So in diagram, a=b



In an isosceles or equilateral triangle you can use SOHCAHTOA if you split the original triangle into two RIGHT ANGLED triangles

Area of a sector = $\frac{\theta}{360} \times \pi r^2$

Perimeter of sector = $\frac{\theta}{360} \times \pi d$ + **any radii/diameter required**

To calculate a shaded area

Good exam technique is to take away one area from another and find what's left!

Enlargement from a point

All new points of shape must be scale factor times away from centre of enlargement

e.g. scale factor 0.5 all points of new shape ½ as far from centre of enlargement

To construct an angle of 60

1. Draw a line
2. centre compasses on end of line
3. draw arc which cuts line
4. centre compasses where arc meets line, draw another arc to cut first arc
5. join original point to point where arcs cross

AMBIGUOUS CASE of SINE RULE

When given 2 Sides and angle not in between, there are always TWO ANSWERS TO ANY OTHER ANGLE

These answers add up to 180
e.g. if you get 77 as an answer, 103 is correct also

To work out length of a line connecting (3,7) and (6,11) use PYTHAGORAS

The line has moved 3 along and 4 up so

Pythagoras gives us $3^2 + 4^2 = 25$

$l = \sqrt{25} = 5$

3D TRIG/PYTHAGORAS

1. IDENTIFY CORRECT RIGHT ANGLED TRIANGLE
2. REDRAW IN 2D
3. USE TRIG/PYTHAGORAS
4. DO 1-3 AGAIN IF NECESSARY!!

Finding the centre of enlargement

Draw lines from new point through where it was before for each point
Where they meet is centre of enlargement

When working with similar triangles where the triangles are 2 triangles in 1 triangle Draw new diagrams with the triangles separate	**Constructing a triangle given 2 sides and angle between** 1. Draw one side 2. use protractor to measure and draw angle at one end of this line 3. set compasses to length of other given side and draw an arc cutting the line you have drawn for angle 4. join up points where arc cuts line for angle and other end of starting line
Constructing the perpendicular at a point on a line 1. Start off with a point on a line 2. open compasses to a radius of 3cm and centred on the point, draw arcs on either side 3. increase radius, centre compasses on the 2 points either side, so that they intersect 4. join original point to where arcs meet	**Constructing the perpendicular from a point to a line** 1. Start with a line and point not on a line 2. open compasses to 3cm more than distance from point to line 3. centre compasses on point, draw arcs on line on either side of point 4. centre compasses on points where arcs cut the line, draw arcs on other side of line so they intersect 5. join original point and point where arcs cross
In diagrams, fill in everything you know before you start solving the problem! (e.g. all angles you know!)	In vectors if it asks you for a shape it is going to be a **TRAPEZIUM** or a **PARALLELOGRAM** trapezium (1 pair of parallel sides) **a, 2a, 4a-b, 4a+b TRAPEZIUM** Parallelogram (2 pairs of parallel sides) **a, 2a, 3a-b, 6a-2b PARALLELOGRAM**
If you have a vector b, and have to add b to it, just extend the original vector in the same direction by b. If you have a vector b, then -b is the same vector in the opposite direction!	Lines are parallel if their vectors are a scalar multiple of each other, e.g. 5a +b is parallel to 10a + 2b or 2.5a + 0.5b **THIS MAY BE THE BEST WAY TO START A VECTORS QUESTION!!!**
Given the sum of the interior angles of a regular polygon To find the number of sides DIVIDE BY 180, ADD 2	An Isosceles trapezium is one with 2 pairs of equal angles Its non parallel sides equal One line of symmetry

When working with circle theorems , look for isosceles triangles formed by triangles with 2 radii,

This will help you find angles more readily!!

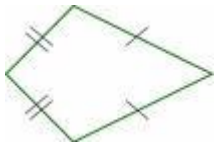
COSINE RULE

You are given $a^2 = b^2 + c^2 - 2bc\cos A$ on formula sheet. FIND SIDES with this formula.

To rearrange so that you can find ANGLES make the cos A positive then divide

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

A great thing to do is to label the side or angle you want a or A, then use the formula.

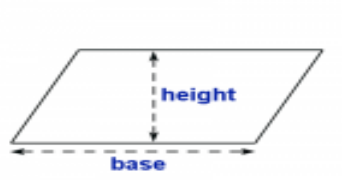


In a **Kite**,

diagonals cross at right angles

two pairs of sides are equal

one pair of opposite angles are equal

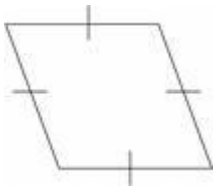


In a **parallelogram**,

Opposite sides are **equal** and **parallel**

Opposite angles are equal

Diagonals bisect each other



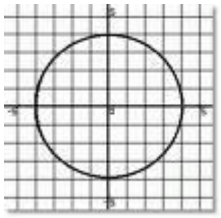
In a **rhombus**,

All sides are equal

Opposite sides are parallel

Opposite angles are equal

Diagonals are perpendicular bisectors of each other



The equation of a circle

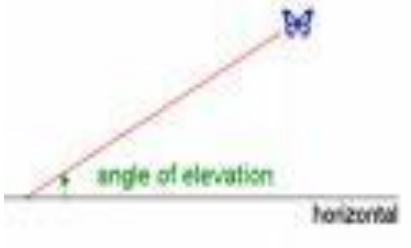
$$x^2 + y^2 = r^2$$

Example:

$x^2 + y^2 = 4$

gives a circle about the origin radius 2

ANGLE OF ELEVATION



ANGLE OF DEPRESSION