Laws of Exponents

Identification of Parts: a^b **a is the base and b is an exponent**

THEOREM 1 Laws of Exponents ($b > 0$)

	Rule	Example
Exponent zero	$b^0 = 1$	
Products	$b^x b^y = b^{x+y}$	$2^5 \cdot 2^3 = 2^{5+3} = 2^8$
Quotients	$\frac{b^x}{b^y} = b^{x-y}$	$\frac{4^7}{4^2} = 4^{7-2} = 4^5$
Negative exponents	$b^{-x} = \frac{1}{b^x}$	$3^{-4} = \frac{1}{3^4} = \frac{1}{81}$
Power to a power	$(b^x)^y = b^{xy}$	$(3^2)^4 = 3^{2(4)} = 3^8$
Roots	$b^{1/n} = \sqrt[n]{b}$	$5^{1/2} = \sqrt{5}$

Problems:

1) $2m^2 \cdot 2m^3$

2) $m^4 \cdot 2m^{-3}$

3) $4r^{-3} \cdot 2r^2$

4) $4n^4 \cdot 2n^{-3}$

5) $2k^4 \cdot 4k$

6) $2x^3y^{-3} \cdot 2x^{-1}y^3$

7) $2y^2 \cdot 3x$

8) $4v^3 \cdot vu^2$

9) $4a^3b^2 \cdot 3a^{-4}b^{-3}$

10) $x^2y^{-4} \cdot x^3y^2$

11) $\left(x^2\right)^0$

12) $\left(2x^2\right)^{-4}$

13) $\left(4r^0\right)^4$

14) $\left(4a^3\right)^2$

15) $\left(3k^4\right)^4$

16) $(4xy)^{-1}$

17) $\left(2b^4\right)^{-1}$

18) $\left(x^2y^{-1}\right)^2$

19) $\left(2x^4y^{-3}\right)^{-1}$

20) $(3m)^{-2}$

21) $\dfrac{r^2}{2r^3}$

22) $\dfrac{x^{-1}}{4x^4}$

23) $\dfrac{3n^4}{3n^3}$

24) $\dfrac{m^4}{2m^4}$

25) $\frac{3m^{-4}}{m^{3}}$

26) $\frac{2x^{4}y^{-4}z^{-3}}{3x^{2}y^{-3}z^{4}}$

27) $\frac{4x^{0}y^{-2}z^{3}}{4x}$

28) $\frac{2h^{3}j^{-3}k^{4}}{3jk}$

29) $\frac{4m^{4}n^{3}p^{3}}{3m^{2}n^{2}p^{4}}$

30) $\frac{3x^{3}y^{-1}z^{-1}}{x^{-4}y^{0}z^{0}}$

Solve each equation.

1) $4^{2x+3} = 1$

2) $5^{3-2x} = 5^{-x}$

3) $3^{1-2x} = 243$

4) $3^{2a} = 3^{-a}$

5) $4^{3x-2} = 1$

6) $4^{2p} = 4^{-2p-1}$

7) $6^{-2a} = 6^{2-3a}$

8) $2^{2x+2} = 2^{3x}$

Evaluate each function at the given value.

1) $f(x) = \frac{1}{3} \cdot 6^x$ at $x = 2$

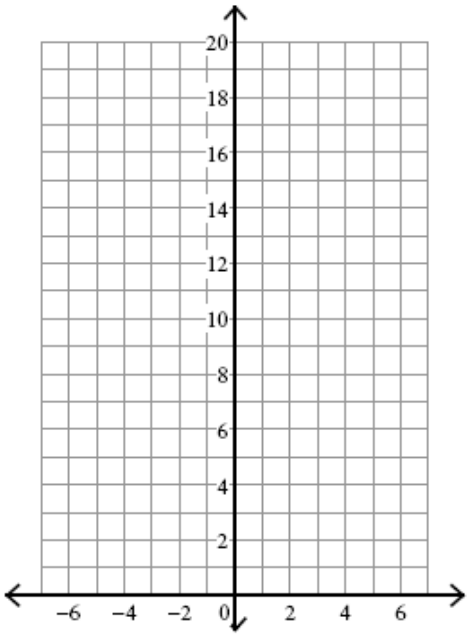
2) $f(n) = 10 \cdot 2^n$ at $n = 5$

3) $f(n) = 10 \cdot 2^n$ at $n = -2$

4) $g(x) = \frac{1}{5} \cdot \left(\frac{1}{3}\right)^x$ at $x = 3$

Sketch the graph of each function.

5) $f(x) = 5 \cdot 2^x$



7) $f(x) = \frac{1}{3} \cdot 2^x$