UNITS OF MEASUREMENT

Common units used with the International System

UNITS OF MEAS.	ABBREV.	RELATION	UNITS OF MEAS.	ABBREV.	RELATION
meter	m	length	degree Celsius	°C	temperature
hectare	ha	area	kelvin	K	thermodynamic temp.
tonne	t	mass	pascal	Pa	pressure, stress
kilogram	kg	mass	joule	J	energy, work
nautical mile	M	distance (navigation)	newton	N	force
knot	kn	speed (navigation)	watt	W	power, radiant flux
liter	L	volume or capacity	ampere	A	electric current
second	s	time	volt	V	electric potential
hertz	Hz	frequency	ohm	Ω	electric resistance
candela	cd	luminous intensity	coulomb	C	electric charge

Metric system

mm	millimeter	.001 m
cm	centimeter	.01 m
dm	decimeter	.1 m
m	meter	1 m
dam	decameter	10 m
hm	hectometer	100 m
km	kilometer	1000 m

Note: Prefixes also apply to l (liter) and g (gram). Canadian preferred spelling: metre, litre.

English system

1 foot (ft)	= 12 inches (in) 1'=12"
1 yard (yd)	= 3 feet
1 mile (mi)	= 1760 yards
1 sq. foot	= 144 sq. inches
1 sq. yard	= 9 sq. feet
1 acre	= 4840 sq. yards = 43,560 ft²
1 sq. mile	= 640 acres

1 tablespoon	= 3 teaspoons
1 cup (c)	= 16 tablespoons
1 pint (pt)	= 2 cups
1 quart (qt)	= 2 pints
1 gallon (gal)	= 4 quarts
16 ounces (oz)	= 1 pound (lb)
1 ton (T)	= 2000 pounds

Conversions

Length / Area

to go from		to	multiply by	to go from		to	multiply by
cm	→	in	0.3937	in	→	cm	2.54
m	→	ft	3.2808	ft	→	m	0.3048
km	→	mi	0.6214	mi	→	km	1.609
m^2	→	ft^2	10.76	ft^2	→	m^2	0.0929
km^2	→	mi^2	0.3861	mi^2	→	km^2	2.59

Weight / Volume

to go from		to	multiply by	to go from		to	multiply by
g	→	oz	0.0353	oz	→	g	28.35
kg	→	lb	2.2046	lb	→	kg	0.4536
t	→	T	1.1023	T	→	t	0.9072
ml	→	fl oz	0.0338	fl oz	→	ml	29.575
L	→	US gal	0.2642	US gal	→	L	3.785

Temperature

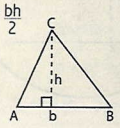
°C → °F: n x 1.8; add 32 | °F → °C: (n-32) x 0.555

MATHEMATICS

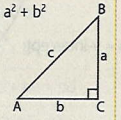
GEOMETRY

Formulas

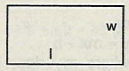
Area of Δ ABC = $\frac{bh}{2}$



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

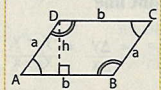


Rectangle



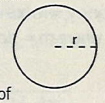
Perimeter = 2(l + w)
Area = lw

Parallelogram



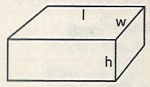
Area of ABCD=bh

Circumference of a circle = $2\pi r$



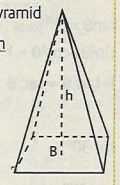
Area of a circle = πr^2

Surface area of this prism = 2hw + 2hl + 2wl



Volume = lwh

Volume of a pyramid = $\frac{Bh}{3}$



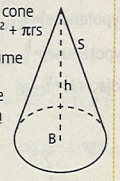
B = area of base

Surface area of cylinder = $2\pi rh + 2\pi r^2$

Volume of a cylinder = $\pi r^2 h$

Surface area of a cone = $\pi r^2 + \pi rs$

Volume of a cone = $\frac{Bh}{3}$



B = area of base

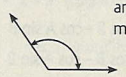
Surface area of a sphere = $4\pi r^2$

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

Angles and triangles

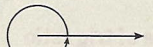
a **right** angle is 90°

an **acute** angle is less than 90°



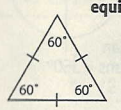
an **obtuse** angle is more than 90° but less than 180°

a straight angle is 180°



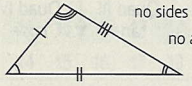
1 complete angle of rotation = 360°

two complementary angles - add up to 90°
two supplementary angles - add up to 180°



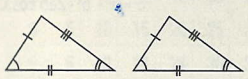
equilateral triangle
3 sides of equal length,
3 angles of 60° each

isosceles triangle
2 sides of equal length,
base angles are equal

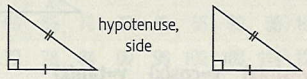


scalene triangle
no sides equal,
no angles equal

Congruency cases

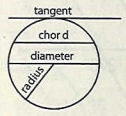


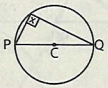
side, side, side
side, angle, side
angle, side, angle



hypotenuse, side

Circle terms & theorems





∠a = ∠b
angles subtended on the same arc AB

C is the center of the circle

TRIGONOMETRY

Slopes

Equation of a straight line

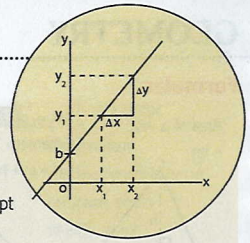
$y - y_1 = m(x - x_1)$

where m = slope = $\frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

or

$y = mx + b$

where m = slope, b = y-intercept

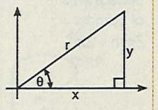


Trigonometric ratios

$\sin\theta = \frac{y}{r}$ (opposite/hypotenuse) $= \frac{1}{\csc\theta}$

$\cos\theta = \frac{x}{r}$ (adjacent/hypotenuse) $= \frac{1}{\sec\theta}$

$\tan\theta = \frac{y}{x}$ (opposite/adjacent) $= \frac{1}{\cot\theta}$



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

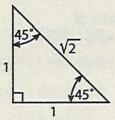
$\sin^2\theta + \cos^2\theta = 1$

$1 + \tan^2\theta = \sec^2\theta$

$1 + \cot^2\theta = \csc^2\theta$

$\cos^2\theta - \sin^2\theta = \cos 2\theta$

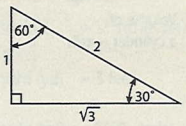
$\sec\theta = \frac{1}{\cos\theta}$



$\sin 45° = \frac{1}{\sqrt{2}}$

$\cos 45° = \frac{1}{\sqrt{2}}$

$\tan 45° = 1$



$\sin 30° = \frac{1}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$

$\tan 30° = \frac{1}{\sqrt{3}}$

$\sin 60° = \frac{\sqrt{3}}{2}$

$\cos 60° = \frac{1}{2}$

$\tan 60° = \sqrt{3}$

$\sin(A+B) = \sin A \cos B + \cos A \sin B$

$\sin(A-B) = \sin A \cos B - \cos A \sin B$

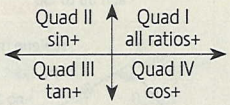
$\cos(A+B) = \cos A \cos B - \sin A \sin B$

$\cos(A-B) = \cos A \cos B + \sin A \sin B$

$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

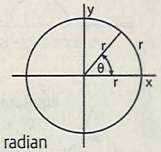
Cast



Value of trig ratio

θ	0	π/2	π	3π/2	2π
sin θ	0	1	0	−1	0
cos θ	1	0	−1	0	1
tan θ	0	∞	0	−∞	0

∞ undefined (infinite)

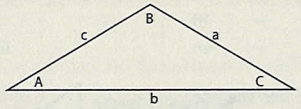


θ=1 radian

2π radians = 360°

Sine law

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



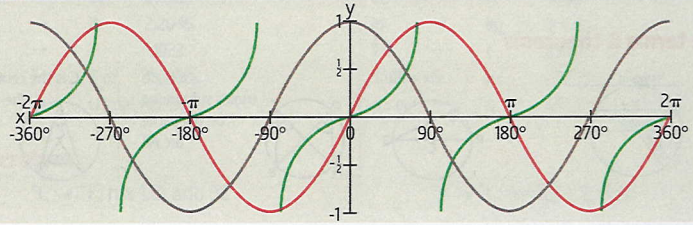
Cosine law

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

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

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

y=sin(x) y=cos(x) y=tan(x)



ALGEBRA

Expanding

$a(b + c) = ab + ac$
$(a - b)^2 = a^2 - 2ab + b^2$
$(a + b)^2 = a^2 + 2ab + b^2$
$(a + b)(c + d) = ac + ad + bc + bd$
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

Factoring

$a^2 - b^2 = (a + b)(a - b)$
$a^3b - ab = ab(a + 1)(a - 1)$
$a^2 + 2ab + b^2 = (a + b)^2$
$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
$a^2 - 2ab + b^2 = (a - b)^2$
$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Roots of a quadratic

The solution for a quadratic equation $ax^2+bx+c=0$ is given by the quadratic formula

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

Law of exponents

If $a, b \in R$, $a, b \geq 0$, and p, q, r, s are $\in Q$, then:

1. $a^r a^s = a^{r+s}$
2. $\frac{a^r}{a^s} = a^{r-s}$ } $\frac{a^p a^q}{a^r} = a^{p+q-r}$
3. $(a^r)^s = a^{rs}$
4. $(ab)^r = a^r b^r$
5. $\left(\frac{a}{b}\right)^r = \frac{a^r}{b^r}$ $(b \neq 0)$
6. $a^0 = 1$ $(a \neq 0)$
7. $a^{-r} = \frac{1}{a^r}$ $(a \neq 0)$
8. $a^{\frac{r}{s}} = \sqrt[s]{a^r}$ $a^{\frac{1}{2}} = \sqrt{a}$ $a^{\frac{1}{3}} = \sqrt[3]{a}$

Logarithms

$\text{Log}(xy) = \text{Log}\, x + \text{Log}\, y$

$\text{Log}\left(\frac{x}{y}\right) = \text{Log}\, x - \text{Log}\, y$

$\text{Log}\, x^r = r\, \text{Log}\, x$

$\text{Log}\, x = n \leftrightarrow x = 10^n$ (Common log)

$\text{Log}_a x = n \leftrightarrow x = a^n$ (Log to the base a)

$\text{Ln}\, x = n \leftrightarrow x = e^n$ (Natural log)

$\pi \approx 3.14159265$

$e \approx 2.71828183$

MULTIPLICATION CHART

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
11	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220
12	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240