

# MATH FACTS

## SYMBOLS






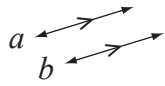



### Number

+	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 <sup>rd</sup> 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 $a$

### Algebra

$3x$	3 times $x$ , 3 lots of $x$ , $3 \cdot x$ , $3x$
$x^2$	$x$ raised to the 2 <sup>nd</sup> power, $x \cdot x$
$-x$	opposite of $x$
$\frac{1}{x}$	reciprocal of $x$
$(x,y)$	coordinates in a coordinate plane

### Geometry

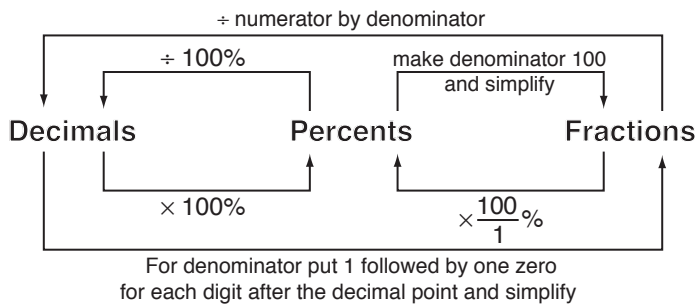
$\pi$ (pi)	$\approx 3.14$ or $\frac{22}{7}$
$^\circ$	degree (a right angle measures $90^\circ$ )
$\cong$	is congruent to,  $\cong$ 
$\sim$	is similar to,  $\sim$ 
$\parallel$	is parallel to
$\perp$	is perpendicular to
$\triangle ABC$	triangle with vertices $A$ , $B$ and $C$
	right angle
$\overleftrightarrow{AD}$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

# 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 $\mathbb{R}$

#### IRRATIONAL

$\pi$ ,  $\phi$ ,  $e$ ,  $\sqrt{2}$ ,  $\sqrt{3}$ ,  $\sqrt{5}$ ,  
2.6293045632....  
 $\cos 30^\circ$

 $\mathbb{Q}$ 

#### RATIONAL

$-2\frac{3}{7}$ , 3.010101...,  
 $\frac{4}{10}$ , 0.56,  $\sqrt{\frac{4}{9}}$

 $\mathbb{Z}$ 

#### Integers

..., -3, -2, -1, 0, 1, 2, 3, ...

 $\mathbb{N}$ 

Natural (Whole Numbers)  
0, 1, 2, 3, 4, 5, 6, ...

### 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

### Sign rules

$$++ = +$$

$$-- = +$$

$$+- = -$$

$$-+ = -$$

### 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.

### Ratios and Proportions

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

$$a : b = c : d$$

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

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

$$ad = bc$$

## ALGEBRA FACTS

### Identity Properties

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

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

### Commutative Properties

Addition  $a + b = b + a$

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

### Associative Properties

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

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

### Distributive Properties

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

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

### Inverse operation rules

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

### Inverse properties

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

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

**MEASUREMENT FACTS (1)****CONVERSIONS - Customary****Length**

$$12 \text{ inches (in.)} = 1 \text{ foot (ft)}$$

$$\begin{array}{l} 3 \text{ ft} = \\ 36 \text{ in.} = \end{array} \left. \vphantom{\begin{array}{l} 3 \text{ ft} = \\ 36 \text{ in.} = \end{array}} \right] 1 \text{ yard (yd)}$$

$$\begin{array}{l} 5280 \text{ ft} = \\ 1760 \text{ yd} = \end{array} \left. \vphantom{\begin{array}{l} 5280 \text{ ft} = \\ 1760 \text{ yd} = \end{array}} \right] 1 \text{ mile (mi)}$$

**Mass**

$$16 \text{ ounces (oz)} = 1 \text{ pound (lb)}$$

$$2000 \text{ lb} = 1 \text{ ton}$$

**Liquid Capacity**

$$8 \text{ fluid ounces (fl oz)} = 1 \text{ cup (c)}$$

$$2 \text{ c} = 1 \text{ pint (pt)}$$

$$2 \text{ pt} = 1 \text{ quart (qt)}$$

$$4 \text{ qt} = 1 \text{ gallon (gal)}$$

**Temperature - degrees Fahrenheit (°F)**

$$32^{\circ}\text{F} = \text{freezing point of water}$$

$$98.6^{\circ}\text{F} = \text{human body temperature}$$

$$212^{\circ}\text{F} = \text{boiling point of water}$$

**Area**

$$144 \text{ square inch (in.}^2\text{)} = 1 \text{ square foot (ft}^2\text{)}$$

$$9 \text{ ft}^2 = 1 \text{ square yard (yd}^2\text{)}$$

**CONVERSIONS - Metric****Length**

$$10 \text{ millimeters (mm)} = 1 \text{ centimeter (cm)}$$

$$\begin{array}{l} 100 \text{ cm} = \\ 1000 \text{ mm} = \end{array} \left. \vphantom{\begin{array}{l} 100 \text{ cm} = \\ 1000 \text{ mm} = \end{array}} \right] 1 \text{ meter (m)}$$

$$1000 \text{ m} = 1 \text{ kilometer (km)}$$

**Mass**

$$1000 \text{ milligrams (mg)} = 1 \text{ gram (g)}$$

$$1000 \text{ g} = 1 \text{ kilogram (kg)}$$

$$1000 \text{ kg} = 1 \text{ tonne (t)}$$

**Liquid Capacity**

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

$$1000 \text{ L} = 1 \text{ kiloliter (kL)}$$

**Temperature - degrees Celsius (°C)**

$$0^{\circ}\text{C} = \text{freezing point of water}$$

$$37^{\circ}\text{C} = \text{human body temperature}$$

$$100^{\circ}\text{C} = \text{boiling point of water}$$

**Area**

$$100 \text{ square mm (mm}^2\text{)} = 1 \text{ square cm (cm}^2\text{)}$$

$$10,000 \text{ cm}^2 = 1 \text{ square meter (m}^2\text{)}$$

$$1,000,000 \text{ m}^2 = 1 \text{ square km (km}^2\text{)}$$

**Volume**

$$1000 \text{ cubic mm (mm}^3\text{)} = 1 \text{ cubic cm (cm}^3\text{)}$$

$$1,000,000 \text{ cm}^3 = 1 \text{ cubic meter (m}^3\text{)}$$

## 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

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

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

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

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

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

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

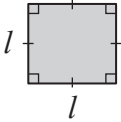
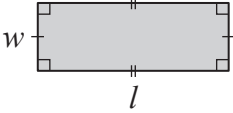
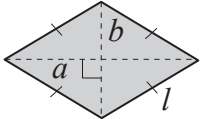
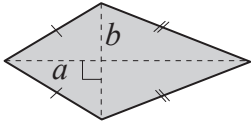
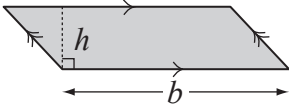
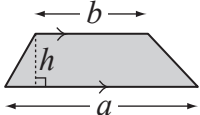
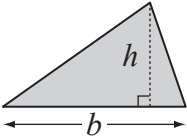

$$\text{milli (m)} = 1 \text{ thousandth} = \frac{1}{1000}$$

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

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

## 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

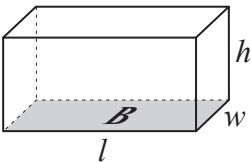
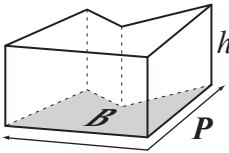
**mono** - one  
**bi** or **di** - two  
**tri** - three  
**quad** or **tetra** - four  
**penta** - five  
**hexa** - six  
**hepta** - seven  
**octa** - eight  
**nona** - nine  
**deca** - ten

#### 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	Volume
Rectangular Prism		$V = lwh$ or $= Bh$
Prism - (All)		$V = Bh$

### Abbreviations

$l$  length

$w$  width

$h$  height

$b$  base length

$r$  radius

$A$  area

$P$  perimeter

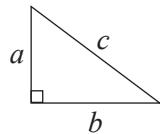
$V$  volume

$B$  base area

$C$  circumference

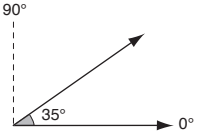
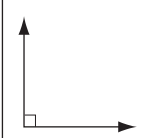
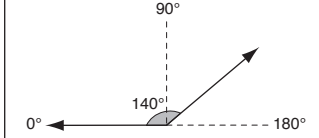
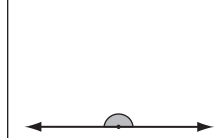
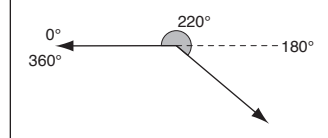
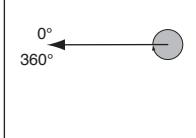
### Pythagorean theorem

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



# GEOMETRY FACTS

## Angle Types

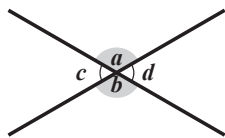
Acute $< 90^\circ$	Right $90^\circ$	Obtuse more than $90^\circ$ less than $180^\circ$	Straight $180^\circ$	Reflex more than $180^\circ$ less than $360^\circ$	Revolution $360^\circ$
					

## Properties of angles

### Vertically Opposite Angles

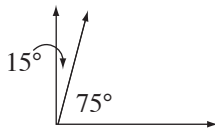
Are equal

$$\angle a = \angle b, \angle c = \angle d$$



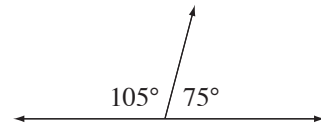
### Complementary Angles

Add to  $90^\circ$



### Supplementary Angles

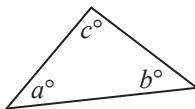
Add to  $180^\circ$



### Properties of angles in a triangle

The sum of interior angles of a triangle is  $180^\circ$ .

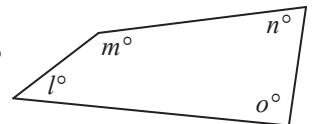
$$a^\circ + b^\circ + c^\circ = 180^\circ$$



### Properties of angles in a quadrilateral

The sum of interior angles of a quadrilateral is  $360^\circ$ .

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



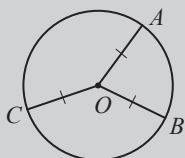
### Triangle types

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

Angles	Triangle type
all acute angles	<b>acute</b>
one right angle	<b>right</b>
one obtuse angle	<b>obtuse</b>

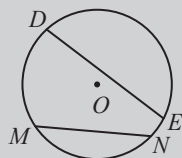
### Properties of circles

**Radius** - joins the center with any point on the circle

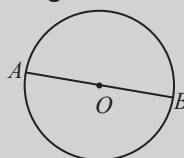


$$OA = OB = OC$$

**Chord** - joins any two points on the circle

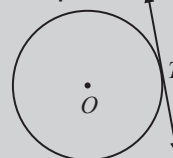


**Diameter** - a chord passing through the center



$$AB = 2OA$$

**Tangent** - a line touching the circle in one point



**Circumference** - the distance around the circle

