Mathematics Notes for Revision

General Tips

1 - Check your calculate mode at all times

Questions may require your calculator to be in radian or degree mode. Be sure to double check it before you start attempting angle or trigonometry questions.

2 - Study the formula sheet

One of the most overlooked tips that students make. The formula sheet is the only thing that you have access to outside of the examination. Hence, make full use of it!

3 - Construction questions

Compass arcs showing your construction method are required so do not erase them out – they are an important part of your working.

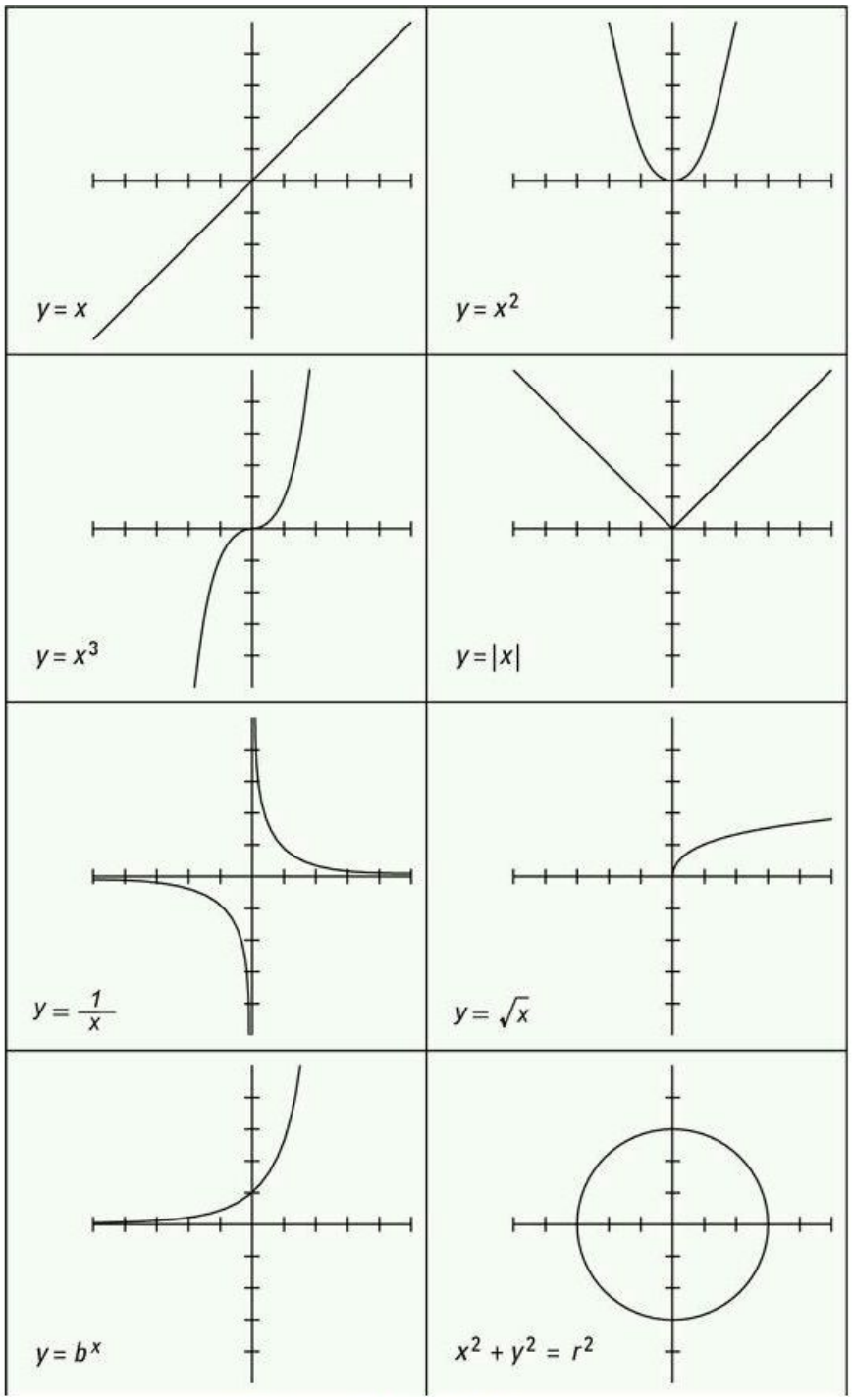
4 - Reading the question

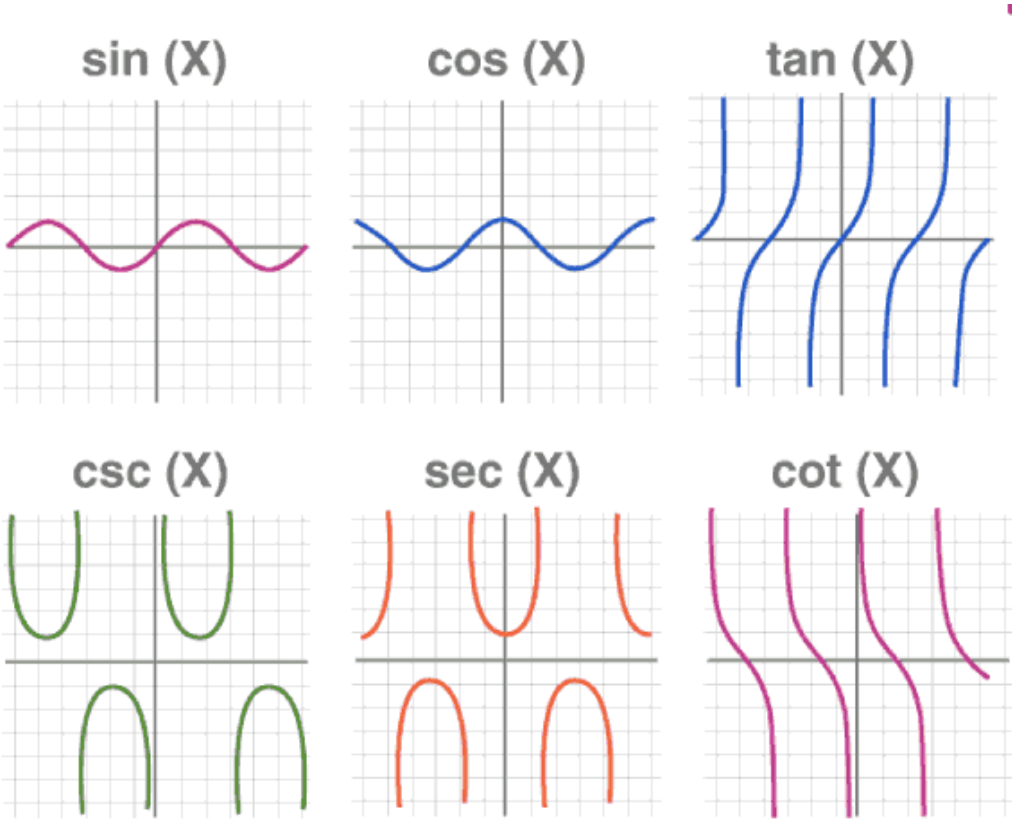
If the question specifically asks you to “show all your workings”, then you are advised to show step by step workings. Marks are given for the work that you do correctly, not subtracted for the work that you get wrong. Even if you do get the final answer wrong, you will be awarded method marks and even error carry forward marks.

5 - Knowing simple conversions

It is advisable to know some simple conversions at the back of your mind, instead of memorising them only. Some conversions that you should know at the tip of your fingers are - km/h to m/s, days to seconds, decimal values of time etc.

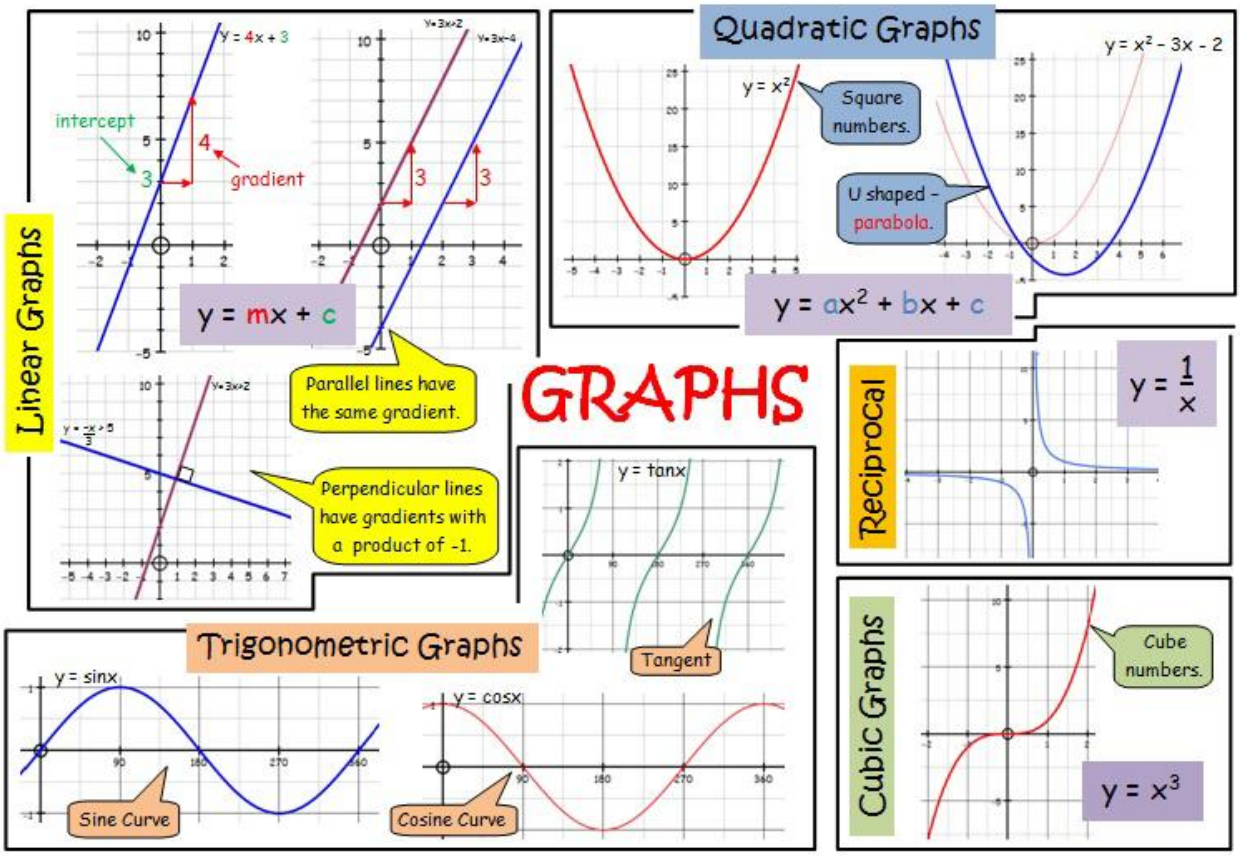
1 - Graph Functions





Alternatively, you can visit this graph plotter, where you can type the specific equation, it will generate the graph with respect to the equation.

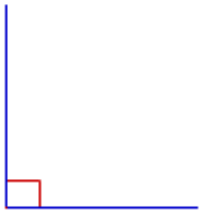
https://www.transum.org/Maths/Activity/Graph/Desmos.asp


GRAPHS
Linear Graphs
y = 4x + 3
intercept
3
4
gradient
y = mx + c
Parallel lines have the same gradient.
Perpendicular lines have gradients with a product of -1.
Quadratic Graphs
y = x²
Square numbers.
y = x² - 3x - 2
U shaped - parabola.
y = ax² + bx + c
Reciprocal
y = 1/x
Cubic Graphs
Cube numbers.
y = x³
Trigonometric Graphs
y = sinx
Sine Curve
y = cosx
Cosine Curve
y = tanx
Tangent

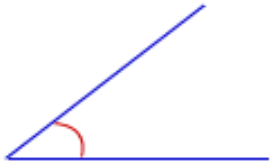
2 - Prefixes

Prefix	Symbol	Multiplier	
exa	E	10^{18}	1,000,000,000,000,000,000
peta	P	10^{15}	1,000,000,000,000,000
tera	T	10^{12}	1,000,000,000,000
giga	G	10^{9}	1,000,000,000
mega	M	10^{6}	1,000,000
kilo	k	10^{3}	1,000
hecto	h	10^{2}	100
deka	da	10^{1}	10
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10^{-3}	0.001
micro	μ	10^{-6}	0.000,001
nano	n	10^{-9}	0.000,000,001
pico micro micro	p $\mu\mu$	10^{-12}	0.000,000,000,001
femto	f	10^{-15}	0.000,000,000,000,001
atto	a	10^{-18}	0.000,000,000,000,000,001

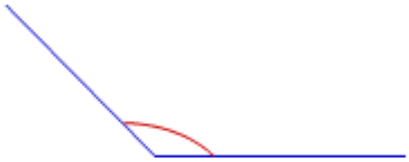
3 - Types of Angles and Triangles



Right Angle, **90°**

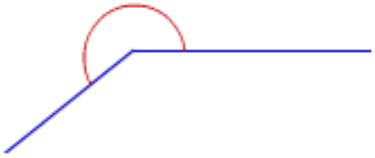


Acute Angle,
Less than **90°**

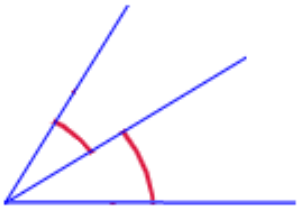


Obtuse Angle,
Greater than **90°**
Less than **180°**

Straight Angle,
Exactly **180°**



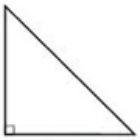
Reflex Angle,
Greater than **180°**
Less than **360°**



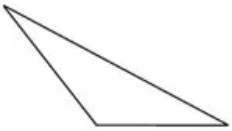
Adjacent Angles,

By Angle

Acute
all angles <90

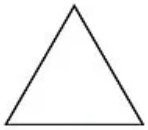


Right
one angle = 90

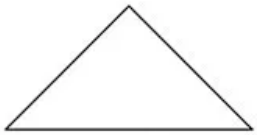


Obtuse
one angle > 90

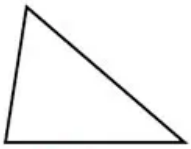
By Side



Equilateral
3 equal sides



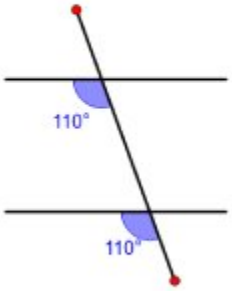
Isosceles
2 equal sides



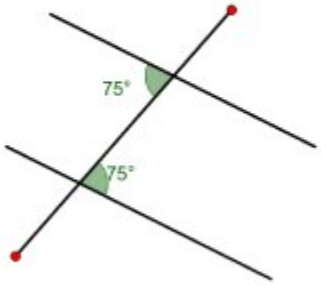
Scalene
no equal sides

Angle Properties

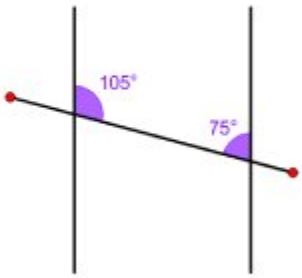
Corresponding Angles



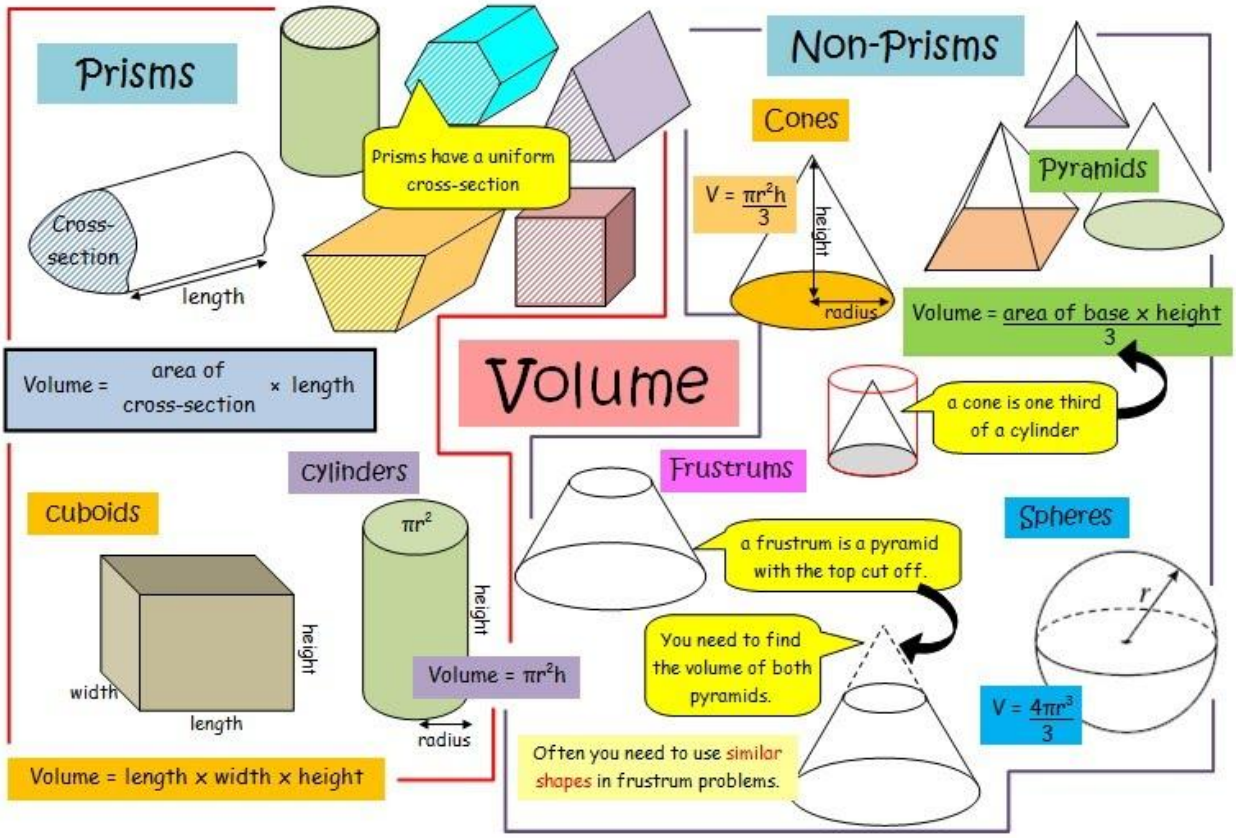
Alternate Angles

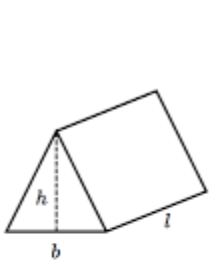


Interior Angles

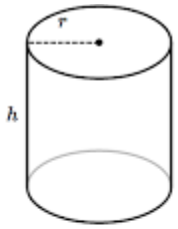


4 - Volume & Polygons

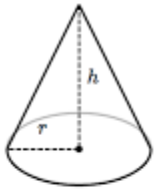




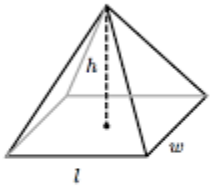
$$V = \frac{b \cdot h \cdot l}{2}$$



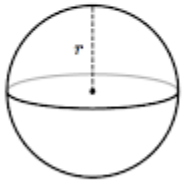
$$V = \pi r^2 h$$



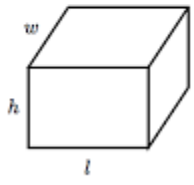
$$V = \frac{\pi r^2 h}{3}$$



$$V = \frac{l \cdot w \cdot h}{3}$$



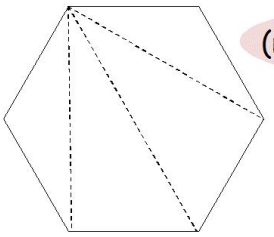
$$V = \frac{4}{3}\pi r^3$$



$$V = l \cdot w \cdot h$$

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

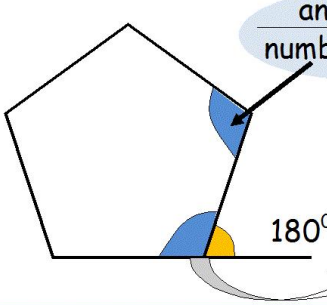
10 - decagon

interior angle

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

OR

180^0 - exterior angle

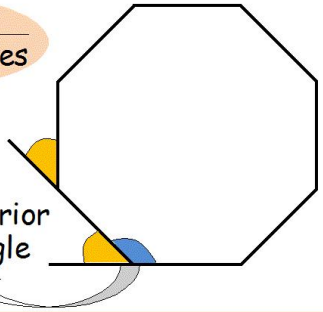


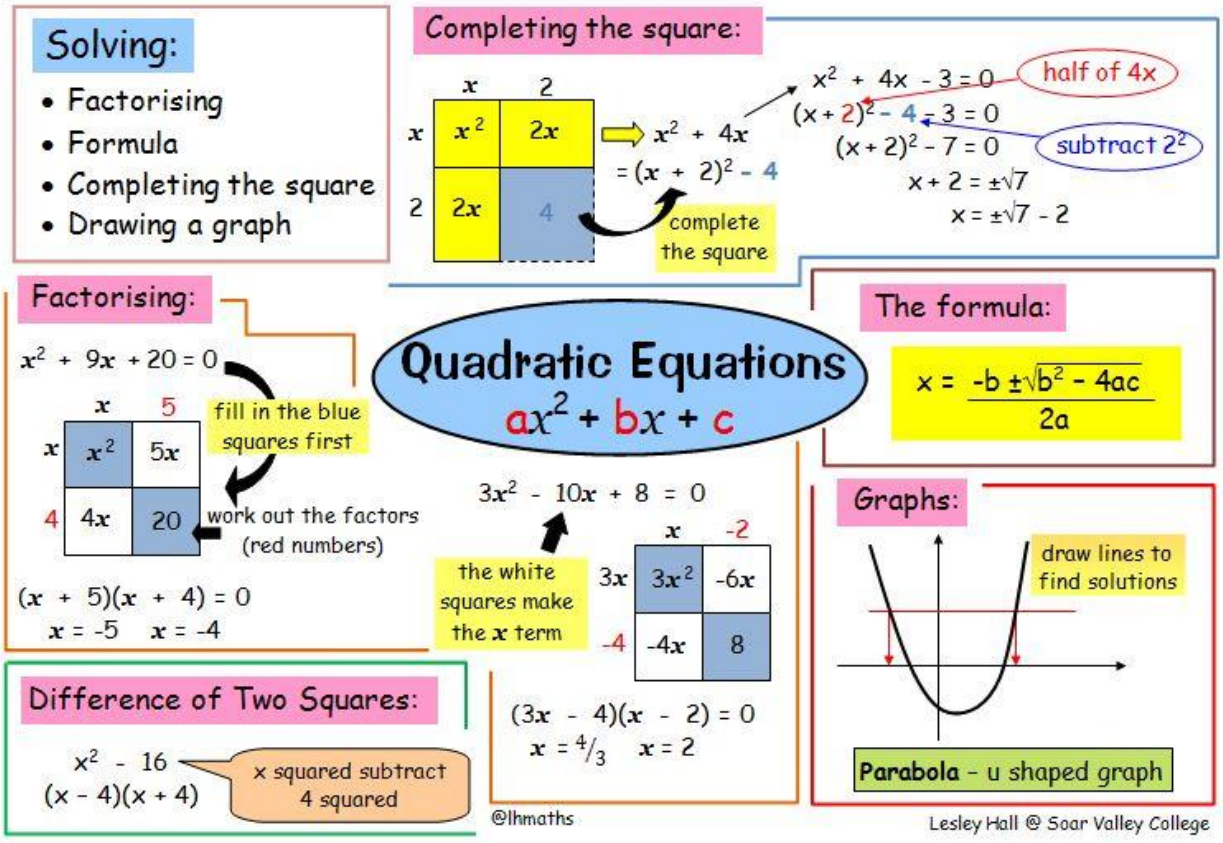
exterior angle

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

OR

180^0 - interior angle





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

Helpful Expansions to Remember

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$(a+b)(a-b) = a^2 - b^2$$

Binomial Expansion

$$(a+b)^n = {}^nC_0 a^n b^0 + {}^nC_1 a^{n-1} b^1 + {}^nC_2 a^{n-2} b^2 + \ldots + {}^nC_n a^0 b^n$$

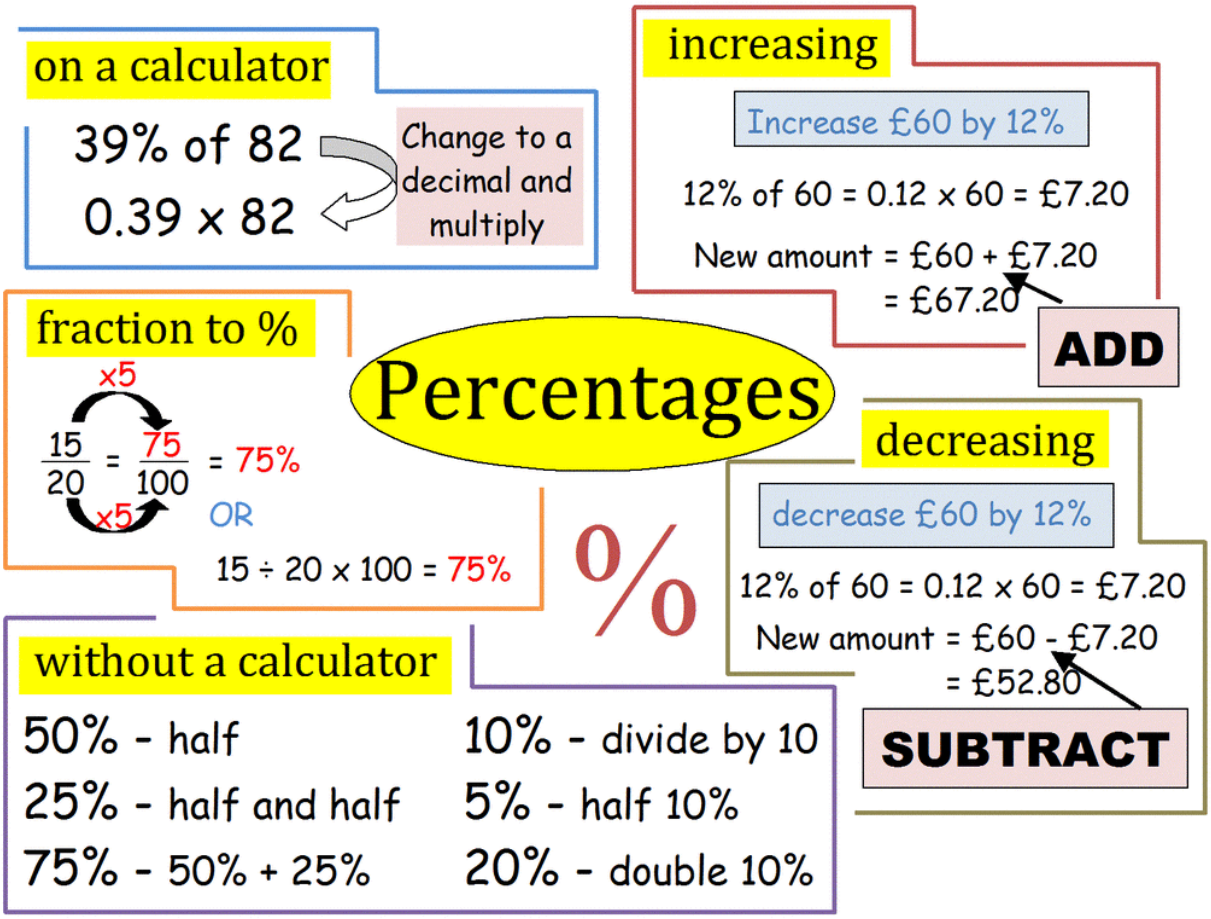
$$= a^n + na^{n-1}b + \frac{n(n-1)}{2!}a^{n-2}b^2 + \frac{n(n-1)(n-2)}{3!}a^{n-3}b^3 + \ldots + b^n$$

$$(1+b)^n = {}^nC_0 b^0 + {}^nC_1 b^1 + {}^nC_2 b^2 + \ldots + {}^nC_n b^n$$

$$= 1 + nb + \frac{n(n-1)}{2!}b^2 + \frac{n(n-1)(n-2)}{3!}b^3 + \ldots + b^n$$

7 - Partial Fractions Decomposition Formulas

Factor in denominator	Term in partial fraction decomposition
$ax+b$	$\frac{A}{ax+b}$
$(ax+b)^k$	$\frac{A_1}{ax+b}+\frac{A_2}{(ax+b)^2}+\cdots+\frac{A_k}{(ax+b)^k},\ k=1,2,3,\ldots$
ax^2+bx+c	$\frac{Ax+B}{ax^2+bx+c}$
$(ax^2+bx+c)^k$	$\frac{A_1x+B_1}{ax^2+bx+c}+\frac{A_2x+B_2}{(ax^2+bx+c)^2}+\cdots+\frac{A_kx+B_k}{(ax^2+bx+c)^k},\ k=1,2,3,\ldots$


Percentages
%
on a calculator
39% of 82
0.39 x 82
Change to a decimal and multiply
increasing
Increase £60 by 12%
12% of 60 = 0.12 x 60 = £7.20
New amount = £60 + £7.20
= £67.20
ADD
fraction to %
x5
15/20 = 75/100 = 75%
x5
OR
15 ÷ 20 x 100 = 75%
decreasing
decrease £60 by 12%
12% of 60 = 0.12 x 60 = £7.20
New amount = £60 - £7.20
= £52.80
SUBTRACT
without a calculator
50% - half
25% - half and half
75% - 50% + 25%
10% - divide by 10
5% - half 10%
20% - double 10%

Simple Probability

$$\text{Probabilty} = \frac{\text{Favorable outcomes}}{\text{Total outcomes}}$$

Example:

$$P(red) = \frac{7}{12}$$

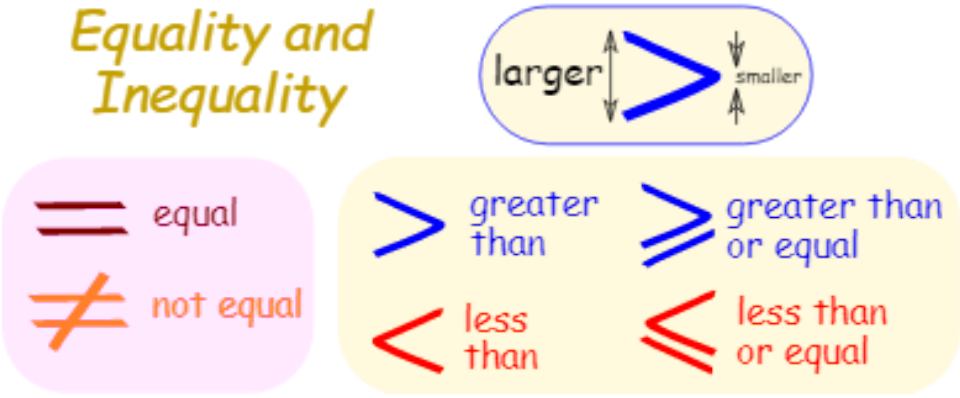
← Number of red marbles

← Total number of marbles (sample space)

$$P(blue) = \frac{5}{12}$$

← Number of blue marbles

← Total number of marbles (sample space)


Equality and Inequality
larger
smaller
equal
not equal
greater than
greater than or equal
less than
less than or equal

11 - Trigonometry Identities

$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta} \qquad \csc\theta = \frac{1}{\sin\theta}$$

$$\begin{aligned} \sin(\theta + 2\pi) &= \sin\theta \\ \cos(\theta + 2\pi) &= \cos\theta \\ \tan(\theta + \pi) &= \tan\theta \end{aligned}$$

Trigonometry Hand Trick:
https://youtu.be/TyrM8G1MqiI

Radians and Degrees

$$\text{Radians} = \left(\frac{\pi}{180^{0}}\right) \times \text{degrees}$$

$$\text{Degrees} = \left(\frac{180^{0}}{\pi}\right) \times \text{radians}$$

km/h to m/s and vice versa

$$\frac{\text{m}}{\text{s}} = \frac{\div 1000 \quad \text{km}}{\div 3600 \quad \text{hr}}$$