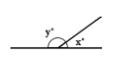
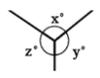
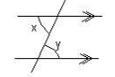
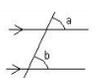
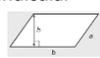


# GCSE MATHS NEED TO KNOW 2019-2020 - HIGHER

## GEOMETRY

A) Angle facts - lines		
1	Vertically opposite angles	are equal 
2	Angles on a straight line	add up to 180 
3	Angles at a point	add up to 360 
4	Alternate angles	are equal 
5	Corresponding angles	are equal 
6	Co-interior angles	add up to 180 

D) Congruence and similarity		
15	The four tests for congruence are	SSS ASA SAS RASH
16	Triangles are <u>similar</u> if...	All angles are the same (AAA) They are an enlargement of each other
17	Area scale factor	Length scale factor <sup>2</sup>
18	Volume scale factor	Length scale factor <sup>3</sup>

E) Area Formulas		
19	Area of a rectangle	= length x width 
20	Area of a parallelogram	= base x perpendicular height 
21	Area of a triangle	= $\frac{1}{2}$ base x perpendicular height 
22	Area of a trapezium	= $\frac{1}{2}$ (a + b) x h 

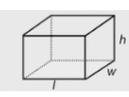
"Half the sum of the parallel sides, times the distance between them  
That is how you calculate  
The area of a trapezium"

"Factors come in two by two, hurrah, hurrah"

"Multiples are in the times tables..."

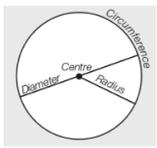
B) Angle facts – triangles and quadrilaterals		
7	Angles in a triangle	add up to 180 
8	Base angles of an isosceles triangle	are equal 
9	Angles in an equilateral triangle	are equal (all 60)
10	Angles in a quadrilateral	add up to 360 

C) Angle facts - polygons		
11	Exterior angles of a polygon	add up to 360°
12	The interior and exterior angle of any polygon	add up to 180°
13	The sum of the interior angles of a polygon can be found by using the formula	<b>(number of sides-2) x 180°</b>
14	<u>Regular</u> polygons have all sides the same length and all angles the same size	

F) Volumes		
23	Volume of a cuboid	= l x w x h 
24	Volume of a prism	= area of cross section x l 
25	Volume of a cylinder	= $\pi r^2 \times h$ 
26	Pyramid	= $\frac{1}{3} \times \text{area of base} \times h$ 

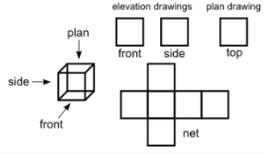
G) Surface area		
27	Surface area of a prism	The sum of the area of all the 2D faces
28	Surface area of a cylinder	$2 \times \pi r^2 + \pi d \times h$

H) Circles		
30	Circumference	$= \pi \times d$
31	Area	$= \pi r^2$
32	Area of a sector	$\frac{\theta}{360} \times \pi r^2$
33	Arc length	$\frac{\theta}{360} \times \pi d$



K) Describing Transformations		
40	Rotation	<ul style="list-style-type: none"> <li>Direction (clockwise or anticlockwise)</li> <li>Degrees</li> <li>Centre of rotation</li> </ul>
41	Reflection	<ul style="list-style-type: none"> <li>Line of reflection</li> </ul>
42	Translation	<ul style="list-style-type: none"> <li>Vector <math>\begin{pmatrix} x \\ y \end{pmatrix}</math></li> </ul>
43	Enlargement	<ul style="list-style-type: none"> <li>Scale factor</li> <li>Centre of enlargement</li> </ul>

*Circumference is pi times diameter, pi times diameter, pi times diameter  
Circumference is pi times diameter, pi times diameter, pi times diameter  
Area is pi r squared*



I) Pythagoras and Trigonometry		
34	Pythagoras' Theorem For a right angled triangle,	$a^2 + b^2 = c^2$  c is always the hypotenuse!
35	Trigonometric ratios 	$\sin \theta = \frac{\text{opp}}{\text{hyp}}$ $\cos \theta = \frac{\text{adj}}{\text{hyp}}$ $\tan \theta = \frac{\text{opp}}{\text{adj}}$ SOHCAHTOA
36	Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
37	Cosine rule	$a^2 = b^2 + c^2 - 2bc \cos A$ $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
38	Area of a triangle	$A = \frac{1}{2} ab \sin C$

**J) Exact values**

39		<b>30°</b>	<b>45°</b>	<b>60°</b>
	<b>sin</b>	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
	<b>cos</b>	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
	<b>tan</b>	$\frac{\sqrt{3}}{3}$	<b>1</b>	$\sqrt{3}$

**L) Circle theorems**

44	The angle in a semi-circle is 90		48	The angle at the centre is twice the angle at the circumference	
45	Opposite angles in a cyclical quadrilateral add up to 180	 $a + c = 180^\circ$ $b + d = 180^\circ$	49	Two tangents from the same point are equal in length	
46	The angle between a tangent and a radius is 90		50	Alternate Segment Theorem	
47	Angles at the circumference in the same segment are equal				

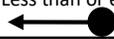
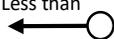
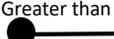
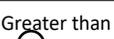
# NUMBER

M) FDP		
51	% increase	Find the % and add it on
52	% decrease	Find the % and take it away
53	Compound interest	<b>original x % multiplier</b> <sup>number of years</sup>
54	Compound depreciation	<b>original x % multiplier</b> <sup>number of years</sup>
55	Convert a fraction to a decimal	Make the denominator 10 or 100 OR divide the numerator by the denominator
56	Convert a decimal to a %	X 100
57	Percentage change (percentage profit/loss)	$\frac{\text{change}}{\text{original}} \times 100$

N) Conversions		
58	1 cm	10mm
59	1m	100cm
60	1km	1000m
61	cm → m	÷ 100
62	m → cm	× 100
63	cm <sup>2</sup> → m <sup>2</sup>	÷ 100 <sup>2</sup>
64	cm <sup>3</sup> → m <sup>3</sup>	÷ 100 <sup>3</sup>
65	1kg	1000g
66	1l	1000ml

O) Standard form		
67	0.0004	$4 \times 10^{-4}$ (the number must be between 1 and 10)
68	40000	$4 \times 10^4$ (the number must be between 1 and 10)

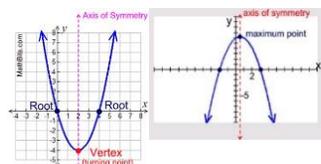
# ALGEBRA

S) Equations		
84	Like terms have what...	Same letter, same index
T) Inequalities		
85	≤	Less than or equal to 
86	<	Less than 
87	≥	Greater than or equal to 
88	>	Greater than 

P) Surds		
69	$\sqrt{a} \times \sqrt{b}$	$\sqrt{ab}$
70	$\frac{\sqrt{a}}{\sqrt{b}}$	$\sqrt{\frac{a}{b}}$
71	$\sqrt{a} \times \sqrt{a}$	$a$
72	$(\sqrt{a} + 1)(\sqrt{a} - 1)$	$a - 1$

Q) Indices		
73	$a^b \times a^c$	$a^{b+c}$
74	$\frac{a^b}{a^c}$	$a^{b-c}$
75	$(a^b)^c$	$a^{bc}$
76	$a^0$	1
78	$a^{-b}$	$\frac{1}{a^b}$
79	$\frac{b}{a^c}$	$\sqrt[c]{a^b}$

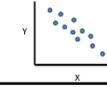
R) Special Numbers		
80	A factor is	A number that divides into another number without a remainder, factors always come in pairs
81	A multiple is	A number in a given numbers times table
82	A square number	Is a number multiplied by itself: 1, 4, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225
83	A prime number	Has only two factors, one and itself: 2, 3, 5, 7, 11, 13, 17.....

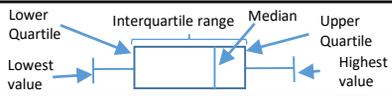
U) Equations of lines, curves and circles		
89	$y = mx + c$	$m = \text{gradient}$ $\frac{\text{Difference in } y}{\text{Difference in } x} = \frac{y_2 - y_1}{x_2 - x_1}$ $c = y \text{ intercept}$ (where the line crosses y axis)
90	To find the mid-point	$(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$
91	Parallel lines	Have the same gradient
92	Perpendicular lines	Gradient = $-\frac{1}{\text{gradient}}$
93	Roots or solutions are	The points at which the graph passes through the x-axis
94	The turning point	The maximum or minimum point of a graph, also referred to as the vertex 
95	Equation of a circle	$x^2 + y^2 = r^2$ Centre (0,0) radius r

V) Quadratic formula and completing the square		
96	$x =$	$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
97	$x^2 + 2a + b$	$(x + a)^2 - a^2 + b$
98	$(x + a)^2 - b$	Completed square form where the turning point is $(-a, +b)$

W) Compound measures		
99	Speed	$speed = \frac{distance}{time}$ 
100	Density	$density = \frac{mass}{volume}$ 
101	Pressure	$pressure = \frac{force}{area}$ 

## DATA, RATIO AND PROPORTION

Y) Correlation		
112	Positive correlation means...	As one variable <u>increases</u> the other variable <u>increases</u> , this looks like: 
113	Negative correlation means....	As one variable <u>increases</u> the other variable <u>decreases</u> , this looks like: 
114	No correlation means....	There is <u>no relationship</u> between the two variables, this looks like: 
115	Line of best fit	A straight line drawn with a ruler that goes through the data with roughly the same number of points on each side of the line
116	Interpolation	Estimating a value within a given data set
117	Extrapolation	Estimating a value outside the give date set by assuming a trend

AA) Data Representation		
115	Box plots	

AC) Proportion		
133	Direct proportion	$y \propto x$ $y = kx$
134	Indirect proportion	$y \propto \frac{1}{x}$ $y = \frac{k}{x}$

X) Functions of graphs		
102	$f(x + a)$	Translate by vector $\begin{pmatrix} -a \\ 0 \end{pmatrix}$ (Shift in the x-direction by $-a$ )
103	$f(x - a)$	Translate by vector $\begin{pmatrix} +a \\ 0 \end{pmatrix}$ (Shift in the x-direction by $+a$ )
104	$f(x) + a$	Translate by vector $\begin{pmatrix} 0 \\ +a \end{pmatrix}$ (Shift in the y-direction by $+a$ )
105	$f(x) - a$	Translate by vector $\begin{pmatrix} 0 \\ -a \end{pmatrix}$ (Shift in the y-direction by $-a$ )
106	$-f(x)$	Reflection in the x-axis
107	$f(-x)$	Reflection in the y-axis
108	$af(x)$	Shrink or stretch graph vertically by a factor of $a$ . (Multiply y-coordinates of $f(x)$ by $a$ )
109	$f(ax)$	Shrink or stretch graph horizontally by a factor of $a$ . (Divide x-coordinates $f(x)$ by $a$ )
110	Composite function	$fg(x)$ – the succession of two functions
111	Inverse function	$f(x)^{-1}$ – the reverse of a function

Z) Averages		
118	Mean	Add all the numbers and divide by how many there are
119	Median	Order the numbers from smallest to biggest and find the middle number
120	Mode	Most frequent
121	Range	Difference between the highest and lowest value
122	Mean from a frequency table	$\frac{Total Fx}{Total F}$
123	Mean from a grouped frequency table	1. Find the mid point of each group 2. $\frac{Total Fx}{Total F}$

AB) Probability		
124	Probabilities of mutually exclusive events	Add up to 1
125	$P(A \cap B)$	Probability of A AND B
126	$P(A \cup B)$	Probability of A OR B
127	$P(A B)$	Probability of A GIVEN B
128	$P(B A)$	Probability of B GIVEN A
129	$P(B')$	Probability of NOT B
130	$P(A \text{ or } B)$	$P(A) + P(B) - (PA \text{ and } B)$
131	$P(A \text{ and } B)$	$P(A B)P(B)$
132	Set notation	$\{1, 2, 3\} \in A$