Reference

Properties

Properties of Equality

Addition Property of Equality
If $a = b$, then $a + c = b + c$.

Subtraction Property of Equality
If $a = b$, then $a - c = b - c$.

Multiplication Property of Equality
If $a = b$, then $a \cdot c = b \cdot c$, $c \neq 0$.

Division Property of Equality
If $a = b$, then $a \div c = b \div c$, $c \neq 0$.

Properties of Inequality

Addition Property of Inequality
If $a > b$, then $a + c > b + c$.
If $a < b$, then $a + c < b + c$.

Subtraction Property of Inequality
If $a > b$, then $a - c > b - c$.
If $a < b$, then $a - c < b - c$.

Multiplication Property of Inequality ($c > 0$)

If $a > b$ and $c > 0$, then $ac > bc$.

If $a < b$ and $c > 0$, then $ac < bc$.

Division Property of Inequality ($c > 0$)

If $a > b$ and $c > 0$, then $\frac{a}{c} > \frac{b}{c}$.

If $a < b$ and $c > 0$, then $\frac{a}{c} < \frac{b}{c}$.

Multiplication Property of Inequality ($c < 0$)

If $a > b$ and $c < 0$, then $ac < bc$.
If $a < b$ and $c < 0$, then $ac > bc$.

Division Property of Inequality ($c < 0$)

If $a > b$ and $c < 0$, then $\frac{a}{c} < \frac{b}{c}$.

If $a < b$ and $c < 0$, then $\frac{a}{c} > \frac{b}{c}$.

* The Properties of Inequality are also true for $\geq$ and $\leq$.

Properties of Exponents

Zero Exponent
$a^0 = 1$, where $a \neq 0$

Negative Exponent
$a^{-n} = \frac{1}{a^n}$, where $a \neq 0$

Product of Powers Property
$a^m \cdot a^n = a^{m+n}$

Quotient of Powers Property
$\frac{a^m}{a^n} = a^{m-n}$, where $a \neq 0$

Power of a Power Property
$(a^m)^n = a^{mn}$

Power of a Product Property
$(ab)^m = a^m b^m$

Power of a Quotient Property
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, where $b \neq 0$

Rational Exponents
$a^{m/n} = (a^{1/n})^m = (\sqrt[n]{a})^m$

Properties of Radicals

Product Property of Square Roots
$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$, where $a, b \geq 0$

Quotient Property of Square Roots
$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$, where $a \geq 0$ and $b > 0$

Other Properties

Zero-Product Property
If a and b are real numbers and $ab = 0$, then $a = 0$ or $b = 0$.

Patterns

Square of a Binomial Pattern
$(a + b)^2 = a^2 + 2ab + b^2$
$(a - b)^2 = a^2 - 2ab + b^2$

Difference of Two Squares Pattern
$a^2 - b^2 = (a + b)(a - b)$

Sum and Difference Pattern
$(a + b)(a - b) = a^2 - b^2$

Perfect Square Trinomial Pattern
$a^2 + 2ab + b^2 = (a + b)^2$
$a^2 - 2ab + b^2 = (a - b)^2$

Formulas

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 of a linear equation
$Ax + By = C$, where A and B are not both 0

Standard form of a quadratic function
$f(x) = ax^2 + bx + c$, where $a \neq 0$

Vertex form of a quadratic function
$f(x) = a(x - h)^2 + k$, where $a \neq 0$

Intercept form of a quadratic function
$f(x) = a(x - p)(x - q)$, where $a \neq 0$

Axis of Symmetry

$x = \frac{-b}{2a}$

Quadratic Formula

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where $a \neq 0$ and $b^2 - 4ac \geq 0$

Exponential growth
$y = a(1 + r)^t$, where $a > 0$ and $r > 0$

Exponential decay
$y = a(1 - r)^t$, where $a > 0$ and $0 < r < 1$

Explicit rule for an arithmetic sequence
$a_n = a_1 + (n - 1)d$

Explicit rule for a geometric sequence
$a_n = a_1 r^{n-1}$

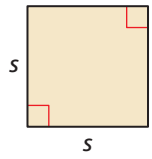
Recursive equation for an arithmetic sequence
$a_n = a_{n-1} + d$

Recursive equation for a geometric sequence

$a_n = r \cdot a_{n-1}$

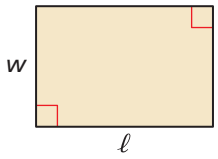
Perimeter, Area, and Volume Formulas

Square



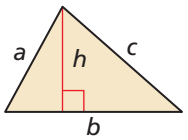
$P = 4s$
$A = s^2$

Rectangle



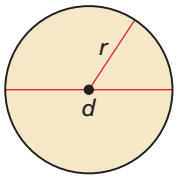
$P = 2\ell + 2w$
$A = \ell w$

Triangle



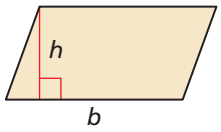
$P = a + b + c$
$A = \frac{1}{2}bh$

Circle



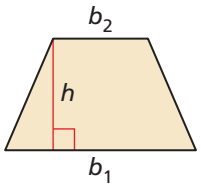
$C = \pi d$ or $C = 2\pi r$
$A = \pi r^2$

Parallelogram



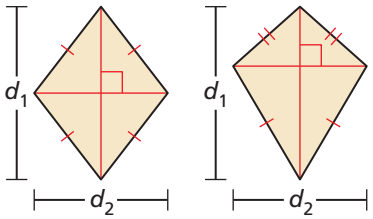
$A = bh$

Trapezoid



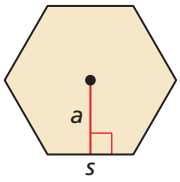
$A = \frac{1}{2}h(b_1 + b_2)$

Rhombus/Kite



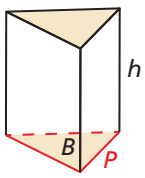
$A = \frac{1}{2}d_1d_2$

Regular *n*-gon



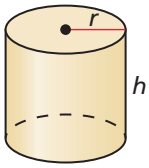
$A = \frac{1}{2}aP$ or $A = \frac{1}{2}a \cdot ns$

Prism



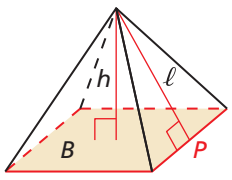
$L = Ph$
$S = 2B + Ph$
$V = Bh$

Cylinder



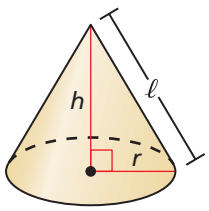
$L = 2\pi rh$
$S = 2\pi r^2 + 2\pi rh$
$V = \pi r^2h$

Pyramid



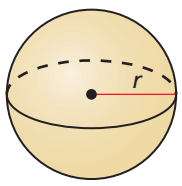
$L = \frac{1}{2}P\ell$
$S = B + \frac{1}{2}P\ell$
$V = \frac{1}{3}Bh$

Cone



$L = \pi r\ell$
$S = \pi r^2 + \pi r\ell$
$V = \frac{1}{3}\pi r^2h$

Sphere

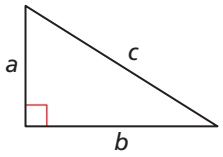


$S = 4\pi r^2$
$V = \frac{4}{3}\pi r^3$

Reference

Other Formulas

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



Simple Interest
$I = Prt$

Compound Interest
$y = P\left(1 + \frac{r}{n}\right)^{nt}$

Distance
$d = rt$

Conversions

U.S. Customary
1 foot = 12 inches
1 yard = 3 feet
1 mile = 5280 feet
1 mile = 1760 yards
1 acre = 43,560 square feet
1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 231 cubic inches
1 pound = 16 ounces
1 ton = 2000 pounds

U.S. Customary to Metric
1 inch = 2.54 centimeters
1 foot ≈ 0.3 meter
1 mile ≈ 1.61 kilometers
1 quart ≈ 0.95 liter
1 gallon ≈ 3.79 liters
1 cup ≈ 237 milliliters
1 pound ≈ 0.45 kilogram
1 ounce ≈ 28.3 grams
1 gallon ≈ 3785 cubic centimeters

Time
1 minute = 60 seconds
1 hour = 60 minutes
1 hour = 3600 seconds
1 year = 52 weeks

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

Metric
1 centimeter = 10 millimeters
1 meter = 100 centimeters
1 kilometer = 1000 meters
1 liter = 1000 milliliters
1 kiloliter = 1000 liters
1 milliliter = 1 cubic centimeter
1 liter = 1000 cubic centimeters
1 cubic millimeter = 0.001 milliliter
1 gram = 1000 milligrams
1 kilogram = 1000 grams

Metric to U.S. Customary
1 centimeter ≈ 0.39 inch
1 meter ≈ 3.28 feet
1 meter ≈ 39.37 inches
1 kilometer ≈ 0.62 mile
1 liter ≈ 1.06 quarts
1 liter ≈ 0.26 gallon
1 kilogram ≈ 2.2 pounds
1 gram ≈ 0.035 ounce
1 cubic meter ≈ 264 gallons