




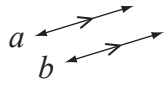



# MATH FACTS

## 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 $a$  |

### Geometry

|  |  |
|--|--|
| $\pi$ (pi)   | $\approx 3.14$ or $\frac{22}{7}$   |
| $^\circ$   | degree (a right angle measures $90^\circ$ )  |
| $\cong$  | 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<br>(line $a$ is parallel to line $b$ )  |
|   | congruent segments   |
|   | equal angles   |
|   | equal side lengths   |

### Algebra

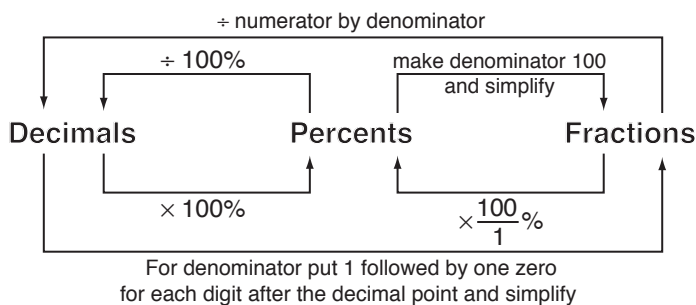
|               |  |
|---------------|--|
| $3x$          | 3 times $x$ , 3 lots of $x$ , $3 \cdot x$ , $3x$     |
| $x^2$         | $x$ raised to the 2 <sup>nd</sup> power, $x \cdot x$ |
| $-x$          | opposite of $x$                                      |
| $\frac{1}{x}$ | reciprocal of $x$    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

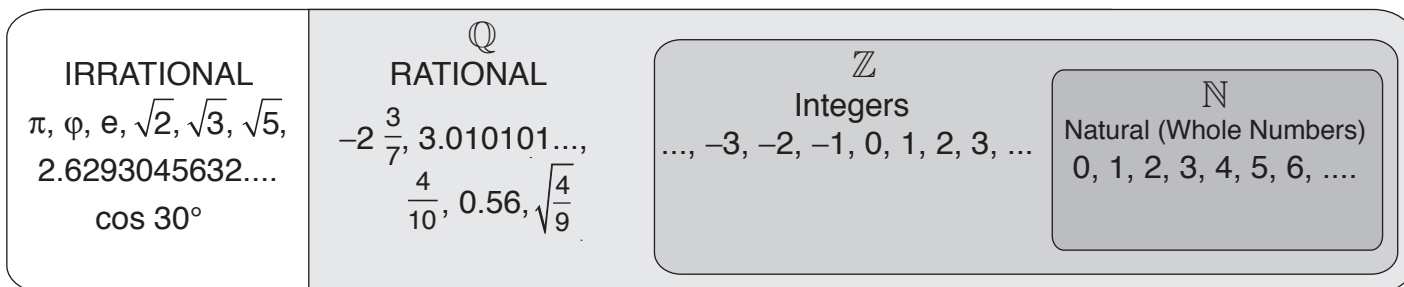
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97

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

### 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

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

#### 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

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

#### 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

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

#### 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

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

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

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

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

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

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

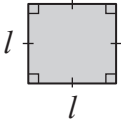
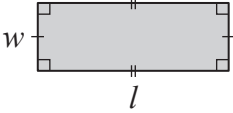
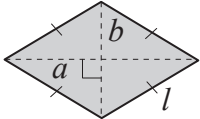
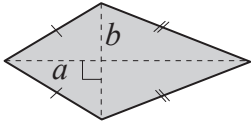
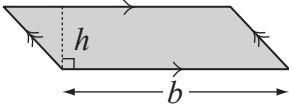
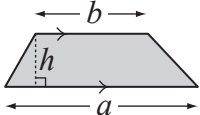
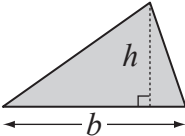

$$\text{milli (m)} = 1 \text{ thousandth} = \frac{1}{1000}$$

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

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

## MEASUREMENT FACTS (3)

### 2D shapes - Formulae

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

#### Prefixes

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

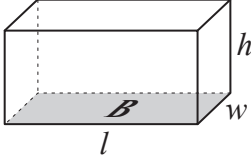
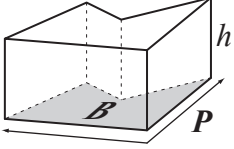
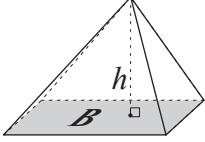
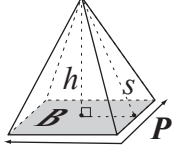
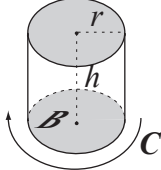
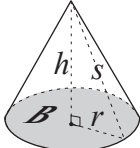
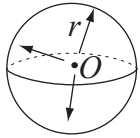
**mono** - one  
**bi or di** - two  
**tri** - three  
**quad or tetra** - four  
**penta** - five  
**hexa** - six  
**hepta** - seven  
**octa** - eight  
**nona** - nine  
**deca** - ten

#### 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 |    | $S.A. = 2lw + 2wh + 2lh$<br>$= 2(lw + wh + lh)$                      | $V = lwh$ or<br>$= Bh$                                    |
| Prism - (All)     |    | $S.A. = P \times h + 2B$<br>$= Ph + 2B$                              | $V = Bh$  |
| Pyramid           |    | $S.A. = \text{Sum of areas of all faces}$                            | $V = \frac{1}{3} Bh$                                      |
| Regular Pyramid   |    | $S.A. = \frac{P \times s}{2} + B$<br>$= \frac{Ps}{2} + B$            | $V = \frac{1}{3} Bh$                                      |
| Cylinder          |   | $L.A. = 2\pi rh$<br>$S.A. = 2\pi r^2 + 2\pi rh$<br>$= 2\pi r(r + h)$ | $V = B \times h$<br>$= \pi r^2 h$                         |
| Cone              |  | $L.A. = \pi rs$<br>$S.A. = \pi r^2 + \pi rs$<br>$= \pi r(r + s)$     | $V = \frac{1}{3} B \times h$<br>$= \frac{1}{3} \pi r^2 h$ |
| 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

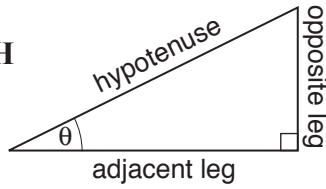
*L.A.* lateral area  
*S.A.* surface area  
*V* volume  
*B* base area  
*P* perimeter of base  
*s* slant height



# TRIGONOMETRY FACTS

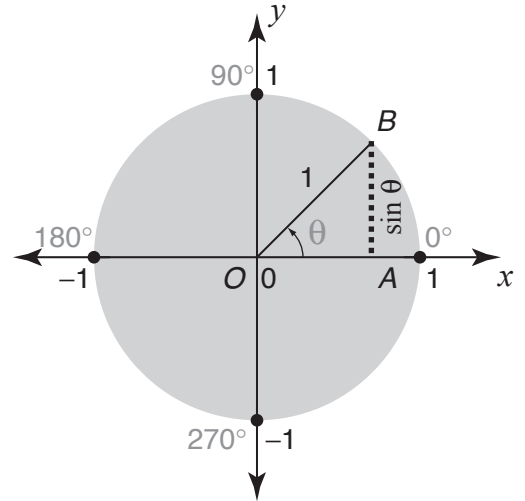
## Sine

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



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

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

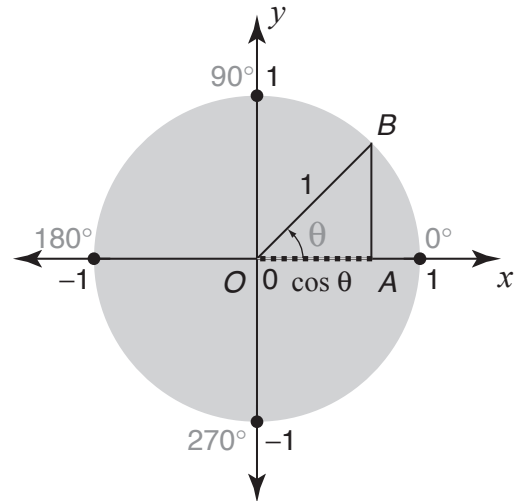


## Cosine

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

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

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

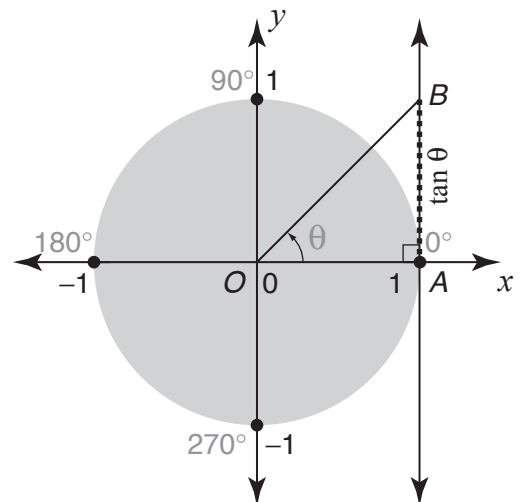


## Tangent

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

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

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



**Trigonometry hint: SOH - CAH - TOA**

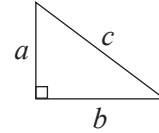
## GEOMETRY FACTS (1)

### Euler's formula

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

### Pythagorean theorem

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



### Angle Types

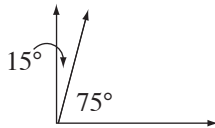
| Acute<br>$< 90^\circ$ | Right<br>$90^\circ$ | Obtuse<br>more than $90^\circ$<br>less than $180^\circ$ | Straight<br>$180^\circ$ | Reflex<br>more than $180^\circ$<br>less than $360^\circ$ | Revolution<br>$360^\circ$ |
|-----------------------|---------------------|---|-------------------------|--|---------------------------|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

### Properties of angles

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

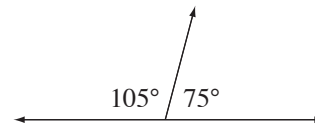
### Complementary Angles

Add to  $90^\circ$



### Supplementary Angles

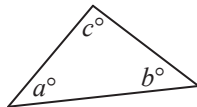
Add to  $180^\circ$



### Properties of angles in a triangle

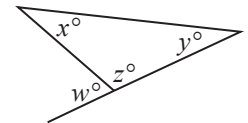
The sum of interior angles of a triangle is  $180^\circ$ .

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



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

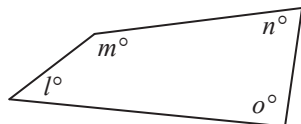
$$w^\circ = x^\circ + y^\circ$$



### Properties of angles in a quadrilateral

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

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



## GEOMETRY FACTS (2)

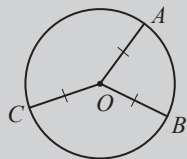
### Triangle types

| 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> |

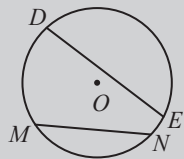
### Properties of circles

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

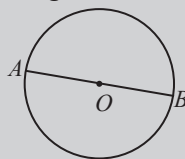


$$OA = OB = OC$$

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

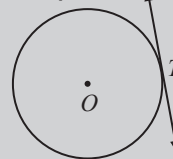


**Diameter** - a chord passing through the center

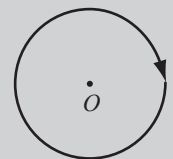


$$AB = 2OA$$

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



**Circumference** - the distance around the circle

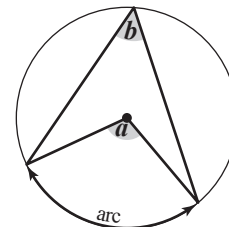


### Properties of angles in a circle

continues on page 256

#### Property 1

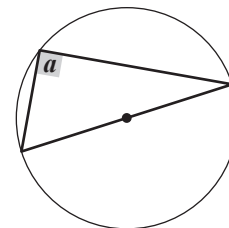
The central arc of a circle is twice the size of the inscribed angle which intercepts the same arc of the circle.



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

#### Property 2

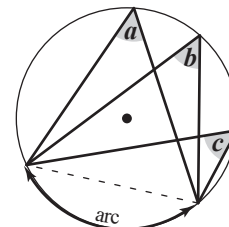
An angle inscribed in a semicircle is a right angle.



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

#### Property 3

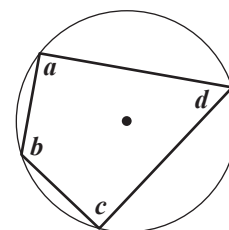
All inscribed angles that intercept the same arc of the circle are equal.



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

#### Property 4

The opposite angles in a quadrilateral inscribed in a circle add up to  $180^\circ$  (are supplementary).



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

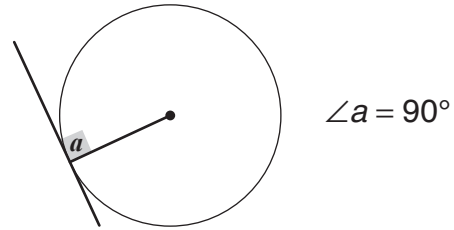
## GEOMETRY FACTS (3)

### Properties of angles in a circle

continued from page 461

#### Property 5

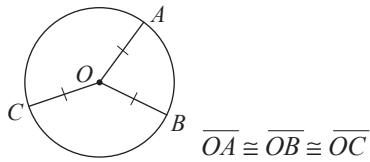
If a line is tangent to a circle, then the line is perpendicular to the radius drawn to the point of tangency.



### Properties of lines related to a circle

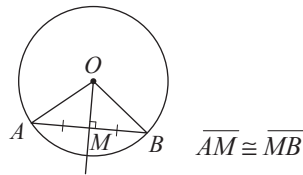
#### Property 1

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.

