Maths-Rules
A mathematics summary ruler
Reinforce key concepts every day!

Ruler top scale: 0mm 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300

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Multiplication table

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Fractions and Decimals

$\frac{1}{10} = 0.1$ $\frac{1}{3} = 0.33\dot{3}$

$\frac{1}{9} = 0.11\dot{1}$ $\frac{2}{5} = 0.4$

$\frac{1}{8} = 0.125$ $\frac{1}{2} = 0.5$

$\frac{1}{7} = 0.\dot{1}4285\dot{7}$ $\frac{3}{5} = 0.6$

$\frac{1}{6} = 0.16\dot{6}$ $\frac{2}{3} = 0.66\dot{6}$

$\frac{1}{5} = 0.2$ $\frac{3}{4} = 0.75$

$\frac{1}{4} = 0.25$ $\frac{4}{5} = 0.8$

$1 = 1.000$

Percentages

To convert to a %, multiply by 100

e.g. $\frac{3}{4} \times \frac{100}{1}$

$= \frac{3}{1} \times \frac{25}{1} = 75\%$

Or move decimal point 2 places to the right

e.g. $0.\widetilde{125} \times 100$

$= 12.5\%$

$\square\% = \square \div 100 = \frac{\square}{100}$

factors of 6: 1, 2, 3, 6
multiples of 6: 6, 12, 18, 24, ...
primes less than 100: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Squares and Square roots

$1^2 = 1$	$\sqrt{1} = 1$	$\sqrt{2} \approx 1.414$
$2^2 = 4$	$\sqrt{4} = 2$	$\sqrt{3} \approx 1.732$
$3^2 = 9$	$\sqrt{9} = 3$	$\sqrt{5} \approx 2.236$
$4^2 = 16$	$\sqrt{16} = 4$	$\sqrt{6} \approx 2.449$
$5^2 = 25$	$\sqrt{25} = 5$	$\sqrt{7} \approx 2.646$
$6^2 = 36$	$\sqrt{36} = 6$	$\sqrt{8} \approx 2.828$
$7^2 = 49$	$\sqrt{49} = 7$	$\sqrt{10} \approx 3.162$
$8^2 = 64$	$\sqrt{64} = 8$	
$9^2 = 81$	$\sqrt{81} = 9$	
$10^2 = 100$	$\sqrt{100} = 10$	

Standard form

$1.23 \times 10^3 = 1230.0$
move dec. pt 3 places right

$1.23 \times 10^{-3} = 0.001\,23$
move dec. pt 3 places left

Positives & Negatives

$\oplus \times \oplus = \oplus$
$\ominus \times \ominus = \oplus$
$\oplus \times \ominus = \ominus$
$\ominus \times \oplus = \ominus$

$+\oplus = \oplus$
$-\ominus = \oplus$
$+\ominus = \ominus$
$-\oplus = \ominus$

mixture = **m**inus
pair = **p**ositive
$\div$ same rules as $\times$

Indices

$a^3 = a \times a \times a$

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

$a^{\frac{1}{2}} = \sqrt{a},\ \ a^{\frac{1}{3}} = \sqrt[3]{a}$

$a^0 = 1 \quad (a \neq 0)$

$a^3 \times a^2 = a^5$

$\frac{a^7}{a^3} = a^4$

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

$(ab)^3 = a^3 b^3$

$\left(\frac{a}{b}\right)^3 = \frac{a^3}{b^3}$

Unit conversions

Mass: 1 kg = 1000 g
Capacity: 1 L = 1000 mL

×1000 ×100 ×10
km   m   cm   mm
÷1000 ÷100 ÷10

$\approx$ approx. =

Equations

Inverse operations
$+$ and $-$
$\times$ and $\div$
$\square^2$ and $\sqrt{\ }$

Order of operations: BOMDAS
Brackets, **O**f, **M**ult or **D**iv, **A**dd or **S**ubtract
( ) of $\times$ or $\div$ $+$ or $-$

$\pi = 3.141592653589793238462...\ \pi \approx \frac{22}{7}$
$e = 2.71828182845904523536...$
golden ratio $\varphi = 1.618033988749894...$

$<$ less than $\leqslant$ less than or equal to
$>$ greater than $\geqslant$ greater than or equal to

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Number line (top): -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10 +11 +12 +13 +14 +15

Ruler bottom scale: 0cm 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

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Angles

acute   right
straight
obtuse
reflex
perigon (360° revolution)

Triangles

sum of angles = 180°

Quadrilateral
4 sides
angle sum = 360°

equilateral
isosceles
scalene
right angled

Polygon (n sides)

sum of angles $= (n-2) \times 180°$

Pentagon
Hexagon
Octagon

Pythagoras

$c^2 = a^2 + b^2$

Pythagorean triads
3, 4, 5   5, 12, 13
7, 24, 25   8, 15, 17

Trigonometry

Hypotenuse   **O**pposite   **A**djacent

SOH **C**AH **T**OA

$\sin\theta = \frac{\textbf{O}\text{pposite}}{\textbf{H}\text{ypotenuse}}$

$\cos\theta = \frac{\textbf{A}\text{djacent}}{\textbf{H}\text{ypotenuse}}$

$\tan\theta = \frac{\textbf{O}\text{pposite}}{\textbf{A}\text{djacent}}$

π radians $= \pi^c = 180°$

(trig circle: sin, tan, cos; S A T C; π, 2π; special triangles: $\frac{\pi}{6}$, 30°, $\sqrt{3}$, 2; $\frac{\pi}{3}$, 60°, 1; $\frac{\pi}{4}$, 45°, $\sqrt{2}$, 1)

Perimeter and Area

Square
$P = 4L$
$A = L^2$

Rectangle
$P = 2(L + W)$
$A = LW$

Parallelogram
$P = 2(a + b)$
$A = bh$

Trapezium
$P = a + b + c + d$
$A = \left(\frac{a+b}{2}\right)h$

Triangle
$P = a + b + c$
$A = \frac{1}{2}bh$

Circle
$C = \pi D = 2\pi r$
$A = \pi r^2$

Ellipse
Kite
Rhombus

1 hectare
1 ha = 100 m × 100 m = 10 000 m² (= 2.47 acres)

DOPS: $(x+a)(x-a) = x^2 - a^2$
Perfect Square: $(x+a)^2 = x^2 + 2ax + a^2$

Factorised   **Expanded**
$(x+2)(x+3) = x^2 + 3x + 2x + 6$
$= x^2 + 5x + 6$

Total Surface Area & Volume

Rectangular prism
$TSA = 2(LW + LH + WH)$
$V = LWH$

Cylinder
$TSA = 2\pi r(r + H)$
$V = \pi r^2 H$

Sphere
$TSA = 4\pi r^2$ $V = \frac{4\pi r^3}{3}$

Prism: **V**olume $=$ **A**rea of base $\times$ **H**eight
Cone, pyramid: Vol. $= \frac{1}{3} \times$ **A**rea of base $\times$ **H**eight

Bearings measure c/w from North

Linear graphs

equation: $y = mx + c$

gradient: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$

y-intercept: c

INTERVAL NOTATION
INCLUDED   NOT INCL.

Statistics

mean $=$ average $= \frac{\text{sum values}}{\text{no. of values}}$

median = middle value
mode = **mo**st common value
range = maximum − minimum

Quadratic formula

If $ax^2 + bx + c = 0$, then

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

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

Number line (bottom): -15 +14 +13 +12 +11 +10 +9 +8 +7 +6 +5 +4 +3 +2 +1 0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13 -14 -15

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