Grade A/A* PROMPT sheet

A/1 Use fractional & negative indices

- **Rules when working with indices:**

$a^x \times a^y = a^{(x+y)}$

$a^3 \times a^2 = a^{(3+2)} = a^5$

$2^3 \times 2^2 = 2^{(5)} = 32$

$a^x \div a^y = a^{(x-y)}$

$a^7 \div a^3 = a^{(7-3)} = a^4$

$3^7 \div 3^3 = 3^{(4)} = 81$

$(a^x)^y = a^{(x\,y)}$

$(a^3)^2 = a^6$

$(2^3)^2 = 2^6 = 64$

$a^0 = 1$

$y^0 = 1$

$8^0 = 1$

$a^{-x} = \frac{1}{a^x}$

$a^{-3} = \frac{1}{a^3}$

$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

$a^{x/y} = (\sqrt[y]{a})^x$

$a^{2/5} = (\sqrt[5]{a})^2$

$32^{2/5} = (\sqrt[5]{32})^2 = 2^2$

$a^{-x/y} = \frac{1}{(\sqrt[y]{a})^x}$

A/2 Manipulate and simplify surds

$\sqrt{25}$ is NOT a surd because it is exactly 5

$\sqrt{3}$ is a surd because the answer is not exact

A surd is an irrational number

- **To simplify surds look for square number factors**

$\sqrt{75} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$

- Rules when working with surds:

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\sqrt{3} \times \sqrt{15} = \sqrt{45} = \sqrt{9x5} = \sqrt{9} \times \sqrt{5} = 3\sqrt{5}$

$m\sqrt{a} + n\sqrt{a} = (m+n)\sqrt{a}$

$2\sqrt{5} + 3\sqrt{5} = (2+3)\sqrt{5} = 5\sqrt{5}$

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Square number

$\sqrt{\frac{72}{20}} = \frac{\sqrt{72}}{\sqrt{20}} = \frac{\sqrt{36} \times \sqrt{2}}{\sqrt{4} \times \sqrt{5}} = \frac{6\sqrt{2}}{2\sqrt{5}} = \frac{3\sqrt{2}}{\sqrt{5}}$

Square number

- **Rationalising the denominator**

This is the removing of a surd from the denominator of a fraction by multiplying both the numerator & the denominator by that surd

In general:

$\frac{a}{\sqrt{b}} =$

$= \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}}$ (Multiply both top & bottom by √b)

$= \frac{a\sqrt{b}}{b}$

Example

$\frac{6}{\sqrt{12}}$

$= \frac{6}{\sqrt{12}} \times \frac{\sqrt{12}}{\sqrt{12}}$ (Multiply both top & bottom by √12)

$= \frac{6\sqrt{12}}{12} = \frac{\sqrt{12}}{2} = \frac{\sqrt{4} \times \sqrt{3}}{2} = \frac{2\sqrt{3}}{2} = \sqrt{3}$

A/3 Upper & lower bounds

- **If 'a' is rounded to nearest 'x'**

Upper bound = a + $\frac{1}{2}$x

Lower bound = a – $\frac{1}{2}$x

e.g. if 1.8 is rounded to 1dp

Upper bound = 1.8 + $\frac{1}{2}$(0.1) = 1.85

Lower bound = 1.8 – $\frac{1}{2}$(0.1) = 1.75

- **Calculating using bounds**

Adding bounds

Maximum = Upper + upper

Minimum = Lower + lower

Subtracting bounds

Maximum = Upper - lower

Minimum = Lower – upper

Multiplying

Maximum = Upper x upper

Minimum = Lower x lower

Dividing

Maximum = Upper ÷ lower

Minimum = Lower ÷ upper

A/4 Direct and inverse proportion

The symbol $\propto$ means:
'varies as' or 'is proportional to'

- **Direct proportion**

If: $y \propto x$ or $y \propto x^2$ or $y \propto x^3$

Formulae: $y = kx$ or $y = kx^2$ or $y = kx^3$

Example

y is directly proportional to x
When y = 21, then x = 3
(find value of k first by substituting these values)

$y \propto x \quad \therefore y = kx$

$21 = k \times 3$

$\therefore \underline{k = 7}$

$\underline{y = 7x}$

(Now this equation can be used to find y, given x)

- **Inverse proportion**

If: $y \propto \frac{1}{x}$ or $y \propto \frac{1}{x^2}$ or $y \propto \frac{1}{x^3}$

Formulae: $y = \frac{k}{x}$ or $y = \frac{k}{x^2}$ or $y = \frac{k}{x^3}$

Example

a is inversely proportional to b
When a = 12 and b = 4

$a \propto \frac{1}{b} \quad \therefore a = \frac{k}{b}$

$12 = \frac{k}{4}$

$\therefore k = 48$

$\therefore a = \frac{48}{b}$

A/5 Solve quadratic equation by factorising

- **Put equation in form $ax^2 + bx + c = 0$**

$2x^2 - 3x - 5 = 0$

- **Factorise the left hand side**

$(2x - 5)(x + 1) = 0$

- **Equate each factor to zero**

$2x - 5 = 0$ or $x + 1 = 0$

$\underline{x = 2.5 \text{ or } x = -1}$

A/6 Solve quadratic equations by formula

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

Example

To solve: $3x^2 + 4x - 2 = 0$

$a = 3$

$b = 4$

$c = -2$

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

$$x = \frac{-4 \pm \sqrt{(-4)^2 - 4(3)(-2)}}{2(3)}$$

$$= \frac{-4 \pm \sqrt{16+24}}{6}$$

$$= \frac{-4 \pm \sqrt{40}}{6}$$

$$x = \frac{-4 + \sqrt{40}}{6} \quad \text{OR} \quad \frac{-4 - \sqrt{40}}{6}$$

$\underline{x = 0.39 \text{(2dp)} \quad \text{OR} \quad -1.72 \text{ (2dp)}}$

A/7 Solve quadratic equation by completing the square

- **Make the coefficient of x^2 a square**

$2x^2 + 10x + 5 = 0$ (mult by 2)

⇨ $4x^2 + 20x + 10 = 0$

- **Add a number to both sides to make a perfect square**

$4x^2 + 20x + 10 = 0$ (Add 15)

$4x^2 + 20x + 25 = 15$

⇨ $(2x + 5)^2 = 15$

- **Square root both sides**

$2x + 5 = \pm\sqrt{15}$ (-5 from both sides)

$2x = -5 \pm \sqrt{15}$

$x = \frac{-5 + \sqrt{15}}{2}$ OR $\frac{-5 - \sqrt{15}}{2}$

$\underline{x = -0.56 \quad \text{OR} \quad -4.44 \text{ (2dp)}}$

A/8 Simplify algebraic fractions

Adding & subtracting algebraic fractions

Example 1

$$\frac{x+3}{4} + \frac{x-5}{3} \quad \text{(common denominator is 12)}$$

$$= \frac{3(x+3)}{12} + \frac{4(x-5)}{12}$$

$$= \frac{3x+9+4x-20}{12}$$

$$= \frac{7x-11}{12}$$

Example 2

$$\frac{5}{(x+1)} - \frac{3}{(x+2)} \quad \text{(common denominator is (x+1)(x+2))}$$

$$= \frac{5(x+2)-3(x+1)}{(x+1)(x+2)}$$

$$= \frac{5x+10-3x-3}{(x+1)(x+2)}$$

$$= \frac{2x+7}{(x+1)(x+2)}$$

- **Simplifying algebraic fractions**

Example

$$\frac{2x^2+3x+1}{x^2-3x-4} \quad \text{(factorise)}$$

$$= \frac{(2x+1)\cancel{(x+1)}}{(x-4)\cancel{(x+1)}} \quad \text{(cancel)}$$

$$= \frac{(2x+1)}{(x-4)}$$

A/9 Solve equations with fractions

$$\frac{x}{2x-3} + \frac{4}{x+1} = 1 \quad \text{Common denominator (2x-3)(x+1)}$$

$$\frac{x(x+1)+4(2x-3)}{(2x-3)(x+1)} = 1$$

$$\frac{x^2+x+8x-12}{(2x-3)(x+1)} = 1$$

$x^2 + 9x - 12 = 1(2x-3)(x+1)$

$x^2 + 9x - 12 = 2x^2 - x - 3$ ($-x^2$ from both sides)

$9x - 12 = x^2 - x - 3$ ($-9x$ from each side)

$-12 = x^2 - 10x - 3$ (+12 to each side)

$0 = x^2 - 10x + 9$ (factorise)

$(x+9)(x+1) = 0$

$x = -9$ or $x = -1$

A/10 Solve simultaneous equations ~ one is a quadratic

- **Rewrite the linear with one letter in terms of the other**
- **Substitute the linear into the quadratic**

Example

$x + y = 4$ (find one letter in terms of the other

$\Rightarrow\ y = 4 - x$

$x^2 + y^2 = 40$ (substitute $y=4-x$)

$x^2 + (4-x)^2 = 40$ (Expand $(4-x)^2$)

$x^2 + 16 - 8x + x^2 = 40$

$2x^2 - 8x + 16 = 40$ (-40 from each side)

$2x^2 - 8x - 24 = 0$ (÷2 both sides)

$x^2 - 4x - 12 = 0$ (factorise)

$(x-6)(x+2) = 0$

$x = 6$ or $x = -2$

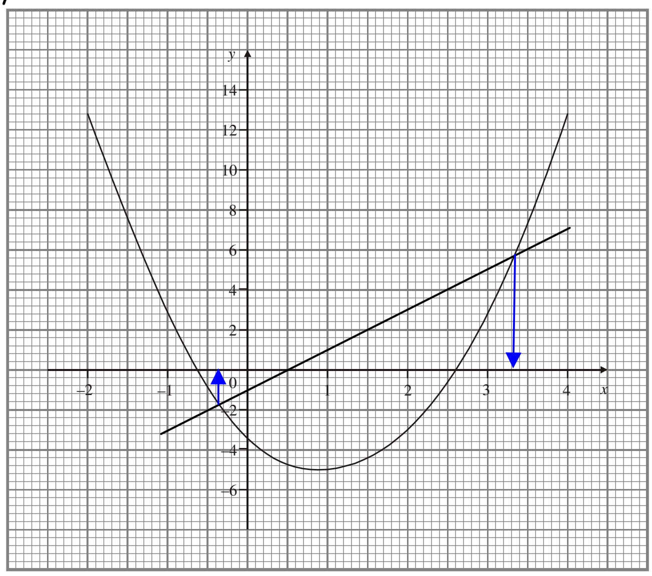
A/10 Solve GRAPHICALLY simultaneous equations ~ one is a quadratic

- **Draw the two graphs and find where they intersect**

Example

$y = 2x^2 - 4x - 3$

$y = 2x - 1$



Solutions are $x = -0.3$ and $x = 3.3$ (points of intersection)

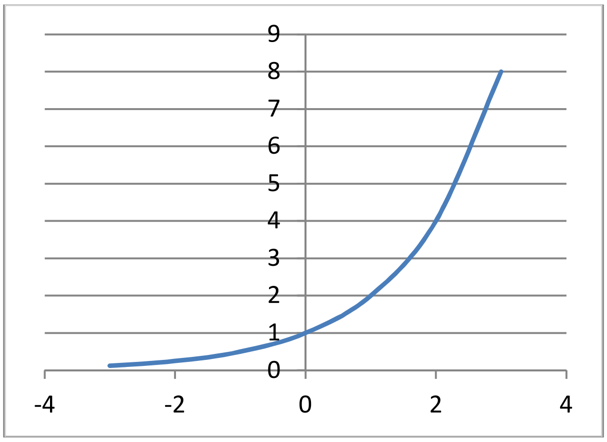
- Sometimes the equation has to be adapted~ rearrange the equation to solve so that the equation of the graph drawn is on the left. On the right is the other equation to be drawn

A/11 Graph of Exponential function

The graph of the exponential function is:

$$y = a^x$$

Example $y = 2^x$



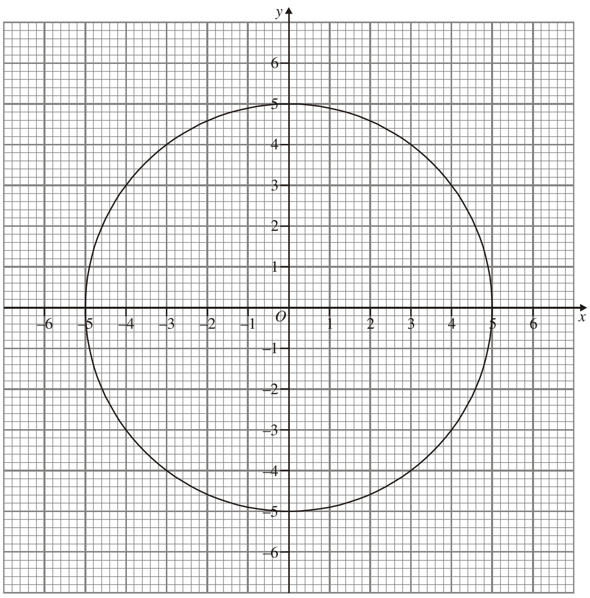
It has no maximum or minimum point
It crosses the y-axis at (0,1)
It never crosses the x-axis

A/12 Graph of the circle

The graph of a circle is of the form:

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

where r is the radius and the centre is (0,0)



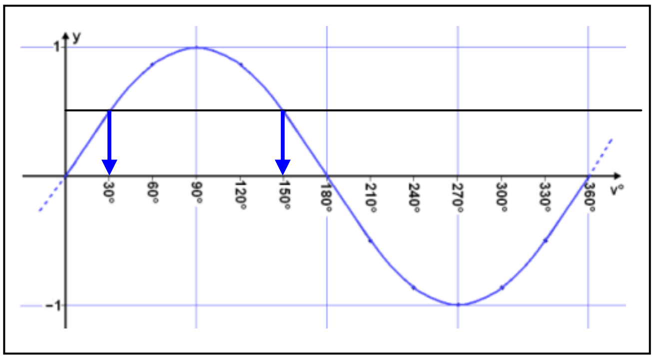
This a circle of radius 5 and a centre (0,0)
The graph of this circle is

$$x^2 + y^2 = 5^2$$
$$\Rightarrow x^2 + y^2 = 25$$

A/13 Graphs of trigonometric functions

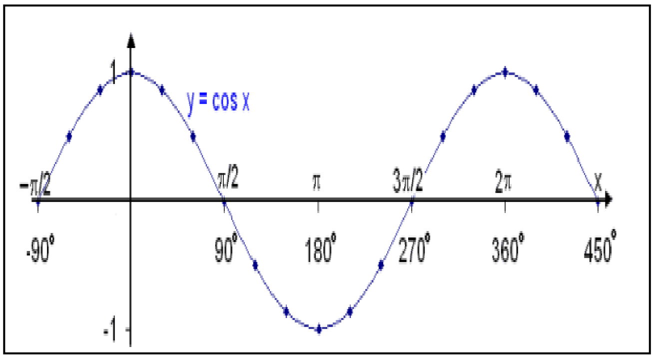
LEARN THE SHAPES OF THE GRAPHS

Graph of y=sin x



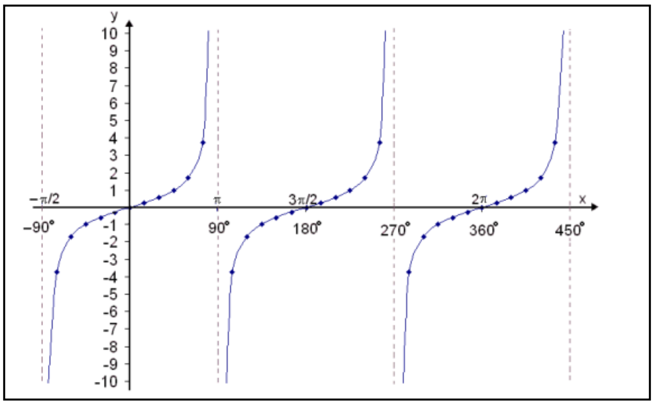
$$-1 \le \sin x \le 1$$

Graph y = cos x



$$-1 \le \cos x \le 1$$

Graph y = tan x



Tan x is undefined at 90^0, 270^0 ....

Solutions to trigonometrical equations can be found on the calculator and by using the symmetry of these graphs

Example:
If sin x = 0.5
x = 30^0 , 150^0 , *(See the solutions on sin graph above* or from calculator)

A/14 Transformation of functions

f(x) means 'a function of x'

e.g. $f(x) = x^2 - 4x + 1$

f(3) means work out the value of f(x) when x = 3

e.g. $f(3) = 3^2 - 4\times3 + 1 = -2$

In general for any graph y = f(x) these are the transformations

$y = f(x) + a$	Translation $\begin{pmatrix}0\\a\end{pmatrix}$
$y = f(x+a)$	Translation $\begin{pmatrix}-a\\0\end{pmatrix}$
$y = -f(x)$	Reflection in the x-axis
$y = f(-x)$	Reflection in the y-axis
$y = af(x)$	Stretch from the x-axis Parallel to the y-axis Scale factor=a
$y = f(ax)$	Stretch from the y-axis Parallel to the x-axis Scale factor= $\frac{1}{a}$

A/15 Change the subject of a formula

- **The subject may only appear once**

Use balancing to isolate the new subject

Example : To make 'x' the new subject

$$A = \frac{k(x+5)}{3} \quad \text{(multiply both sides by 3)}$$

$$\Rightarrow \ 3A = k(x+5) \quad \text{(Expand the bracket)}$$

$$\Rightarrow \ 3A = kx + 5k \quad \text{(-5k from both sides)}$$

$$3A - 5k = kx \quad (\div k \text{ both sides})$$

$$\frac{3A - 5k}{k} = \frac{\cancel{k}x}{\cancel{k}}$$

$$x = \frac{3A - 5k}{k}$$

- **The subject may appear twice**

Collect together all the terms containing the new subject & factorise to isolate it

Example: to make 'b' the new subject

$$a = \frac{2 - 7b}{b - 5} \quad \text{(multiply both sides by (b – 5))}$$

$$a(b - 5) = 2 - 7b \quad \text{(Expand the bracket)}$$

$$ab - 5a = 2 - 7b \quad \text{(+7b to both sides)}$$

$$7b + ab - 5a = 2 \quad \text{(+5a to both sides)}$$

To leave terms in b together

$$7b + ab = 2 + 5a \quad \text{(factorise the left side)}$$

To isolate b

$$\frac{b(7 + a)}{(7 + a)} = \frac{2 + 5a}{(7 + a)} \quad (\div(7 + a) \text{ both sides})$$

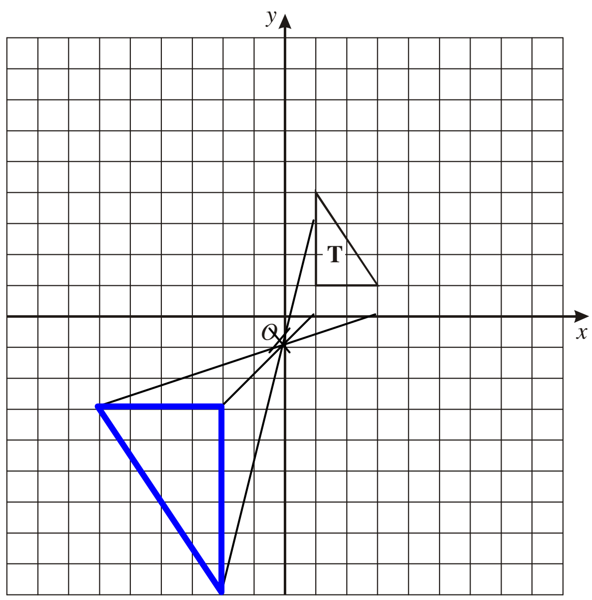
$$b = \frac{2 + 5a}{(7 + a)}$$

A/16 Enlarge by a negative scale factor

With a negative scale factor:

- The image is on the opposite side of the centre
- The image is also inverted

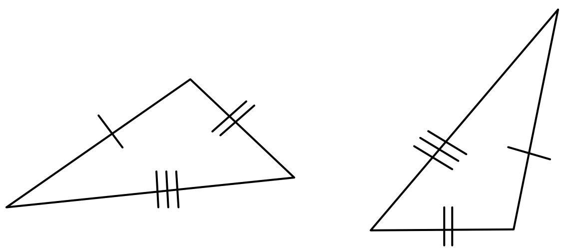
Example : Enlargement scale factor -2 about 0



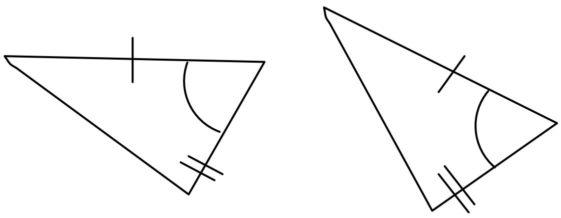
A/17 Congruence

- Congruent shapes have the same size and shape, one will fit exactly over the other.
- 2 triangles are congruent if any of these 4 conditions are satisfied on each triangle

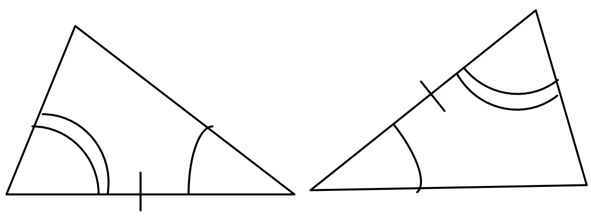
~The corresponding sides are equal ~ **SSS**



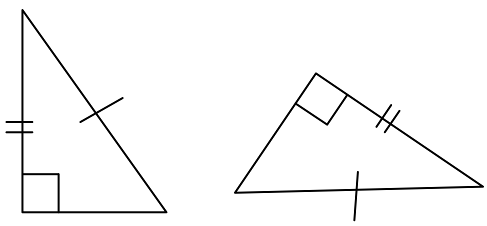
~2 sides & the included angle are equal ~ **SAS**



~2 angles & the corresponding side are equal ~ **ASA**



~Both triangles are right-angled, hypotenuses are equal and another pair of sides are equal ~ **RHS**



A/18 Similarity & enlargement

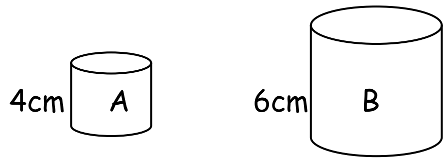
- **For similar shapes when:**

Length scale factor = **k**

Area scale factor = $\mathbf{k^2}$

Volume scale factor = $\mathbf{k^3}$

Example



If height of A = 4cm & height of B = 6cm

- Length scale factor = 6 ÷ 4 = **1.5**

If surface area of A = 132cm^2

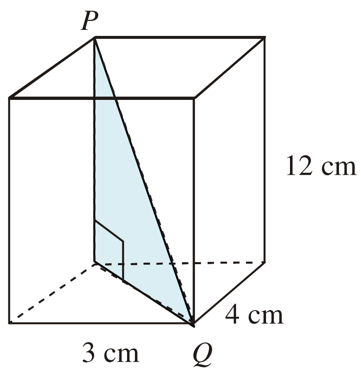
- Surface area of B = 132 x 1.5^2 = 297cm^3

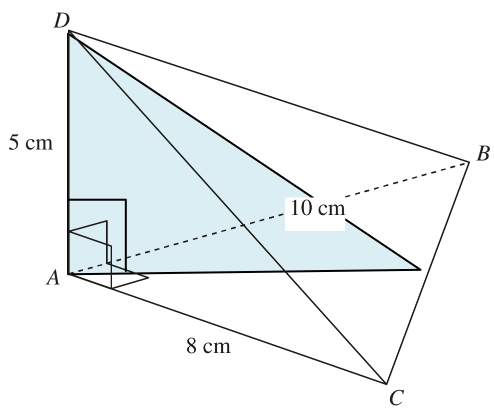
If volume of A = 120 cm^3

- Volume of B = 120 x 1.5^3 = 405cm^3

A/19 Finding lengths & angles in 3D

- **Identify the triangle in the 3D shape containing the unknown side/angle**
- **Use Pythagoras and trigonometry as appropriate**





A/20 **Sine Rule** (non-right angled triangles)

To find an angle use:

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

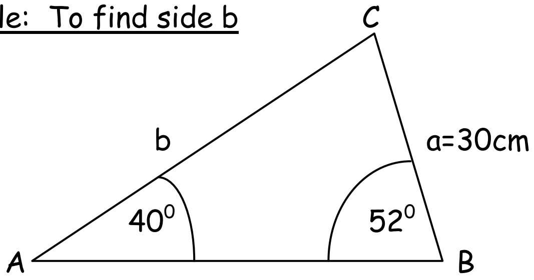
To find a side use:

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

Use SINE RULE when given:

- two sides and a non-included angle
- any two angles and one side

Example: To find side b



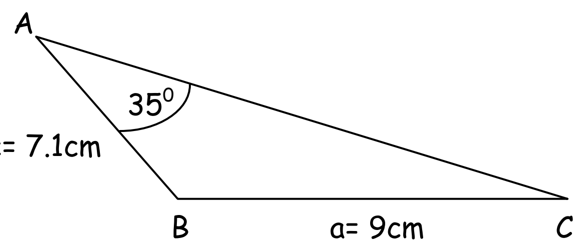
$$\frac{b}{\sin B} = \frac{a}{\sin C}$$

$$\frac{b}{\sin 52^0} = \frac{30}{\sin 40^0}$$

$$b = \frac{30}{\sin 40^0} \times \sin 52^0$$

$$\underline{b = 36.8 \text{ cm (1dp)}}$$

Example: To find angle C



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

$$\frac{\sin C}{7.1} = \frac{\sin 35^0}{9}$$

$$\sin C = \frac{\sin 35^0}{9} \times 7.1$$

$$\sin C = 0.4524.....$$

$$C = \sin^{-1}(0.4524.....)$$

$$\underline{C = 28.9^0\text{(1dp)}}$$

A/20 **Cosine Rule** (non-right angled triangles)

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

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

OR

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

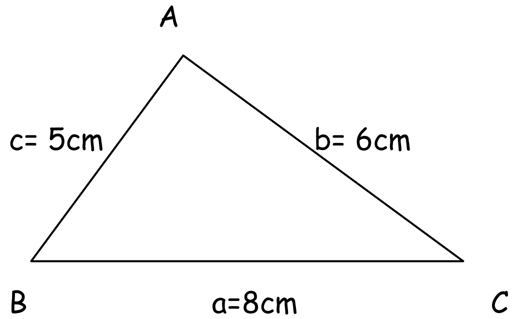
$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Use COSINE RULE when given:

- 3 sides
- 2 sides and the included angle

Example: To find angle C



$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

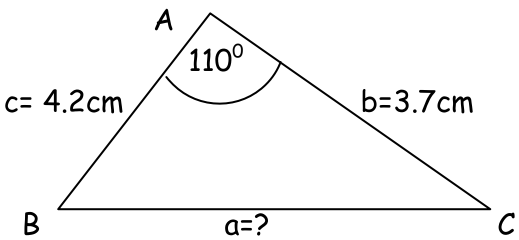
$$\cos C = \frac{8^2 + 6^2 - 5^2}{2\text{x}8\text{x}6}$$

$$\cos C = 0.78125......$$

$$C = \cos^{-1}(0.78125......)$$

$$\underline{C = 38.6^0\text{(1dp)}}$$

Example: To find side a



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

$$a^2 = 3.7^2 + 4.2^2 - 2\text{x}3.7\text{x}4.2 \cos 110^0$$

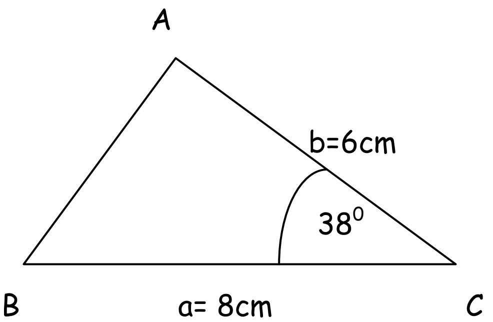
$$a^2 = 41.96$$

$$\underline{a = 6.48\text{(2dp)}}$$

A/20 Area of triangle –height not known

Area = $\frac{1}{2}$ ab sinC
Area = $\frac{1}{2}$ bc sinA
Area = $\frac{1}{2}$ ac sinB

Example



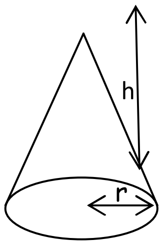
Area = $\frac{1}{2}$ ab sinC
= $\frac{1}{2}$ x 8 x 6 x sin 38^0
= 14.8 cm^2(1dp)

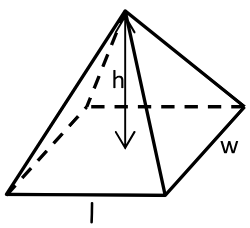
A/21 Pyramid & Sphere –Volume

VOLUME - PYRAMID

Volume of Pyramid = $\frac{1}{3}$ x area of cross-section x height

e.g. cone



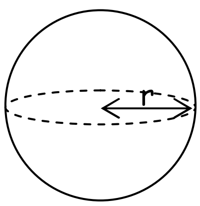


Volume = $\frac{1}{3}$ x $\pi r^2 h$

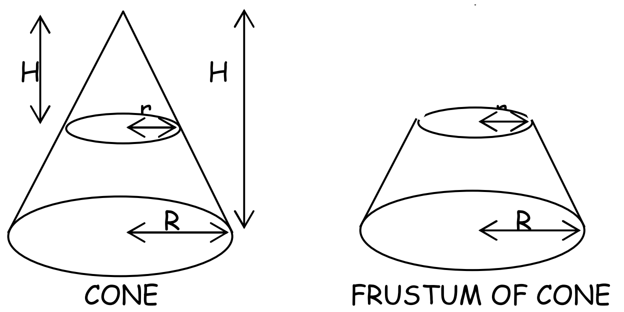
Volume = $\frac{1}{3}$ x l x w x h

VOLUME - SPHERE

Volume of Sphere = $\frac{4}{3}\pi r^3$



VOLUME -FRUSTUM OF A CONE

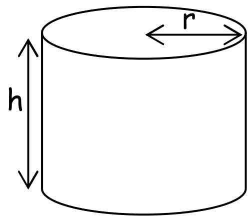


Volume of frustum
= Volume of whole cone – volume of cone removed
= $\frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

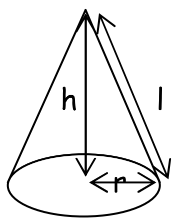
A/21 Pyramid & Sphere – Surface Area

CURVED SURFACE AREA

~Curved surface area of a cylinder = $2\pi rh$

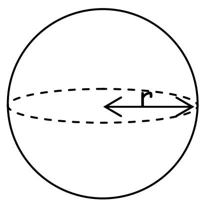


~Curved surface of a cone = πrl

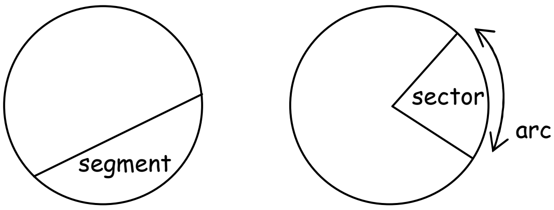


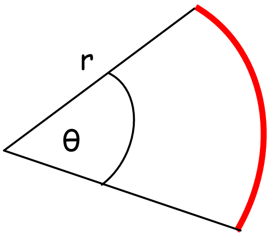
[NB To find 'l' use Pythagoras' Theorem
$l^2 = h^2 + r^2$]

~Curved surface of a sphere = $4\pi r^2$

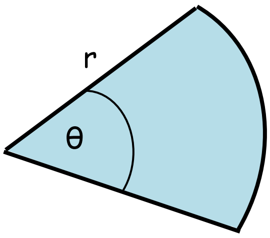


A/22 Length of arc & area of sector





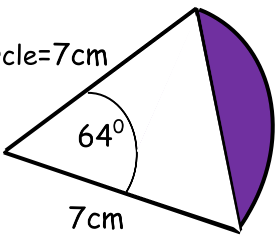
Length of arc = $\dfrac{\theta}{360^0} \times 2\pi r$



Area of sector = $\dfrac{\theta}{360^0} \times \pi r^2$

A/22 Area of segment

radius of circle=7cm



Area of segment

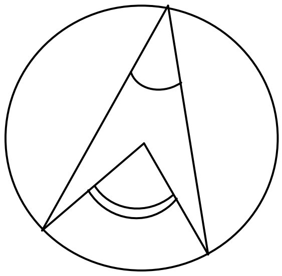
= area of sector – area of triangle

$= \dfrac{\theta}{360^0} \times \pi r^2 \quad - \tfrac{1}{2}\, ab \sin\theta$

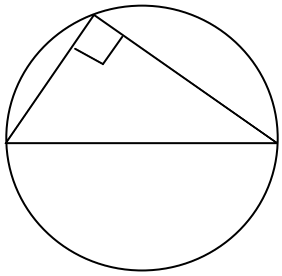
$= \dfrac{64^0}{360^0} \times \pi \times 7^2 \quad - \tfrac{1}{2}\, 7 \times 7 \times \sin 64^0$

= 5.35cm^2 (1dp)

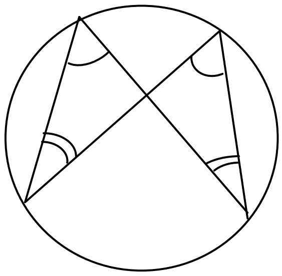
A/23 Circle properties



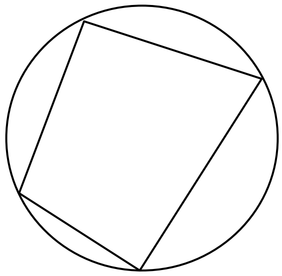
The angle at the centre = 2 x the angle at the circumference



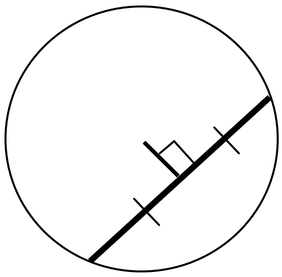
The angle in a semi-circle is a right angle



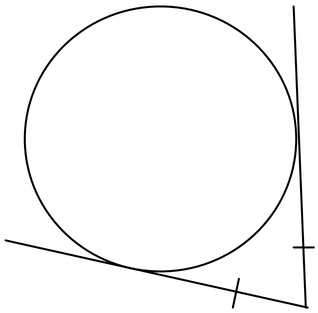
Angles in the same segment are equal



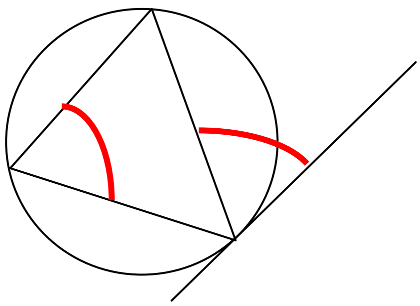
Opposite angles of a cyclic quadrilateral add up to 180^0



The perpendicular from the centre to a chord bisects the chord



Tangents from a point to a circle are equal

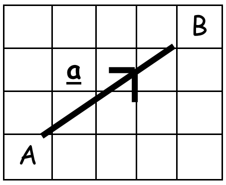


The angle between a tangent and a chord is equal to the angle in the alternate segment

A/24 Vectors

- **Vector notation**

This vector can be written as $\begin{pmatrix}3\\2\end{pmatrix}$ or $\underline{a}$ or $\overrightarrow{AB}$

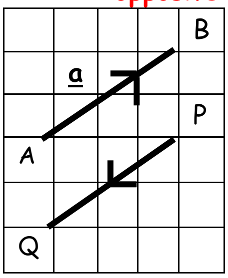


- **A vector has magnitude(length) & direction(shown by an arrow)**

Magnitude can be found by Pythagoras Theorem

$$AB = \sqrt{3^2 + 2^2} = \sqrt{13} \ = 3.6$$

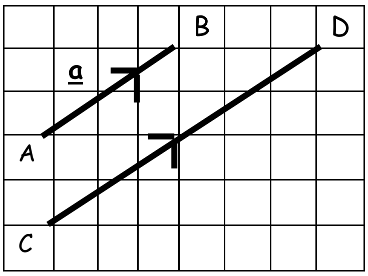
- **A parallel vector with same magnitude but opposite direction**



Vector $\overrightarrow{PQ}$ is equal in length to $\overrightarrow{AB}$ but opposite in direction so we say:

$$\overrightarrow{PQ} = -\underline{a}$$

- **A parallel vector with same direction but different magnitude**



Vector $\overrightarrow{CD}$ is twice (scalar 2) the magnitude but same direction so we say:

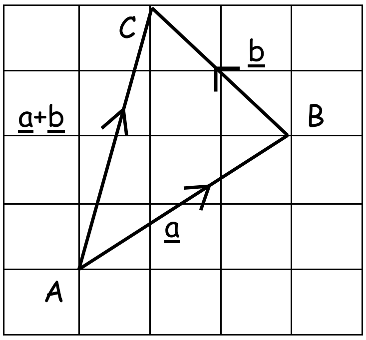
$$\overrightarrow{CD} = 2\underline{a}$$

A negative scalar would reverse the direction

- **Vector addition**

Adding graphically, the vectors go nose to tail

$\underline{a} = \begin{pmatrix}3\\2\end{pmatrix}$ $\underline{b} = \begin{pmatrix}-2\\2\end{pmatrix}$



The combination of these two vectors:

$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC} = \underline{a} + \underline{b}$$

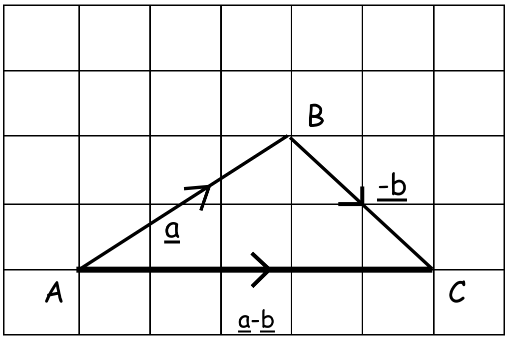
$$\begin{pmatrix}3\\2\end{pmatrix} + \begin{pmatrix}-2\\2\end{pmatrix}$$

$$= \begin{pmatrix}1\\4\end{pmatrix}$$

- **Vector subtraction**

Adding graphically, the vectors go nose to tail

$\underline{a} = \begin{pmatrix}3\\2\end{pmatrix}$ $\underline{b} = \begin{pmatrix}-2\\2\end{pmatrix}$



The combination of these two vectors:

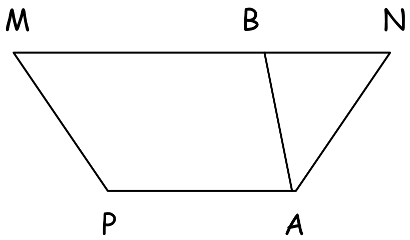
$$\overrightarrow{AB} - \overrightarrow{BC} = \overrightarrow{AC} = \underline{a} - \underline{b}$$

$$\begin{pmatrix}3\\2\end{pmatrix} - \begin{pmatrix}-2\\2\end{pmatrix}$$

$$= \begin{pmatrix}5\\0\end{pmatrix}$$

$\overrightarrow{AC}$ is called the RESULTANT vector

- **The sum of vectors**



$$\overrightarrow{AB} = \overrightarrow{AP} + \overrightarrow{PM} + \overrightarrow{MB}$$

The vector AB is equal to the sum of these vectors or it could be a different route:

go via N

$$\overrightarrow{AB} = \overrightarrow{AN} + \overrightarrow{NB}$$

start point | end point

A/25 Sampling

The sample is:

- a small group of the population.
- an adequate size
- representative of the population

Simple random sampling
Everyone has an equal chance
e.g. pick out names from a hat

Systematic sampling
Arranged in some sort of order
e.g. pick out every 10^{th} one on the list

Stratified sampling
Sample is divided into groups according to criteria
These groups are called strata
A simple random sample is taken from each group in proportion to its size using this formula:

$$\text{No from each group} = \frac{\text{Stratum size}}{\text{Population}} \times \text{Sample size}$$

Example

An inspector wants to look at the work of a stratified sample of 70 of these students.

Language	**Number of students**
Greek	145
Spanish	121
German	198
French	186
Total	**650**

$$\text{No. from Greek} = \frac{145}{650} \times 70 \approx 16$$

$$\text{No. from Spanish} = \frac{121}{650} \times 70 \approx 13$$

$$\text{No. from German} = \frac{198}{650} \times 70 \approx 21$$

$$\text{No. from French} = \frac{186}{650} \times 70 \approx 20$$

This only tells us 'how many' to take - now take a random sample of this many from each language

A/26 Histograms

- Class intervals are not equal
- Vertical axis is the frequency density
- The area of each bar not the height is the frequency

Frequency = class width x frequency density
Frequency density = frequency ÷ class width

To draw a histogram

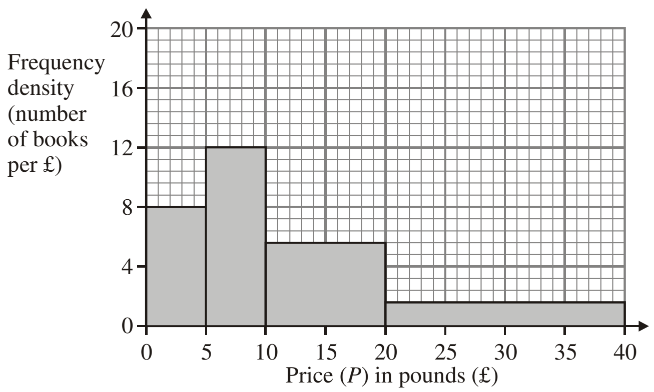
Calculate the frequency density

Example

Age (x years)	Class width	f	Frequency density
$0 < x \le 20$	**20**	**28**	**28**÷**20** = 1.4
$20 < x \le 35$	**15**	**36**	**36**÷**15** = 2.4
$35 < x \le 45$	**10**	**20**	**20**÷**10** = 2
$45 < x \le 65$	**20**	**30**	**30**÷**20** = 1.5

Scale the frequency density axis up to 2.4
Draw in the bars to relevant heights & widths

To interpret a histogram



NOTE: On the vertical axis each small square = 0.8

Price (P) in pounds (£)	f = width x height
$0 < P \le 5$	5 x 8 = 40
$5 < P \le 10$	5 x 12 = 60
$10 < P \le 20$	10 x 5.6 = 56
$20 < P \le 40$	20 x 1.6 = 32

A/27 Probability – the 'and' 'or' rule

P(A or B) = p(A) + p(B)

Use this addition rule to find the probability of either of two mutually exclusive events occurring

e.g. p(a 3 on a dice **or** a 4 on a dice)

$$= \frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

P(A and B) = p(A) x p(B)

Use this multiplication rule to find the probability of either of both of two independent events occurring

e.g. p(Head on a coin **and** a 6 on a dice)

$$= \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$$

A/28 Probability – Tree diagram for successive dependent events

When events are dependent, the probability of the second event is called a conditional event because it is conditional on the outcome of the first event

Example

2 milk and 8 dark chocolates in a box
Kate chooses one and eats it. (ONLY 9 left now)
She chooses a second one
This can be shown on a tree diagram