

Warm-up:

1) Write an equation for a line that is perpendicular to  $4x + 7y = 18$  and has an x-intercept of -3.  $(-3, 0)$

$4x + 7y = 18$   
 $-4x$   
 $7y = -4x + 18$   
 $y = \frac{-4x}{7} + \frac{18}{7}$   
 new  $m = \frac{7}{4}$

Step 1:  $m = \frac{7}{4}$

Step 2:  $y - y_1 = m(x - x_1)$   
 $y - 0 = \frac{7}{4}(x + 3)$   
 $y = \frac{7}{4}x + \frac{21}{4}$

Step 3:  $y = \frac{7}{4}x + \frac{21}{4}$

2) Graph  $y > -3x + 5$  (You can use graph paper from yesterday)

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Homework questions ?

8)

A)  $4x - 3y = 2$  B)  $3x + 4y = -1$  C)  $4y - 3x = 20$

$4x - 3y = 2$   
 $-4x$   
 $-3y = -4x + 2$   
 $y = \frac{4}{3}x - \frac{2}{3}$

$3x + 4y = -1$   
 $-3x$   
 $4y = -3x - 1$   
 $y = -\frac{3}{4}x - \frac{1}{4}$

$4y - 3x = 20$   
 $-4y$   
 $-3x = 20 - 4y$   
 $x = \frac{20 - 4y}{-3}$   
 $x = -\frac{20}{3} + \frac{4}{3}y$

perpendicular

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What do you think??

1) Is  $-3^2 = (-3)^2$  ?

$-(3 \cdot 3) = -9$   
 $(-3)(-3) = 9$   
 $-9 \neq 9$

2) Find  $x^2$  for  $x = -3$

$(-3)^2 = 9$   
 $(-3)(-3) = 9$

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3) let  $a = 2$  and  $b = -3$ , evaluate:

a)  $a^2 = 4$  e)  $b^2 = 9$   
 $(2)^2 = 4$   $(-3)^2 = 9$

b)  $-a = -2$  f)  $-b = 3$   
 $-(2) = -2$   $-(-3) = 3$

c)  $-a^2 = -(2)^2 = -4$  g)  $-b^2 = -9$   
 $-(2)^2 = -4$   $-(3)^2 = -9$

d)  $a^3 = 8$  h)  $b^3 = -27$   
 $(2)^3 = 2 \cdot 2 \cdot 2 = 8$   $(-3)^3 = -27$

$-(-3) = -(-3 \cdot -3)$   
 $-(9) = -9$   
 $9(-3) = -27$

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Work by hand & then with calculator. Did you get the same thing?  $3 \text{ STO } \times \text{ Enter}$

Evaluate  $-x^2 - 2(x+1)$  for  $x=3$

$-3^2 - 2(3+1)$   
 $-3^2 - 2(4)$   
 $-(3)(3) - 8$   
 $-9 - 8 = -17$

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Today: **PROPERTIES OF EXPONENTS**

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Zero as an Exponent

handout for rules

- any nonzero number raised to the 0 power equals 1

Example)  $x^0 = 1$

$$(1000)^0 = 1$$

$$H^0 = 1$$

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$$1) 50^0 = 1$$

$$2) 3x(5a^2bc^{-3})^0 = 3x$$

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Multiplying Monomials

- Rule: Multiply the coefficients.

For like bases, keep the base, add the exponents

Example)  $(2x^3)(4x^5) = 8x^8$

$$\begin{array}{c} 3+5 \\ 8 \\ 8x^8 \end{array}$$

$$(3z^2)(4z^1) = 12z^3$$

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$$3) 2^4 \cdot 2^6 = 2^{4+6} = 2^{10}$$

$$4) a^m \cdot a^n = a^{m+n}$$

$$5) (11ab^2c^3)(4a^3b^4cd) = 44a^4b^6c^4d$$

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You try!

$$6) \left(\frac{1}{2}x^4yz\right)(6xyz)(-4x^2z)$$

$$= -12x^7y^2z^3$$

$$\left(\frac{1}{5}x^2y\right)(9xy^3) = 3x^3y^4$$

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Product to a Power-  $a^n \rightarrow$  (monomial) exponent- Rule: Raise coefficient to the exponent.  
Multiply outside exponent by all exponents inside the ( )Example)  $(2x^3)^4 = 16x^{12}$ 

$$\begin{aligned}
 & \cancel{(2x^3)}^4 \\
 & (2x^3)(2x^3)(2x^3)(2x^3) \\
 & = 16x^{3+3+3+3} = 16x^{12}
 \end{aligned}$$

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7)  $(2a^m)^n = 2^n a^{mn}$

8)  $(-4x^2y^3z^5)^2 = (-4)^2 x^{2 \cdot 2} y^{3 \cdot 2} z^{5 \cdot 2}$

9)  $(x^m)^n = x^{m \cdot n} = 16x^4y^6z^{10}$

$$(a^2 \cdot b^3)^3 = a^6 \cdot b^9$$

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You try!

10)  $(-3xy^2)^3 =$

$$\begin{aligned}
 & = -27x^{1 \cdot (3)}y^{2 \cdot (3)} \\
 & = -27x^3y^6
 \end{aligned}
 \quad \left( \begin{aligned} & (-3)^3 \\ & (-3)(-3)(-3) \\ & 9 \cdot -3 \\ & = -27 \end{aligned} \right)$$

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Negative Exponents- Negative exponents must flip the base's position, so the negative exponent becomes positive.- It **does not** change the sign of the coefficient.

Example)  $x^{-n} = \frac{1}{x^n}$

$$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$$

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11)  $x^{-2} = \frac{1}{x^2}$

12)  $\frac{p}{2p^3} = \frac{p^1 p^3}{2} = \frac{p^4}{2}$

13)  $\frac{-3x^4}{y^2} = \frac{-3x^4}{y^2}$

You try!

14)  $\frac{(4r^2)^3}{2r^4} = \frac{4^3 r^{2 \cdot 3}}{2r^4} = \frac{64r^6}{2r^4} = \frac{32r^6}{r^4} = 32r^2$

$$\begin{aligned}
 & \frac{3 \cdot 2^2 y^{1+2} z^3}{x^{2+3} z^2} \\
 & = \frac{6y^3 z}{x^5}
 \end{aligned}$$

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Simplify

$$\frac{16x^{-3}y^4z^{-2}}{2x^5y^1z^{-3}}$$

$$= \frac{2 \cdot 16x^{-3}y^4z^{-2}}{2x^5y^1z^{-3}}$$

$$= 64x^2y^5z^3$$

Another way

$$= \frac{2 \cdot 16x^5y^1z^3y^4}{x^3z^2}$$

$$= 64x^2y^5z^3$$

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Dividing Monomials

- Divide the coefficients. For like bases, keep the base, subtract the exponents.
- Put answer where larger exponent was.
- You should never have a negative exponent.

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15)  $\frac{x^6}{x^4} = \frac{\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}}{\cancel{x}\cancel{x}\cancel{x}\cancel{x}} = x \cdot x = x^2$

16)  $\frac{2x^3y^7}{6x^5y^1} = \frac{2\cancel{x}\cancel{x}\cancel{x}y^7}{6\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}y^1} = \frac{1}{3} \frac{y^6}{x^2} = \frac{y^6}{3x^2}$

17)  $\frac{3b^2}{b} = \frac{3b \cdot b}{b} = 3b$

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You try!

18)  $\frac{36x^4yz^5}{12x^4y^3} = \frac{3\cancel{z}^5}{y^2} = \frac{3z^5}{y^2}$

$\frac{x^4}{x^4} = x^0$

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Quotient to a Power

- Fraction to an exponent
- raise the numerator to the exponent, raise the denominator to the exponent

Example)  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$$\left(\frac{4}{2}\right)^3 = \frac{4^3}{2^3} = \frac{4 \times 4 \times 4}{2 \times 2 \times 2} = \frac{64}{8} = 8$$

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19)  $\left(\frac{2}{3}\right)^2 = \frac{2^2}{3^2} = \frac{4}{9}$

20)  $\left(\frac{4x^{-3}y^2}{z^5}\right)^4 = \frac{256x^{-12}y^8}{z^{20}} = \frac{256y^8}{x^{12}z^{20}}$

$4 = 4 \times 4 \times 4 \times 4$

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Practice

1- Simplify  $\frac{x^2 y z^3}{x^{-2} y^{-1} z^2}$

2-  $\left(\frac{2x^2}{3y^3}\right)^2$

3-  $\frac{3y^2 z^5 (2x)^0}{2yz^3}$

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