NATIONAL 5 MATHS REVISION CARDS

The best way to revise for your National 5 maths exams is to practice lots of exam style questions.

The revision cards here have the key facts along with links to notes, videos, practice questions and exam questions.

CHECKLIST – CLICK HERE.

N5 Quick Links – Click the topic to go the revision card.

ALGEBRAIC FRACTIONS

A fraction that includes algebraic letter terms is called an algebraic fraction. Like numerical fractions, algebraic fractions can be simplified, added, subtracted, multiplied and divided.

Simplify

$$\frac{7x^2y}{14xy^3} = \frac{x}{2y^2}$$

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

Add and Subtract

$$\frac{x}{2} + \frac{y}{3} = \frac{3x+2y}{6}$$

$$\frac{x}{3} - \frac{5}{2y} = \frac{2xy-9}{6y}$$

Multiply and Divide

$$\frac{3x}{y^2} \times \frac{2x^2y}{12} = \frac{x^3}{2y}$$

$$\frac{3x}{y^2} \div \frac{x}{12}$$
$$= \frac{3x}{y^2} \times \frac{12}{x} = \frac{36}{y^2}$$

ALGEBRAIC FRACTIONS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

ARC LENGTH AND SECTOR AREA

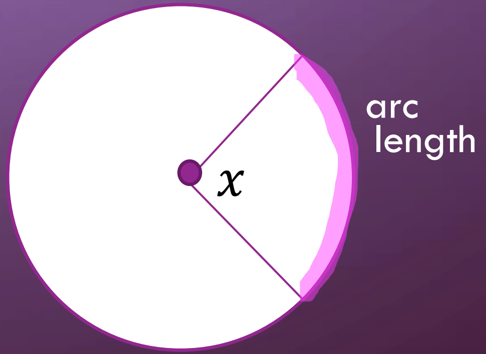
Arc Length and Sector Area are related to the circumference and area of a circle respectively. You need to know the following formulae where r is the radius, d is the diameter, x is the angle at the centre.

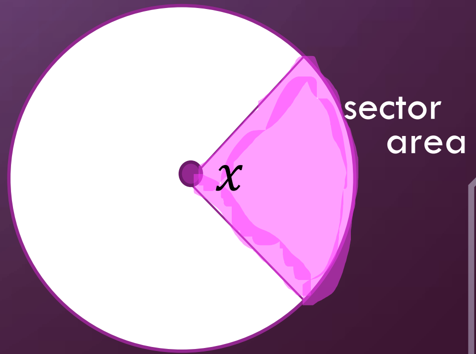
Area of circle	Circumference	Arc Length	Sector Area
$A = \pi r^2$	$C = \pi d$	$\frac{x}{360}\pi d$	$\frac{x}{360}\pi r^2$

To find the angle given arc length or sector area either work backwards or use the following formulae:

$$x = \frac{\text{Arc Length} \times 360}{\pi d}$$

$$x = \frac{\text{Sector Area} \times 360}{\pi r^2}$$





ARC LENGTH AND SECTOR AREAS

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

CHANGE SUBJECT OF FORMULA

The subject of the formula is the letter on the left hand side of the formula. For example in $y = 4x + 2$ the subject is y. To change the subject of the formula use inverse operations to rearrange the formula with a different letter alone on the left hand side.

Some operations and their inverses:

- Add ↔ Subtract
- Multiply ↔ Divide
- Square ↔ Square root

$3y = 2x^2 + 5$	Change subject to x
$2x^2 + 5 = 3y$	Swap sides
$2x^2 = 3y - 5$	Subtract 5
$x^2 = \frac{3y - 5}{2}$	Divide by 2
$x = \sqrt{\frac{3y - 5}{2}}$	Square root

CHANGE SUBJECT OF FORMULA RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

THE DISCRIMINANT

The discriminant, $b^2 - 4ac$, is used to find out the types of solutions (roots) to a quadratic equation. If a question requires you to use the discriminant it will usually ask you about the "nature" of the roots of a quadratic equation. The discriminant is the part under the square root in the quadratic formula.

$b^2 - 4ac < 0$	$b^2 - 4ac = 0$	$b^2 - 4ac > 0$
No real roots	Two equal real roots	Two distinct real roots

[CLICK HERE FOR DISCRIMINANT RESOURCES]

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

EQUATIONS AND INEQUALITIES

To solve an equation or inequality, the aim is to rearrange so that the letter term is alone on the right hand side of the equals or inequality sign. To do this, use inverse operations.

Equation example

$$4(x+2)=3+2(x-1)$$
$$4x+8=3+2x-2$$
$$4x+8=1+2x$$
$$2x=-7$$
$$x=-\frac{7}{2}$$

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

Inequality Example

$$3+5x\leq 2x-1$$
$$5x\leq 2x-4$$
$$3x\leq -4$$
$$x\leq -\frac{4}{3}$$

In an inequality, when multiplying or dividing by a negative, the inequality changes direction.

$$6+x>2+5x$$
$$-4x>-4$$
$$x<\frac{-4}{-4}$$
$$x<1$$

EQUATIONS AND INEQUALITIES RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

FACTORISING

Factorising means to put an algebraic expression into brackets. The order of factorising is important. There can be a mixture of the different types of factorising in one question.

Common Factor

- $3x + 15 = 3(x + 5)$
- $4y^2 - 34y = 2y(2y - 17)$

Difference of Two Squares

- $a^2 - b^2 = (a-b)(a+b)$
- $9x^2 - 25 = (3x-5)(3x+5)$

Trinomial/ Quadratic

- $x^2 - 3x - 10 = (x-5)(x+2)$
- $6x^2+4x-5 = (3x-1)(2x+5)$

FACTORISING RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

FRACTIONS

Factorising means to put an algebraic expression into brackets. The order of factorising is important. There can be a mixture of the different types of factorising in one question.

Add and Subtract

- Use"Smile and Kiss"

Multiply

- Multiply numerators together and multiply denominators together

Divide

- "Flip" the second fraction upside down and then multiply.

CLICK HERE FOR FRACTIONS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

GRADIENTS

The gradient of a line is a measure of how steep the line is. A higher gradient means a steeper line. The letter "m" is used to represent gradient (no one seems to know why it is m!)

Gradient Formula Version 1

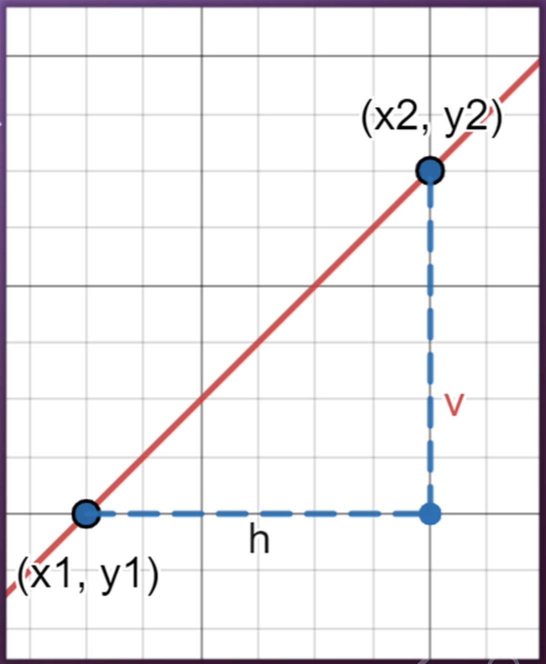
- If V is the vertical distance between any two points on the line and h is the horizontal distance between any two points on the line.

$$m = {}^{v}/_{h}$$

Gradient Formula Version 2

- If (x_1, y_1) and (x_2, y_2) are two points on a line then the gradient is given by:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$



GRADIENTS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

INDICES

An index is the power of a number or variable. Indices is the plural of index. There are a number of index rules to learn and remember that anything to the power of zero is equal to 1.

Multiplication Rule

- When multiplying add indices

$$x^a \times x^b = x^{a+b}$$

Division Rule

- When dividing subtract indices

$$x^a \div x^b = x^{a-b}$$

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

Raise to a Power

- If raising one power to another power multiply indices

$$(x^a)^b = x^{ab}$$

Negative Indices

- A negative index can be written as 1 over the same base to the positive index

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

Fractional Indices

- These correspond to roots.

$$x^{1/a} = \sqrt[a]{x}$$

$$x^{\frac{a}{b}} = \left(\sqrt[b]{x}\right)^a$$

$$x^3 \times x^4 = x^{3+4} = x^7$$

$$x^8 \div x^6 = x^{8-6} = x^2$$

$$\left(x^3\right)^5 = x^{3\times5} = x^{15}$$

$$x^{-4} = \frac{1}{x^4}$$

$$x^{\frac{3}{4}} = \left(\sqrt[4]{x}\right)^3$$

INDICES RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

MULTIPLYING BRACKETS

It is important to be able to remove the brackets from an algebra expression. This can be done in various ways including the "claw" or "grid" methods. Use the method that you like best.

Single Bracket

- $4(x+5)=4x+20$
- $3x(x-y+2) = 3x^2-3xy+ 6$

Double Bracket

- $(x+2)(2x- 7) = 2x^2-3x-14$
- $(3x–1)(x^2+4x–2)=3x^3+11x^2-10x+2$

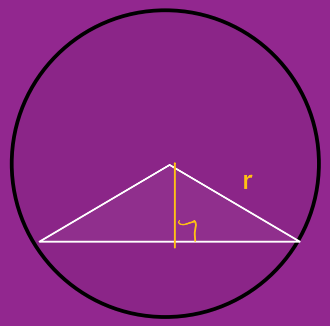
MUTLIPLYING BRACKETS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

PYTHAGORAS

You should know Pythagoras' Theorem and be able to apply it in various situations. You should be able to recognise that, due to symmetry, Pythagoras can often be used in circle problems. The converse of Pythagoras is also used to prove a triangle is right angled.

Circle



A chord joined to the centre by two radii can be split in the middle to make two right angled triangles

Converse

Square the length of the longest side

Square the lengths of the two shorter sides and add together

If these two values are the same then the triangle is right angled.

Applied Questions

In applied questions you are expected to recognise that right angled triangles are present (or can be formed) and use Pythagoras in these.

CLICK HERE FOR PYTHAGORAS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

PERCENTAGES

In N5 percentages you should be able to calculate compound interest, appreciation, depreciation and reverse a percentage calculation

Compound interest

- Question: interest is earned at 4%p.a. on a balance of £2500. How much in account after 3 years?
- Multiplier is 1.04. Power is 3.
- Calculation is 1.04^3 x2500 = £2812.16

Appreciation

- Question: an antique appreciates in value by 2.5% each year.It was bought 4 years ago for £550. What is it worth now?
- Multiplier is 1.025. Power is 4
- Calculation is 1.025^4 x 550 = £607.10

Depreciation

- Question: a car depreciated in value by 12% each year. It was bought 5 years ago for £25000. What is it worth now?
- Multiplier is 0.88 (as100% - 12% = 88%). Power is 5
- Calculation is 0.885 x 25000 = £13193.30

Reverse Percentages

- In a sale with 15% off, a coat is priced at £25.49. What was its price before the sale?
- 100 – 15 = 85%
- 85%   25.49   ÷ 85
- 1%   0.29988235   ÷ 100
- 100%   £29.99

CLICK HERE FOR PERCENTAGES RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

QUADRATIC EQUATIONS

A quadratic equation is an equation where a squared term is the higest power in the equation. At N5, a quadratic equation should be equal to zero before you solve it. It can be solved either by factorising or by using the quadratic formula.

Factorising

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

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

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

$x= -2$ or $x = -1$

Quadratic formula

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

$a= 1, b = 3, c = -2$

Quadratic formula continued

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

$$x = \frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times -2}}{2 \times 1}$$

$$x = \frac{-3 \pm \sqrt{17}}{2}$$

$$x = \frac{-3+\sqrt{17}}{2} \text{ or } x = \frac{-3-\sqrt{17}}{2}$$

$$x = 0.56 \text{ or } x = -3.56$$

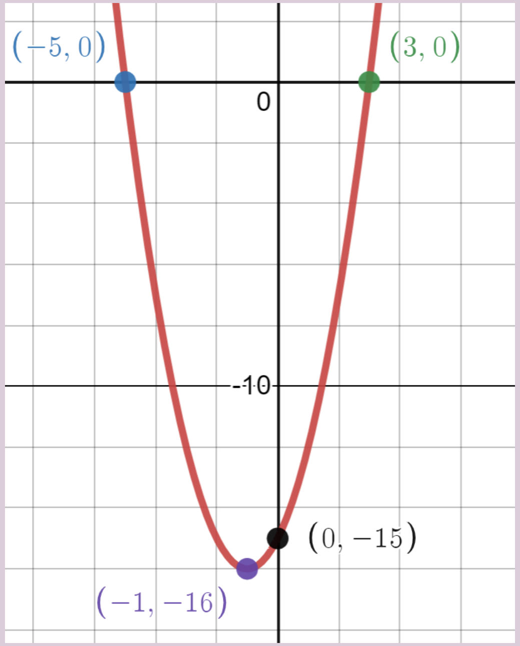
CLICK HERE FOR QUADRATIC EQUATIONS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

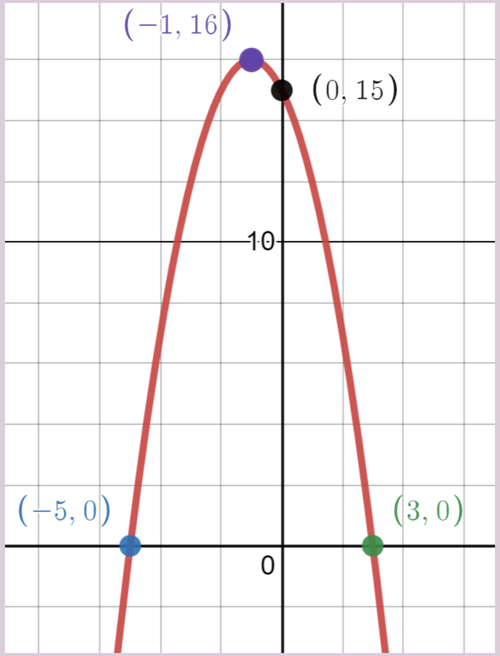
QUADRATIC GRAPHS

The graph of a quadratic function is known as a parabola. If the coefficient of x2 is positive then the parabola has a minimum turning point (happy parabola), if the coefficient of x2 is negative then the parabola has a maximum turning point (sad parabola). To sketch a parabola, show points on the axes and coordinates of the turning point.

Maximum TP



Minimum TP



CLICK HERE FOR QUADRATIC GRAPHS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

SCIENTIFIC NOTATION

Also known as standard form. This is a convenient way of writing numbers that are very large or very small using powers of 10.

Large Numbers

$$4 \cdot 3 \times 10^5 = 430\,000$$

$$5.21 \times 10^3 = 5210$$

Small Numbers

$$3 \cdot 5 \times 10^{-4} = 0.00035$$

$$9.31 \times 10^{-2} = 0.0931$$

Numbers in scientific notation have the form

$$a \times 10^b$$

Where a is a number such that $1 \leq a < 10$ and b is any whole number.

SCIENTIFIC NOTATION RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

SIMULTANEOUS EQUATIONS

A simultaneous equation is a set of two equations involving two unknown variables. Solving a simultaneous equation can be done graphically, by substitution or by elimination to find the value of each variable.

solving by elimination

$$3x + 4y = 19 \quad \times 3$$
$$2x + 3y = 14 \quad \times 4$$

$$9x + 12y = 57$$
$$-8x - 12y = -56$$

Add

$$x = 1$$

Substitute x = 1 into 3x + 4y= 19

$$3 + 4y = 19$$
$$4y = 16$$
$$y = 4$$

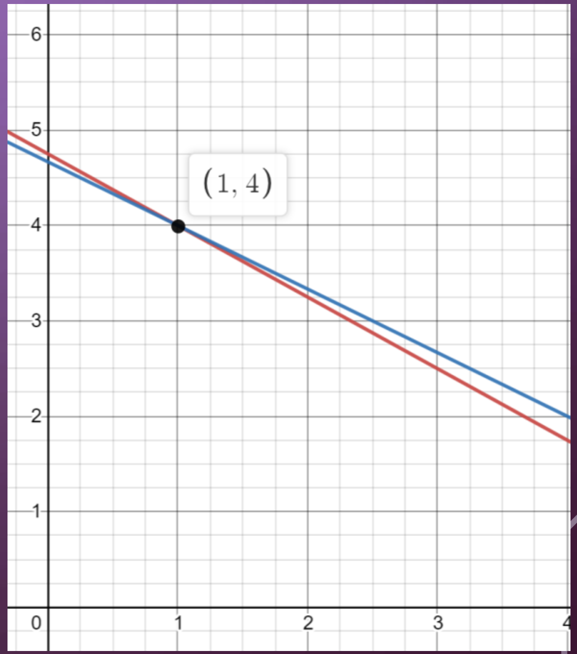
Solution x = 1, y = 4

solving graphically

$$3x + 4y = 19$$
$$2x + 3y = 14$$

Sketch both straight lines and identify the point of intersection as (1,4). This means here that the solution is

x = 1, y = 4



SIMULTANEOUS EQUATIONS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

STRAIGHT LINE

To find the equation of a straight line in maths we need to know the gradient and a point on the line. The gradient can be calculated if we know two points on the line. None of these formulae are given on the formula sheet so you must learn them!

Gradient Formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Where $(x_1, y_1) and\ (x_2, y_2)$ are points on the line

General Equation of Straight Line

$$y = mx + c$$

Where m is the gradient and c is the y-intercept (the point where the line crosses the y- axis).

Finding equation of a line

$$y - b = m(x - a)$$

Where m is the gradient and (a,b) is a point on the line.

STRAIGHT LINE RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

STATISTICS

In N5 maths you need to be able to analyse data and use your analysis to make comparisons. The main skills are

Median, Quartiles and Interquartile range

- From an ordered data set, the median is the middle value, the quartiles are the mid values of the upper and lower halves of the data.

Scattergraphs and line of best fit

- You should be able to use points on a scattergraph to find the equation of the line of best fit using straight line formulae.

Standard deviation

- Use a formula to calculate standard deviation. Use results to compare data sets.

STATISTICS RESOURCES
(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

SURDS

A surd is an exact representation of an irrational number. Instead of writing a decimal, to keep an answer exact we use a root. Surds can be simplified, added, subtracted, multiplied, divided etc. Use knowledge of perfect square numbers (eg 1, 4, 9,16, 25, 36, 49, 64, 81, 100, 121, 144 etc).

Simplifying

$$\sqrt{32} = \sqrt{16 \times 2} = \sqrt{16} \times \sqrt{2} = 4\sqrt{2}$$

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

Arithmetic

Collect surds with the same number under the root.

$$2\sqrt{3} + 4\sqrt{3} = 7\sqrt{3}$$

$$\sqrt{32} - 3\sqrt{2} = 4\sqrt{2} - 3\sqrt{2} = \sqrt{2}$$

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

Rationalising

Multiply numerator and denominator by the same root

$$\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\frac{4}{3\sqrt{5}} = \frac{4}{3\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{4\sqrt{5}}{3 \times 5} = \frac{4\sqrt{5}}{15}$$

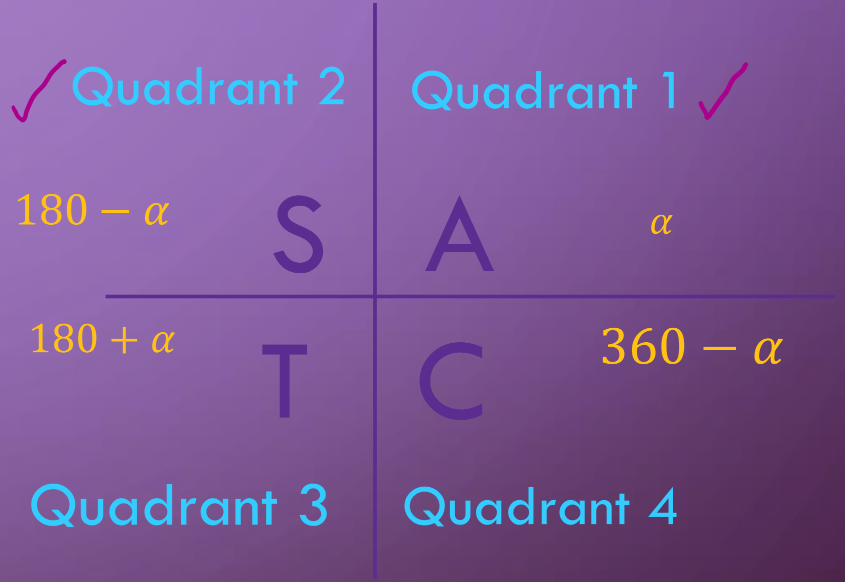
SURDS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

TRIG EQUATIONS

You should be able to solve trig equations using calculators and a CAST diagram. You should understand how to use the CAST diagram to identify all solutions to the trig equation.
A trig equation must be in the form sin x = number or cos x = number or tan x = number before it can be solved.

$$2\sin x + 1 = 2$$
$$2\sin x = 1$$
$$\sin x = 0\cdot 5$$



As sine is positive in this example, solutions lie in Q1 and Q2

Q_1

$$x = \sin^{-1} 0\cdot 5$$
$$x = 30^0$$

Q^2

$$x = 180 - 30$$
$$x = 150^0$$

Solutions are $x = 30^0$ and $x = 150^0$

CLICK HERE FOR TRIG EQUATION RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

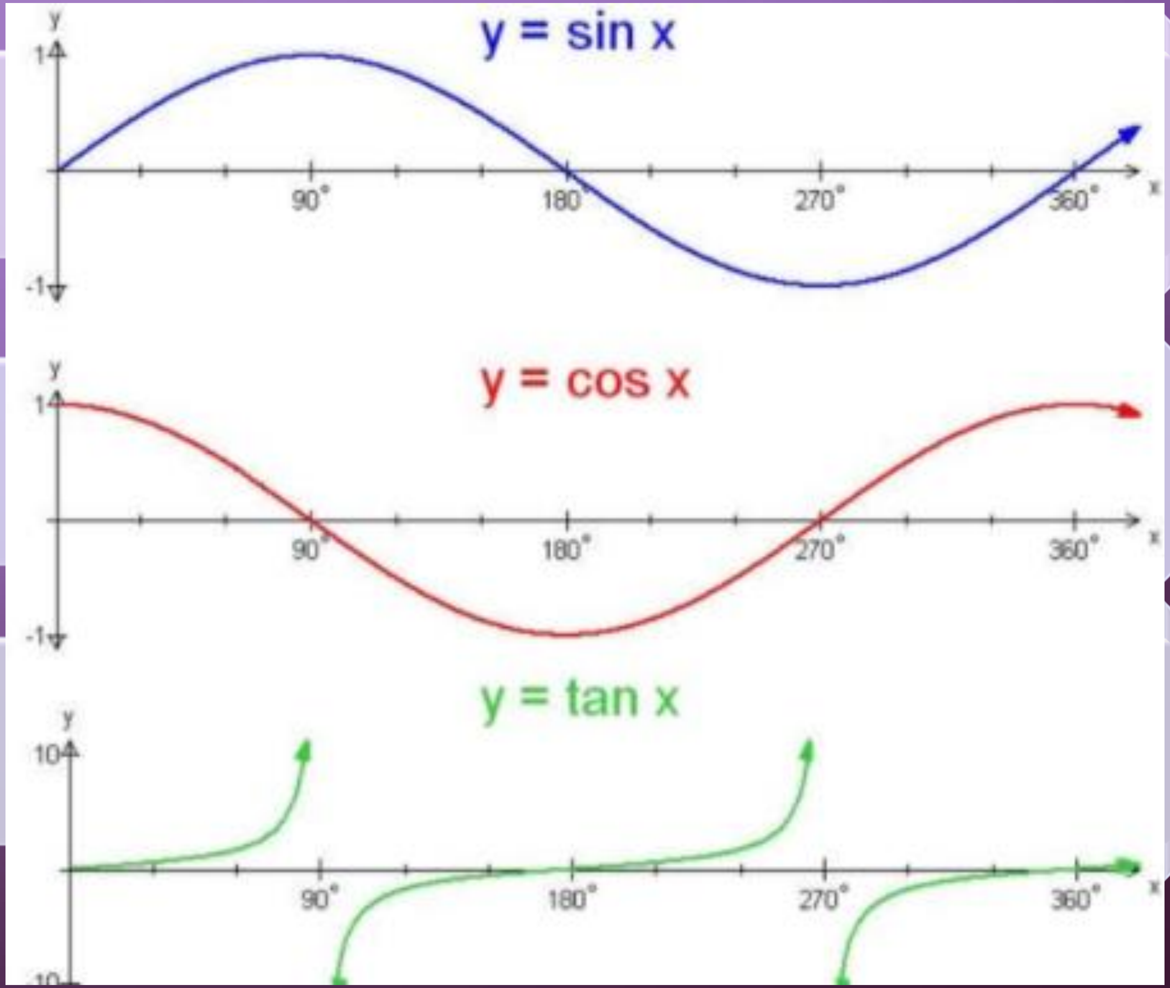
TRIG GRAPHS

You should be able to recognise and sketch each of the trig graphs, sine , cosine and tangent. You should be able to shift the graphs of sine and cosine vertically. You should understand what is meant by a period change and amplitude change. You should also know about phase angles (A)

Sine Graph

Cosine Graph

Tangent Graph



CLICK HERE FOR TRIG GRAPH RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

TRIG IDENTITIES

In Nat 5 you should be able to use the two trig identities shown below to prove relationships and simplify expressions.

Identity 1

$$\tan x = \frac{\sin x}{\cos x}$$

Identity 2

$$\sin^2 x + \cos^2 x = 1$$

$$\sin^2 x = 1 - \cos^2 x$$

$$\cos^2 x = 1 - \sin^2 x$$

CLICK HERE FOR TRIG IDENTITY RESOURCES

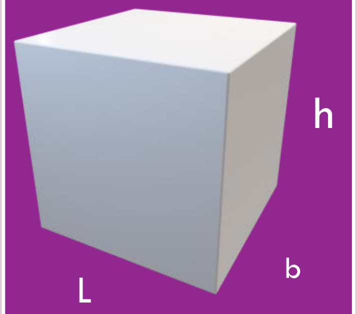
(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

VOLUMES

The volume of a 3D object is the amount of space inside the object. This is usually measured in cm^3, millilitres or litres. At N5, you are expected to know the formulas for calculating the volumes of cuboid, cube and cylinder. The other necessary volume formulas are provided on the formula sheet.

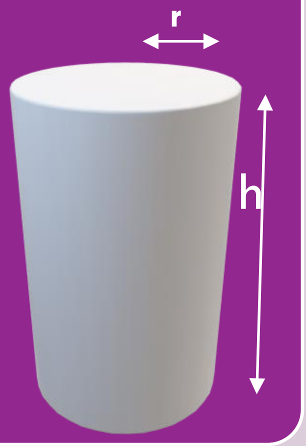
Cube/cuboid

$$V = lbh$$



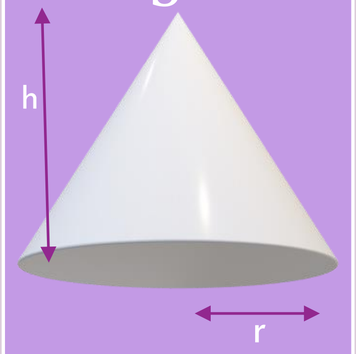
Cylinder

$$V = \pi r^2 h$$



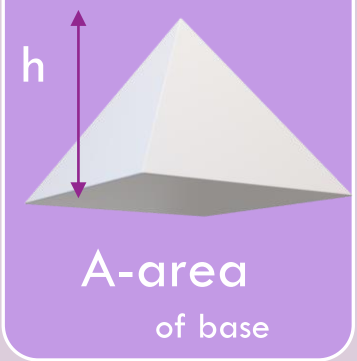
Cone

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



Pyramid

$$V = {}^{1}/_{3}\, Ah$$



Sphere

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

VOLUMES RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

FUNCTIONS

A function is a one to one mapping of an input to an output. In N5 you will be asked to evaluate either the output given a specific input value or the input given the output value.

Here is an example. If $f(x) = 3x^2 + 5$

then $f(2) = 3 \times 2^2 + 5 = 17$

and $f(-1) = 3 \times (-1)^2 + 5 = 8$

Sometimes you need to work backwards to find the input value.

Here is another example. Given that $f(x) = 4 - 3x^2$ find the value of "a" where $f(a) = -23$.

$f(a) = 4 - 3a^2$ and $f(a) = -23$

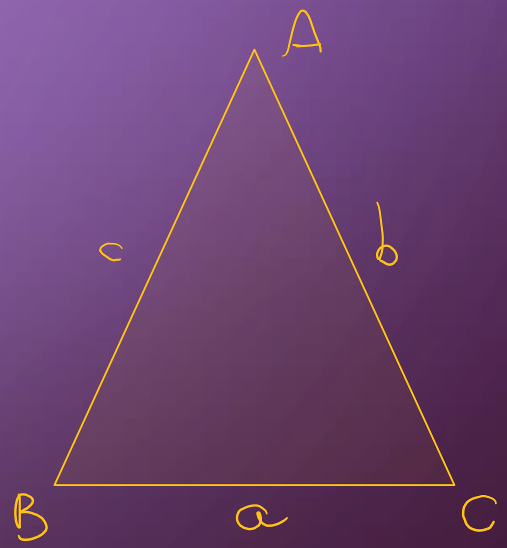
$$4 - 3a^2 = -23$$
$$-3a^2 = -27$$
$$a^2 = 9$$
$$a = \sqrt{9}$$
$$a = \pm 3$$

CLICK HERE FOR FUNCTIONS RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

TRIG – SINE RULE, COSINE RULE AND AREA OF A TRIANGLE

In a non-right angled triangle, the following formulae can be used to find the area, missing sides or missing angles. When finding a side or an angle, look to see if you know a "matching pair" of side and opposite angle. If you do, use the sine rule. If not – use the cosine rule.



Area of a Triangle

$$A = {}^{1}/_{2}\, ab \sin C$$

Sine Rule

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

Cosine Rule

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

CLICK HERE FOR TRIGONOMETRY RESOURCES

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

COMPLETING THE SQUARE

In completing the square, a quadratic expression is written in the form

$$(x \pm a)^2 \pm b$$

Where a and b are numbers.
This can be used to solve equations and to find the turning point of a parabola.

Examples:

$$x^2 + 4x + 3$$
$$= (x+2)^2 + 3 - 2^2$$
$$= (x+2)^2 + 3 - 4$$
$$= (x+2)^2 - 1$$

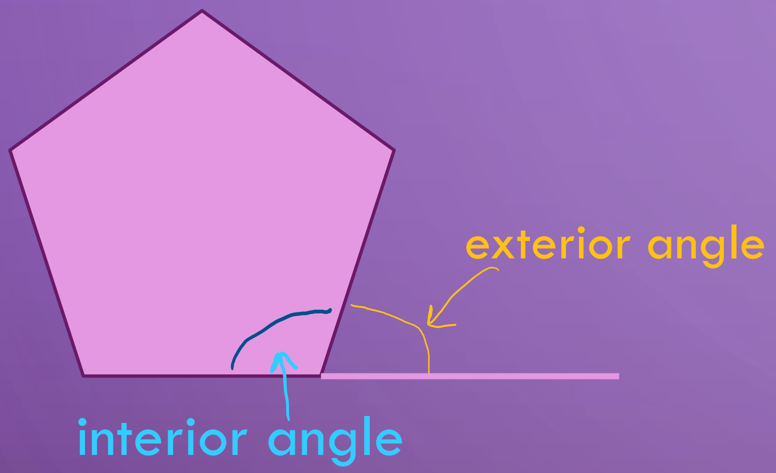
$$x^2 - 3x - 2$$
$$= \left(x - \tfrac{3}{2}\right)^2 - 2 - \left(\tfrac{3}{2}\right)^2$$
$$= \left(x - \tfrac{3}{2}\right)^2 - 2 - \tfrac{9}{4}$$
$$= \left(x - \tfrac{3}{2}\right)^2 - \tfrac{17}{4}$$

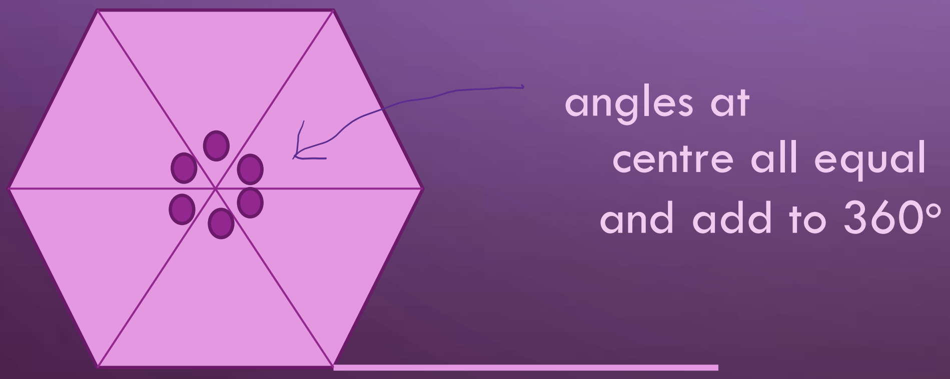
CLICK HERE FOR COMPLETING THE SQUARE RESOURCES

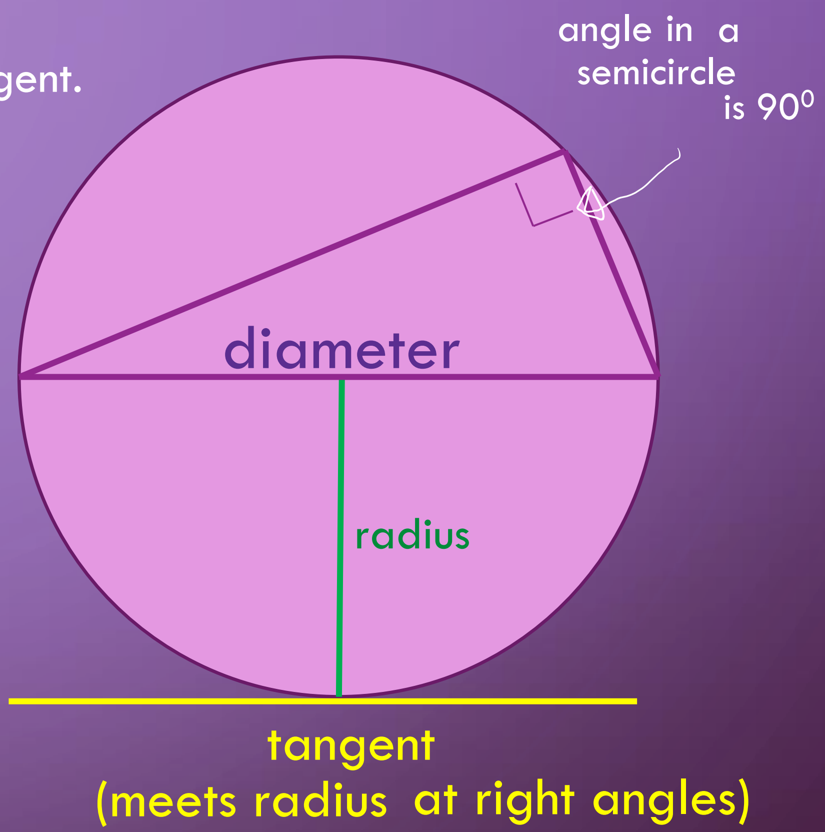
(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)

SHAPE PROPERTIES

You should be able to find interior, exterior angles in polygons.
You should also understand angles in a circle including at a tangent.







[CLICK HERE FOR SHAPE PROPERTIES RESOURCES]

(VIDEOS, PRACTICE QUESTIONS AND ANSWERS)