




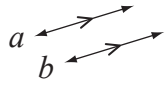



MATH FACTS

SYMBOLS

Number

+	plus or add
-	minus or subtract
\times, \cdot	multiplied by, times, lots of
\div	divided by, into groups of
=	equals, is equal to
\neq	is not equal to
\approx	is approximately equal to
<	is less than, $4 < 6$
>	is greater than, $8 > 5$
\leq	is less than or equal to
\geq	is greater than or equal to
()	brackets, a grouping symbol
%	percent, $12\% = \frac{12}{100}$
.	decimal point as in 7.9
-3	negative 3
6^3	6 raised to the 3 rd power, $6 \times 6 \times 6$
$\sqrt{9}$	square root of 9
$\frac{4}{7}$	fraction, $4 \div 7$, four sevenths
$a:b$ or $\frac{a}{b}$	ratio of a to b
$2.\bar{4}$ or $2.\bar{13}$	repeating decimal
$ a $	absolute value of a

Geometry

π (pi)	≈ 3.14 or $\frac{22}{7}$
$^\circ$	degree (a right angle measures 90°)
\cong	is congruent to, 
\sim	is similar to, 
\parallel	is parallel to
\perp	is perpendicular to
$\triangle ABC$	triangle with vertices A, B and C
	right angle
\overleftrightarrow{AD}	line AD
\overline{BC}	segment BC
\widehat{AB}	arc AB
	parallel lines (line a is parallel to line b)
	congruent segments
	equal angles
	equal side lengths

Algebra

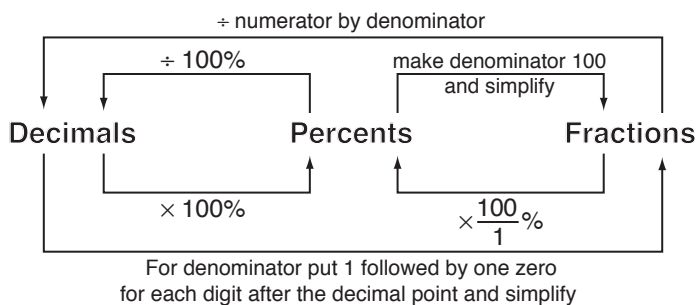
$3x$	3 times x , 3 lots of x , $3 \cdot x$, $3x$
x^2	x raised to the 2 nd power, $x \cdot x$
$-x$	opposite of x
$\frac{1}{x}$	reciprocal of x
(x,y)	coordinates in a cartesian plane
m	slope of a linear graph
b	y -intercept of a linear graph

NUMBER FACTS (1)

Place Value

millions	hundreds of thousands	tens of thousands	thousands	hundreds	tens	units	↓ decimal point	tenths	hundredths	thousandths
1,000,000	100,000	10,000	1000	100	10	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Decimals / Fractions / Percents



Fraction	Decimal	Percent
$\frac{1}{1}$	1	100%
$\frac{1}{2}$	0.5	50%
$\frac{1}{3}$	$0.\bar{3}$	33.33%
$\frac{2}{3}$	$0.\bar{6}$	66.66%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%
$\frac{2}{5}$	0.4	40%
$\frac{3}{5}$	0.6	60%
$\frac{4}{5}$	0.8	80%
$\frac{1}{8}$	0.125	12.5%
$\frac{1}{9}$	$0.\bar{1}$	11.11%

0

Subtraction $a - 0 = a$

Multiplication $a \cdot 0 = 0$ and $0 \cdot a = 0$

Division $0 \div a = 0$

1

Multiplication $a \cdot 1 = a$ and $1 \cdot a = a$

Division $a \div 1 = a$

Prime numbers < 100

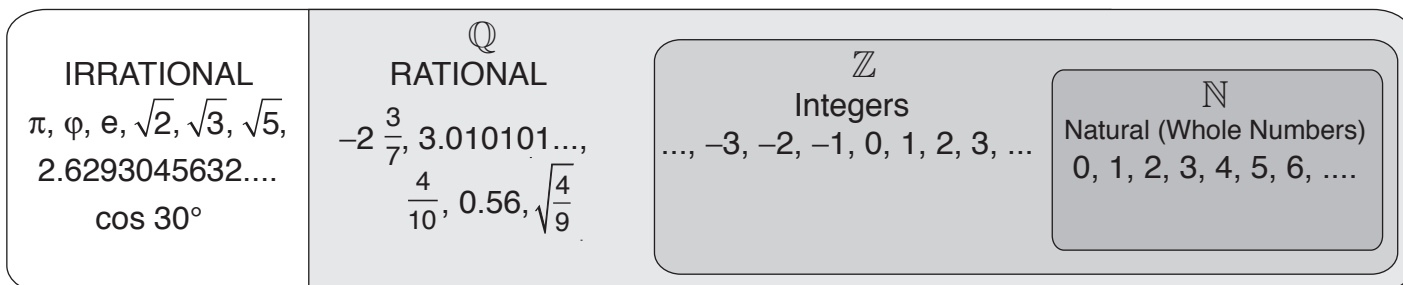
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97

Perfect squares of numbers 0 to 30

0, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400, 441, 484, 529, 576, 625, 676, 729, 784, 841 and 900

NUMBER FACTS (2)

Real Numbers \mathbb{R}



Rational Approximations

$$\sqrt{2} = 1.4142 \quad \sqrt{3} = 1.7321 \quad \sqrt{5} = 2.2361 \quad \sqrt{6} = 2.4495 \quad \sqrt{7} = 2.6458 \quad \sqrt{10} = 3.1623 \quad \sqrt{15} = 3.8730$$

Operation terminology

Addition: sum, all together, in total, more than

Subtraction: difference, less than, change

Multiplication: product, times, lots of

Division: a fraction (half, third, quarter) of, quotient

Order of operations

- 1) Simplify inside all brackets first.
- 2) Evaluate powers and square roots.
- 3) Do all multiplications or divisions in order from left to right.
- 4) Do all additions or subtractions in order from left to right.

Sign rules

$$++ = +$$

$$-- = +$$

$$+- = -$$

$$-+ = -$$

Ratios and Proportions

$$a : b = \frac{a}{b}$$

$$a : b = c : d$$

$$\frac{a}{b} = \frac{c}{d}$$

$$a \times d = b \times c$$

$$ad = bc$$

Applied number - money

$$\text{Percent} = \text{Fraction} \times \frac{100}{1} \%$$

$$\frac{P}{100} = P\%$$

$$\text{Commission} = \% \times \text{Selling price}$$

$$\text{Simple Interest} = \text{principal} \times \text{rate} \times \text{time}$$

$$I = prt$$

$$\text{Percent change} = \frac{\text{amount of change}}{\text{original amount}} \times \frac{100}{1} \%$$

Applied number - distance

$$\text{Distance } (d) = \text{rate of speed } (r) \times \text{time taken } (t)$$

$$d = rt$$

$$r = \frac{d}{t}$$

Applied number - rates

$$\text{Rate } (r) = \frac{\text{amount } (a)}{\text{time } (t)}$$

$$a = rt$$

ALGEBRA FACTS

Identity Properties

Additive identity $a + 0 = 0 + a = a$

Multiplicative identity $a \cdot 1 = 1 \cdot a = a$

Associative Properties

Addition $(a + b) + c = a + (b + c)$

Multiplication $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Perfect square rules

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

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

Difference of two square rule

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

Operations with radicals

$$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$$

$$\sqrt{a} \times \sqrt{a} = \sqrt{a \times a} = a$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

$$\frac{\sqrt{a}}{\sqrt{a}} = \sqrt{\frac{a}{a}} = 1$$

Inverse properties

Addition $a + (-a) = -a + a = 0$

Multiplication $a \cdot \frac{1}{a} = \frac{1}{a} \cdot a = 1, a \neq 0$

Inverse operation rules

Operation	Inverse Operation	Operation	Inverse Operation	Operation	Inverse Operation	Operation	Inverse Operation
+	-	-	+	×	÷	÷	×
$x + 3 = 6$	$x - 3 = 6$	$3x = 6$	$\frac{3x}{3} = \frac{6}{3}$	$\frac{x}{3} = 6$			
$x + 3 - 3 = 6 - 3$	$x - 3 + 3 = 6 + 3$	$\frac{3x}{3} = \frac{6}{3}$	$x = 2$	$\frac{x}{3} \times 3 = 6 \times 3$			
$x = 3$	$x = 9$			$x = 18$			

Commutative Properties

Addition $a + b = b + a$

Multiplication $a \cdot b = b \cdot a$

Distributive Properties

$$a(b + c) = ab + ac$$

$$a(b - c) = ab - ac$$

Exponential Properties

$a^0 = 1$ Zero exponent

$a^{-n} = \frac{1}{a^n}$ Negative exponent

$a^m \times a^n = a^{m+n}$ Product of powers

$\frac{a^m}{a^n} = a^{m-n}$ Quotient of powers

$(a^m)^n = a^{mn}$ Power to power

$(ab)^n = a^n b^n$ Product to power

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ Quotient to power

Properties of Equality

Addition $a = b \Rightarrow a - c = b - c$

Subtraction $a = b \Rightarrow a + c = b + c$

Multiplication $a = b \Rightarrow a \cdot c = b \cdot c$

Division $a = b \Rightarrow \frac{a}{c} = \frac{b}{c}, c \neq 0$

MEASUREMENT FACTS (1)

CONVERSIONS - Customary

Length

$$\begin{aligned} 12 \text{ inches (in.)} &= 1 \text{ foot (ft)} \\ 3 \text{ ft} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} 1 \text{ yard (yd)} \\ 36 \text{ in.} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} \\ 5280 \text{ ft} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} 1 \text{ mile (mi)} \\ 1760 \text{ yd} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} \end{aligned}$$

Mass

$$\begin{aligned} 16 \text{ ounces (oz)} &= 1 \text{ pound (lb)} \\ 2000 \text{ lb} &= 1 \text{ ton} \end{aligned}$$

Liquid Capacity

$$\begin{aligned} 8 \text{ fluid ounces (fl oz)} &= 1 \text{ cup (c)} \\ 2 \text{ c} &= 1 \text{ pint (pt)} \\ 2 \text{ pt} &= 1 \text{ quart (qt)} \\ 4 \text{ qt} &= 1 \text{ gallon (gal)} \end{aligned}$$

Temperature - degrees Fahrenheit (°F)

$$\begin{aligned} 32^\circ\text{F} &= \text{freezing point of water} \\ 98.6^\circ\text{F} &= \text{human body temperature} \\ 212^\circ\text{F} &= \text{boiling point of water} \end{aligned}$$

Area

$$\begin{aligned} 144 \text{ square inch (in.}^2\text{)} &= 1 \text{ square foot (ft}^2\text{)} \\ 9 \text{ ft}^2 &= 1 \text{ square yard (yd}^2\text{)} \\ 4840 \text{ yd}^2 &= 1 \text{ acre} \end{aligned}$$

CONVERSIONS - Metric

Length

$$\begin{aligned} 10 \text{ millimeters (mm)} &= 1 \text{ centimeter (cm)} \\ 100 \text{ cm} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} 1 \text{ meter (m)} \\ 1000 \text{ mm} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} \\ 1000 \text{ m} &= 1 \text{ kilometer (km)} \end{aligned}$$

Mass

$$\begin{aligned} 1000 \text{ milligrams (mg)} &= 1 \text{ gram (g)} \\ 1000 \text{ g} &= 1 \text{ kilogram (kg)} \\ 1000 \text{ kg} &= 1 \text{ tonne (t)} \end{aligned}$$

Liquid Capacity

$$\begin{aligned} 1000 \text{ milliliters (mL)} &= \left. \begin{array}{l} \\ \\ \end{array} \right\} 1 \text{ liter (L)} \\ 1000 \text{ cm}^3 &= \left. \begin{array}{l} \\ \\ \end{array} \right\} \\ 1000 \text{ L} &= 1 \text{ kiloliter (kL)} \end{aligned}$$

Temperature - degrees Celsius (°C)

$$\begin{aligned} 0^\circ\text{C} &= \text{freezing point of water} \\ 37^\circ\text{C} &= \text{human body temperature} \\ 100^\circ\text{C} &= \text{boiling point of water} \end{aligned}$$

Area

$$\begin{aligned} 100 \text{ square mm (mm}^2\text{)} &= 1 \text{ square cm (cm}^2\text{)} \\ 10,000 \text{ cm}^2 &= 1 \text{ square meter (m}^2\text{)} \\ 1,000,000 \text{ m}^2 &= 1 \text{ square km (km}^2\text{)} \end{aligned}$$

Volume

$$\begin{aligned} 1000 \text{ cubic mm (mm}^3\text{)} &= 1 \text{ cubic cm (cm}^3\text{)} \\ 1,000,000 \text{ cm}^3 &= 1 \text{ cubic meter (m}^3\text{)} \end{aligned}$$

MEASUREMENT FACTS (2)

Time

$$60 \text{ seconds (s)} = 1 \text{ minute (min)}$$

$$60 \text{ minutes (min)} = 1 \text{ hour (h)}$$

$$24 \text{ hours} = 1 \text{ day}$$

$$7 \text{ days} = 1 \text{ week}$$

$$4 \text{ weeks (approx.)} = 1 \text{ month}$$

$$365 \text{ or } 366 \text{ days} =$$

$$52 \text{ weeks (approx.)} = \left. \begin{array}{l} 365 \text{ or } 366 \text{ days} = \\ 12 \text{ months} = \end{array} \right\} 1 \text{ year}$$

$$12 \text{ months} =$$

$$10 \text{ years} = 1 \text{ decade}$$

$$100 \text{ years} = 1 \text{ century}$$

Conversion factors: metric \leftrightarrow customary

Length

$$1 \text{ inch} \approx 2.54 \text{ centimeters}$$

$$1 \text{ kilometer} \approx 0.62 \text{ miles}$$

Mass

$$1 \text{ ounce} \approx 28 \text{ grams}$$

$$1 \text{ kilogram} \approx 2.2 \text{ pounds}$$

Liquid Capacity

$$1 \text{ liter} \approx 1.06 \text{ quarts}$$

Liquid Capacity

$$1 \text{ milliliter (mL)} = 1 \text{ cubic centimeter (cm}^3\text{)}$$

$$1000 \text{ liter (L)} = 1 \text{ cubic meter (m}^3\text{)}$$

METRIC PREFIXES

$$\text{giga (G)} = 1 \text{ billion} = 1,000,000,000$$

$$\text{mega (M)} = 1 \text{ million} = 1,000,000$$

$$\text{kilo (k)} = 1 \text{ thousand} = 1000$$

$$\text{hecto (h)} = 1 \text{ hundred} = 100$$

$$\text{deca (da)} = 1 \text{ ten} = 10$$

$$\text{micro } (\mu) = 1 \text{ millionth} = \frac{1}{1,000,000}$$

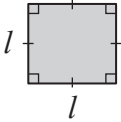
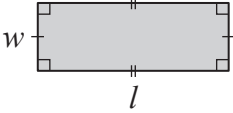
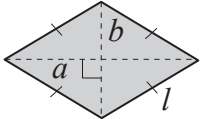
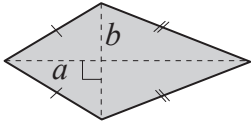
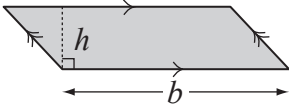
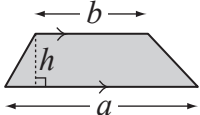
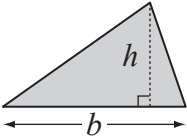

$$\text{milli (m)} = 1 \text{ thousandth} = \frac{1}{1000}$$

$$\text{centi (c)} = 1 \text{ hundredth} = \frac{1}{100}$$

$$\text{deci (d)} = 1 \text{ tenth} = \frac{1}{10}$$

MEASUREMENT FACTS (3)

2D shapes - Formulae

Name	Shape	Perimeter	Area
Square		$P = 4 \times l$ $= 4l$	$A = l \times l$ $= l^2$
Rectangle		$P = 2l + 2w$ $= 2(l + w)$	$A = l \times w$ $= lw$
Rhombus		$P = 4 \times l$ $= 4l$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
Kite		$P = \text{Sum of all sides}$	$A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$
Parallelogram		$P = \text{Sum of all sides}$	$A = b \times h$ $= bh$
Trapezoid		$P = \text{Sum of all sides}$	$A = \frac{1}{2}(a + b)h$
Triangle		$P = \text{Sum of all sides}$	$A = \frac{b \times h}{2}$ $= \frac{1}{2}bh$
Circle		$C = 2\pi r$	$A = \pi r^2$ where $\pi \approx 3.14$ or $\frac{22}{7}$

Prefixes

poly - many
equi - equal
hedra - face
gon - angle
lateral - side

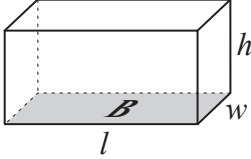
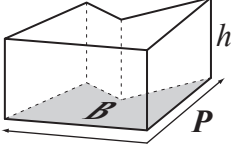
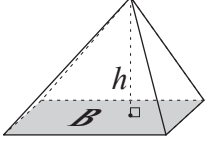
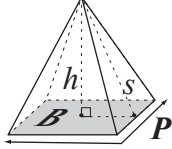
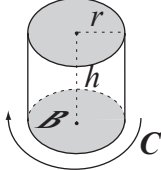
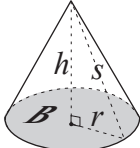
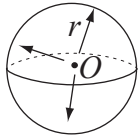
mono - one
bi or di - two
tri - three
quad or tetra - four
penta - five
hexa - six
hepta - seven
octa - eight
nona - nine
deca - ten

Abbreviations

l length
w width
h height
b base length
P perimeter
r radius
C circumference
A area

MEASUREMENT FACTS (4)

3D shapes - Formulae

Name	Shape	Surface Area	Volume
Rectangular Prism		$S.A. = 2lw + 2wh + 2lh$ $= 2(lw + wh + lh)$	$V = lwh$ or $= Bh$
Prism - (All)		$S.A. = P \times h + 2B$ $= Ph + 2B$	$V = Bh$
Pyramid		$S.A. = \text{Sum of areas of all faces}$	$V = \frac{1}{3} Bh$
Regular Pyramid		$S.A. = \frac{P \times s}{2} + B$ $= \frac{Ps}{2} + B$	$V = \frac{1}{3} Bh$
Cylinder		$L.A. = 2\pi rh$ $S.A. = 2\pi r^2 + 2\pi rh$ $= 2\pi r(r + h)$	$V = B \times h$ $= \pi r^2 h$
Cone		$L.A. = \pi rs$ $S.A. = \pi r^2 + \pi rs$ $= \pi r(r + s)$	$V = \frac{1}{3} B \times h$ $= \frac{1}{3} \pi r^2 h$
Sphere		$S.A. = 4\pi r^2$	$V = \frac{4}{3} \pi r^3$

Abbreviations

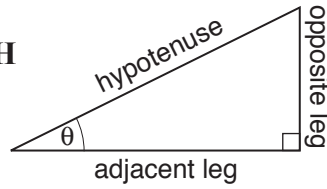
l length
w width
h height
b base length
P perimeter
r radius
C circumference
A area

L.A. lateral area
S.A. surface area
V volume
B base area
P perimeter of base
s slant height

TRIGONOMETRY FACTS

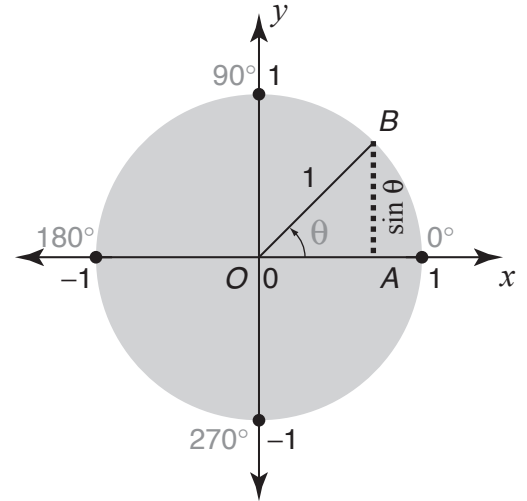
Sine

$$\sin \theta = \frac{\text{opposite leg}}{\text{hypotenuse}} \quad \text{SOH}$$



$$\sin \theta = \frac{AB}{OB} = \frac{AB}{1} = AB$$

angle	0°	30°	45°	60°	90°	180°
sine	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0

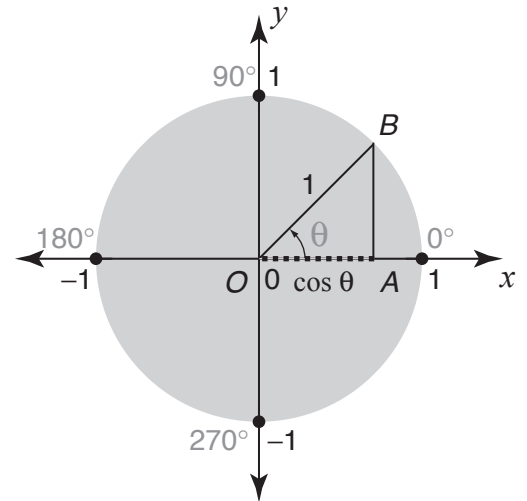


Cosine

$$\cos \theta = \frac{\text{adjacent leg}}{\text{hypotenuse}} \quad \text{CAH}$$

$$\cos \theta = \frac{OA}{OB} = \frac{OA}{1} = OA$$

angle	0°	30°	45°	60°	90°	180°
cosine	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1

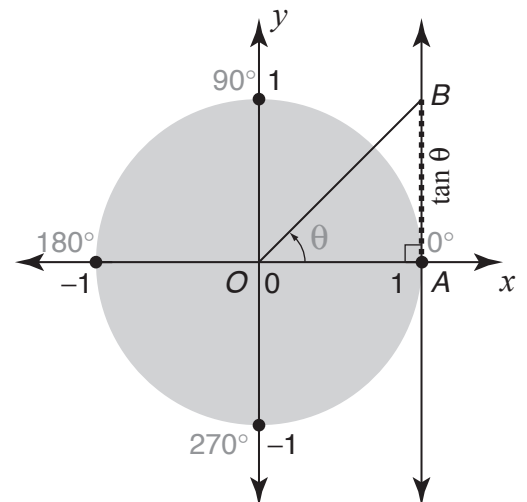


Tangent

$$\tan \theta = \frac{\text{opposite leg}}{\text{adjacent leg}} \quad \text{TOA}$$

$$\tan \theta = \frac{AB}{OA} = \frac{AB}{1} = AB$$

angle	0°	30°	45°	60°	90°	180°
tangent	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	X	0



Trigonometry hint: SOH - CAH - TOA

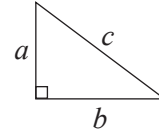
GEOMETRY FACTS (1)

Euler's formula

For any polyhedra: $E = V + F - 2$
Edges = Vertices + Faces - 2

Pythagorean theorem

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



Angle Types

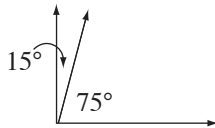
Acute $< 90^\circ$	Right 90°	Obtuse more than 90° less than 180°	Straight 180°	Reflex more than 180° less than 360°	Revolution 360°

Properties of angles

Vertical	Corresponding	Alternate Interior	Same-side Interior
$\angle a = \angle b, \angle c = \angle d$	$\angle a = \angle b$	$\angle a = \angle b$	$\angle a + \angle b = 180^\circ$

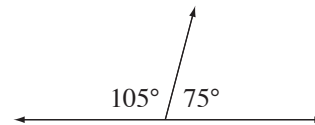
Complementary Angles

Add to 90°



Supplementary Angles

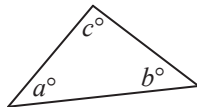
Add to 180°



Properties of angles in a triangle

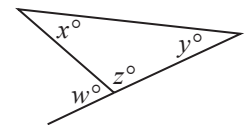
The sum of interior angles of a triangle is 180° .

$$a^\circ + b^\circ + c^\circ = 180^\circ$$



An exterior angle of a triangle is equal to the sum of the two opposite interior angles of the triangle.

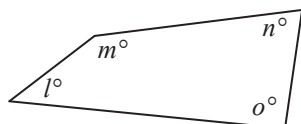
$$w^\circ = x^\circ + y^\circ$$



Properties of angles in a quadrilateral

The sum of interior angles of a quadrilateral is 360° .

$$l^\circ + m^\circ + n^\circ + o^\circ = 360^\circ$$



GEOMETRY FACTS (2)

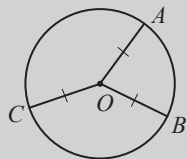
Triangle types

Sides and angles	Triangle type
no equal sides/angles	scalene
two equal sides/angles	isosceles
three equal sides/angles	equilateral

Angles	Triangle type
all acute angles	acute
one right angle	right
one obtuse angle	obtuse

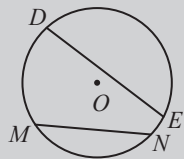
Properties of circles

Radius - joins the center with any point on the circle

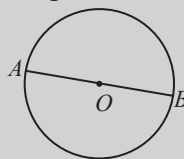


$$OA = OB = OC$$

Chord - joins any two points on the circle

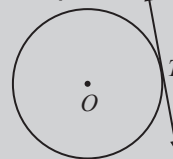


Diameter - a chord passing through the center



$$AB = 2OA$$

Tangent - a line touching the circle in one point



Circumference - the distance around the circle

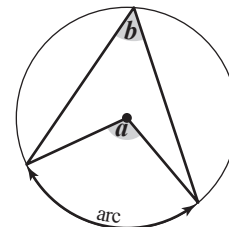


Properties of angles in a circle

continues on page 256

Property 1

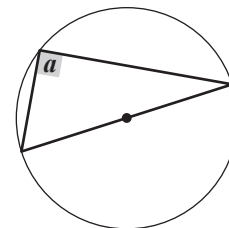
The central arc of a circle is twice the size of the inscribed angle which intercepts the same arc of the circle.



$$\angle a = 2 \times \angle b$$

Property 2

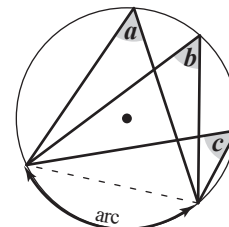
An angle inscribed in a semicircle is a right angle.



$$\angle a = 90^\circ$$

Property 3

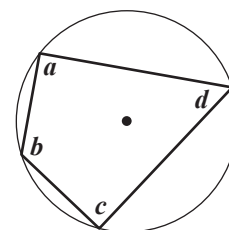
All inscribed angles that intercept the same arc of the circle are equal.



$$\angle a = \angle b = \angle c$$

Property 4

The opposite angles in a quadrilateral inscribed in a circle add up to 180° (are supplementary).



$$\begin{aligned} \angle a + \angle c &= 180^\circ \\ \angle b + \angle d &= 180^\circ \end{aligned}$$

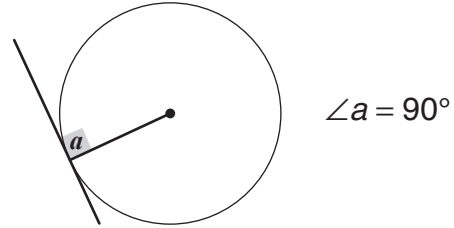
GEOMETRY FACTS (3)

Properties of angles in a circle

continued from page 461

Property 5

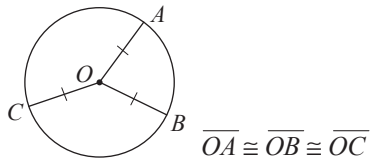
If a line is tangent to a circle, then the line is perpendicular to the radius drawn to the point of tangency.



Properties of lines related to a circle

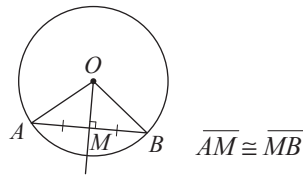
Property 1

The radii in a circle are the same length.



Property 2

In a circle, a diameter that is perpendicular to a chord bisects the chord.



Property 3

The two segments tangent to a circle from a point outside the circle are congruent.

