

Symbols

| | |
|---------------------------|---|
| $<$ | is less than |
| $>$ | is greater than |
| \leq | is less than or equal to |
| \geq | is greater than or equal to |
| $=$ | is equal to |
| \neq | is not equal to |
| \approx | is approximately equal to |
| \sim | similar |
| $ a $ | absolute value: $ 3 = 3$; $ -3 = 3$ |
| \perp | perpendicular |
| \parallel | parallel |
| (x, y) | ordered pair |
| \widehat{AB} | arc AB |
| \overleftrightarrow{AB} | line AB |
| \overrightarrow{AB} | ray AB |
| \overline{AB} | line segment AB |
| $\angle A$ | angle A |
| $m\angle A$ | measure of angle A |
| $\triangle ABC$ | triangle ABC |
| π | pi; $\pi \approx 3.14$; $\pi = \frac{22}{7}$ |

Formulas

| Perimeter | |
|---------------|-----------------------------------|
| P | = sum of the lengths of the sides |
| Rectangle | $P = 2l + 2w$ |
| Square | $P = 4s$ |
| Circumference | $C = 2\pi r, C = \pi d$ |

| Area | |
|-----------------|---|
| Circle | $A = \pi r^2$ |
| Parallelogram | $A = bh$ |
| Rectangle | $A = lw$ |
| Square | $A = s^2$ |
| Triangle | $A = \frac{1}{2}bh$ |
| Trapezoid | $A = \frac{1}{2}h(b_1 + b_2)$ |
| Regular Polygon | $A = \frac{1}{2}ap$, where a is the apothem and p is the perimeter |

| Surface Area | |
|-------------------|---------------------------|
| Cube | $SA = 6e^2$ |
| Rectangular Prism | $SA = 2lw + 2lh + 2wh$ |
| Cylinder | $SA = 2\pi r^2 + 2\pi rh$ |
| Cone | $SA = \pi r^2 + \pi rl$ |
| Regular Pyramid | $SA = B + \frac{1}{2}pl$ |
| Sphere | $SA = 4\pi r^2$ |

| Volume | |
|-------------------|-----------------------------|
| Cylinder | $V = Bh, B = \pi r^2$ |
| Rectangular Prism | $V = lwh$ |
| Triangular Prism | $V = Bh, B = \frac{1}{2}bh$ |
| Pyramid | $V = \frac{1}{3}Bh$ |
| Cone | $V = \frac{1}{3}\pi r^2h$ |
| Sphere | $V = \frac{4}{3}\pi r^3$ |

| Quadratic Equations | |
|---------------------|--|
| Standard form | $ax^2 + bx + c = 0$ |
| Quadratic Formula | $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ |

| Linear Equations | |
|----------------------|-----------------------------------|
| Slope | $m = \frac{y_2 - y_1}{x_2 - x_1}$ |
| Slope-intercept form | $y = mx + b$ |
| Point-slope form | $y - y_1 = m(x - x_1)$ |
| Standard form | $Ax + By = C$ |

| Other Formulas | |
|---------------------|---|
| Pythagorean Theorem | $a^2 + b^2 = c^2$, where c is the hypotenuse of a right triangle |
| Distance | $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ |
| Midpoint | $m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ |
| Direct variation | $y = kx$ |
| Inverse variation | $y = \frac{k}{x}$ |

Trigonometry

For an acute angle A in a right triangle:

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}}$$

Temperature

Celsius $C = \frac{5}{9}(F - 32)$

Fahrenheit $F = \frac{9}{5}C + 32$

Properties of Real Numbers

| | |
|---|--|
| Reflexive Property of Equality | For all real numbers a , $a = a$. |
| Symmetric Property of Equality | For all real numbers a and b , if $a = b$, then $b = a$. |
| Transitive Property of Equality | For all real numbers a , b , and c , if $a = b$ and $b = c$, then $a = c$. |
| Substitution Property of Equality | For all real numbers a and b , if $a = b$, then a may be replaced by b . |
| Additive Identity | For all real numbers a , $a + 0 = 0 + a = a$. |
| Multiplicative Identity | For all real numbers a , $a \cdot 1 = 1 \cdot a = a$. |
| Commutative Property of Addition | For all real numbers a and b , $a + b = b + a$. |
| Commutative Property of Multiplication | For all real numbers a and b , $a \cdot b = b \cdot a$. |
| Associative Property of Addition | For all real numbers a , b , and c , $(a + b) + c = a + (b + c)$. |
| Associative Property of Multiplication | For all real numbers a , b , and c , $(a \cdot b) \cdot c = a \cdot (b \cdot c)$. |
| Distributive Property of Multiplication over Addition | For all real numbers a , b , and c , $a(b + c) = a \cdot b + a \cdot c$. |
| Additive Inverse | For all real numbers a , there is exactly one real number $-a$ such that $a + (-a) = 0$ and $(-a) + a = 0$. |
| Multiplicative Inverse | For all real numbers a and b where $a \neq 0$, $b \neq 0$, there is exactly one number $\frac{b}{a}$ such that $\frac{b}{a} \cdot \frac{a}{b} = 1$ and $\frac{a}{b} \cdot \frac{b}{a} = 1$. |
| Multiplication Property of Zero | For all real numbers a , $a \cdot 0 = 0$ and $0 \cdot a = 0$. |
| Addition Property of Equality | For all real numbers a , b , and c , if $a = b$, then $a + c = b + c$. |
| Subtraction Property of Equality | For all real numbers a , b , and c , if $a = b$, then $a - c = b - c$. |
| Multiplication Property of Equality | For all real numbers a , b , and c , if $a = b$, then $a \cdot c = b \cdot c$. |
| Division Property of Equality | For all real numbers a , b , and c , $c \neq 0$ if $a = b$, then $\frac{a}{c} = \frac{b}{c}$. |
| Zero Product Property of Equality | For all real numbers a and b , if $a \cdot b = 0$ then $a = 0$ or $b = 0$ or both a and b equal 0. |
| Addition Property of Inequality* | For all real numbers a , b , and c , if $a > b$, then $a + c > b + c$. |
| Subtraction Property of Inequality* | For all real numbers a , b , and c , if $a > b$, then $a - c > b - c$. |
| Multiplication Property of Inequality* | For all real numbers a , b , and c , $c > 0$, if $a > b$, then $a \cdot c > b \cdot c$. For all real numbers a , b , and c , $c < 0$, if $a > b$, then $a \cdot c < b \cdot c$. |
| Division Property of Inequality* | For all real numbers a , b , and c , $c > 0$ if $a > b$, then $\frac{a}{c} > \frac{b}{c}$. For all real numbers a , b , and c , $c < 0$ if $a > b$, then $\frac{a}{c} < \frac{b}{c}$. |

*These properties are also true for $<$, \leq , \geq .

Properties of Exponents

For any numbers a and b and all integers m and n ,

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

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

$$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$$

$$a^{-n} = \frac{1}{a^n}, a \neq 0 \text{ and } \frac{1}{a^{-n}} = a^n, a \neq 0$$

$$a^0 = 1, a \neq 0$$

Properties of Radicals

In the expression $\sqrt[n]{a}$,

a is the radicand, $\sqrt{\quad}$ is the radical symbol, and n is the root index.

$$\sqrt[n]{a} = b, \text{ if } b^n = a \quad b \text{ is the } n\text{th root of } a.$$

$$a\sqrt{b} \pm c\sqrt{b} = (a \pm c)\sqrt{b}, \text{ where } b \geq 0.$$

$$(a\sqrt{b})(c\sqrt{b}) = ac\sqrt{bd}, \text{ where } b \geq 0, d \geq 0.$$

$$\frac{a\sqrt{b}}{c\sqrt{d}} = \frac{a}{c}\sqrt{\frac{b}{d}}, \text{ where } b \geq 0, c \neq 0, d > 0.$$

Table of Measures

| Customary | Metric |
|--|---|
| Distance/Length | |
| 1 yard (yd) = 3 feet (ft) = 36 inches (in.) | 1 meter (m) = 100 centimeters (cm) |
| 1 foot (ft) = 12 inches (in.) | 1 meter (m) = 1000 millimeters (mm) |
| 1 mile (mi) = 1760 yards (yd) | 1 meter (m) = 10 decimeters (dm) |
| 1 mile (mi) = 5280 feet (ft) | 1 centimeter (cm) = 10 millimeters (mm) |
| 1 acre (ac) = 43,560 square feet (ft) | 1 kilometer (km) = 1000 meters (m) |
| Volume | |
| 1 cup (c) = 8 fluid ounces (fl oz) | 1 liter (L) = 1000 milliliters (mL) |
| 1 pint (pt) = 2 cups (c) | 1 liter (L) = 1000 cubic centimeters (cm ³) |
| 1 quart (qt) = 4 cups (c) = 2 pints (pt) | 1 liter (L) = 100 centiliters (cL) |
| 1 gallon (gal) = 16 cups (c) = 4 quarts (qt) | 1 liter (L) = 10 deciliters (dL) |
| | 1 kiloliter (kL) = 1000 liters (L) |
| Weight/Mass | |
| 1 pound (lb) = 16 ounces (oz) | 1 gram (g) = 1000 milligrams (mg) |
| 1 ton (T) = 2000 pound (lb) | 1 kilogram (kg) = 1000 grams (g) |
| | 1 tonne (t) = 1000 kilograms (kg) |
| Time | |
| 1 minute (min) = 60 seconds (sec) | 1 year (yr) = 365 days (d) |
| 1 hour (hr) = 60 minutes (min) | 1 year (yr) = 52 weeks (wk) |
| 1 day (d) = 24 hours (hr) | 1 year (yr) = 12 months (mo) |