



Douglas College

Douglas College Learning Centre

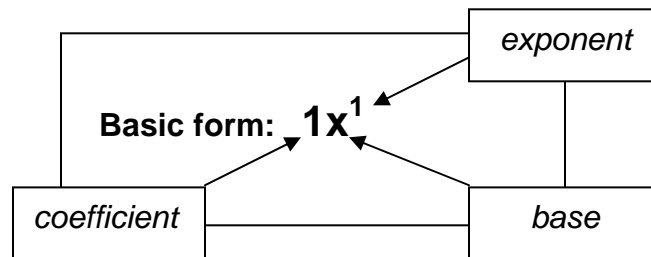
EXPONENTS

An In Depth Look

To use this worksheet, you should first be comfortable with basic multiplication and division, order of operations and fractions. Also, if this is the first time that you have used exponents, you should refer to the handout Exponents: An Introduction before continuing.

Exponents are used to indicate repeated multiplications of a *base*, which can be a number, a variable or an equation. An exponent is calculated by using its base as a factor for as many times as is shown by the exponent. For example:

- a) $5^2 = 5 \times 5 = 25$
- b) $a^3 = a \times a \times a$
- c) $2^4 = 2 \times 2 \times 2 \times 2$
- d) $n^1 = n$



Though these examples may seem straight forward, exponents are sometimes quite difficult to calculate because they are not always presented in the basic form shown above. There are several rules that will help you to solve exponents in all the forms that you may run across them.

Rules	Examples
$x^0 = 1$	<ul style="list-style-type: none"> a) $2^0 = 1$ b) $a^0 = 1$

$x^{-n} = \frac{1}{x^n}$	<p>a) $3^{-2} = \frac{1}{3^2} = \frac{1}{3 \times 3} = \frac{1}{9}$</p> <p>b) $a^{-3} = \frac{1}{a^3}$</p>
$xy^2 = x \times y \times y$	<p>a) $2 \times 3^2 = 2 \times 9 = 18$</p> <p>b) $7 \times 1^3 = 7 \times 1 \times 1 \times 1 = 7$</p>
$(xy)^2 = x \times x \times y \times y$	<p>a) $(2 \times 3)^2 = 2 \times 2 \times 3 \times 3 = 36$</p> <p>b) $(3z)^2 = 3 \times 3 \times z \times z = 9z^2$</p>
$x^n x^m = x^{n+m}$	<p>a) $2^2 \times 2^3 = (2 \times 2) \times (2 \times 2 \times 2) = 2^5 = 2^{2+3}$</p> <p>b) $a^1 \times a^0 = a \times 1 = a = a^{1+0}$</p>
$\frac{x^n}{x^m} = x^{(n-m)}$	<p>a) $\frac{3^4}{3^2} = \frac{3 \times 3 \times 3 \times 3}{3 \times 3} = 3^2 = 3^{4-2}$</p> <p>b) $\frac{x^2}{x} = \frac{x \times x}{x} = x = x^{2-1}$</p>
$(x^n)^m = x^{n \times m}$	<p>a) $(2^3)^2 = (2 \times 2 \times 2)^2 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{3 \times 2}$</p> <p>b) $((z^2)^3)^1 = (z \times z)^3 = z \times z \times z \times z \times z \times z = z^6 = z^{2 \times 3 \times 1}$</p>
$(xy)^n = x^n y^n$	<p>a) $(2 \times 3)^2 = (2 \times 3) \times (2 \times 3) = 2^2 \times 3^2 = 36$</p>

Exercise

Evaluate each exponent.

1) 6^2

2) 3^4

3) y^0

4) 7^{-2}

5) $3^{-2} \times 6^2$

6) $(3x)^3$

7) $3x^3 \times 2x^2$

8) $x^2y^{-2} \times x^{-2}y^3$

9) $3(xy)^3$

10) $(x^2)^4 \times 6x^{-3}$

11) $(xyz)^3 \times 2x^2x^{-3}x^{-2}$

Answers

1) 36

2) 81

3) 1

4) $1/49$

5) 4

6) $27x^3$

7) $6x^5$

8) y

9) $3x^3y^3$

10) $6x^5$

11) $2x^5z$