



# Algebra 2 Formulas

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## Exponents

Product rule

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

Quotient rule

$$\frac{a^m}{a^n} = a^{m-n}$$

Power rule

$$(a^m)^n = a^{m \cdot n}$$

Zero power

$$a^0 = 1$$

Inverse power

$$a^{-1} = \frac{1}{a}$$

## Fractions

### Complex fractions

A complex fraction is a fraction that contains more than one fraction line. In other words, there is at least one fraction nested inside the numerator and/or denominator of the other fraction. As an example,

$$\frac{\frac{a}{x+y} + \frac{m}{y}}{\frac{x}{a+m}}$$

is a complex fraction.



## Radicals

Division rule

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

Multiplication rule

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

Multiple rule

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

## Complex numbers

A complex number has a real part and an imaginary part, like

$$4 + 5i$$

Standard form for a complex number means writing the real part first, followed by the imaginary part.

## Equations

### Direction and inverse variation

If  $A$  varies directly as  $B$  or if  $A$  is directly proportional to  $B$ , then

$$A = kB$$

If  $A$  varies inversely as  $B$  or if  $A$  is inversely proportional to  $B$ , then

$$A = \frac{k}{B}$$



## Distance, rate, and time

Distance = Rate  $\times$  Time

$$D = RT$$

## Uniform motion

Knowing that

$$d = r \cdot t$$

where  $d$  is distance,  $r$  is rate and  $t$  is time, if two objects travel the same distance, such that

$$d_1 = d_2$$

then we can also say that

$$r_1 t_1 = r_2 t_2$$

## Polynomials and factoring

### Special factoring

Difference of squares

$$x^2 - y^2 = (x + y)(x - y)$$

Difference of cubes

$$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

Sum of cubes

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$



## Zero theorem

If  $p$  and  $q$  are real numbers and  $p \cdot q = 0$ , then either  $p = 0$  or  $q = 0$ , or both.

If  $a, b, c, d, \dots$  are real numbers and  $a \cdot b \cdot c \cdot d \cdot e \cdot f \cdot \dots = 0$ , then one or more of the factors is equal to 0.

## Graphing

### Vertical shifts

The graph of a function of  $F$  where

$$F(x) = f(x) + k$$

is the graph of  $f$  shifted vertically  $k$  units.

### Horizontal shifts

The graph of a function of  $F$  where

$$F(x) = f(x - k)$$

is the graph of  $f$  shifted horizontally  $k$  units.

### Reflections



The graph of the function of  $F$  where

$$F(x) = -f(x)$$

is the graph of  $f$  reflected about the  $x$ -axis.

## Distance between two points

The distance  $d$  between two coordinate points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

## Logarithms

### Laws of logarithms

$$\log_a x = y \iff a^y = x$$

$$\log_a(xy) = \log_a x + \log_a y$$

$$\log_a a^x = x$$

$$\log_a \left( \frac{x}{y} \right) = \log_a x - \log_a y$$

$$a^{\log_a x} = x$$

$$\log_a x^r = r \log_a x$$

### Laws of natural logarithms

$$\log_e x = \ln x$$

$$\ln(e^x) = x$$

$$\ln x = y \iff e^y = x$$

$$e^{\ln x} = x$$



$$\log_a x = \frac{\ln x}{\ln a}$$

$$\ln e = 1$$



