

Part A: Knowledge

1. For each of the following expressions in the chart below,
 a) state which exponent law applies. Note that your choices are one of the following:
product rule, quotient rule, power of a power rule, or none of these laws
 b) write the expression as a power with a single, positive exponent, and
 c) Evaluate the expression

Expression	Exponent Law to Use (if any) See your choices above!	Simplified as a single power with one exponent	Evaluated (no decimals!)
$(2^3)^2$	power of a power ✓	$2^{3 \times 2} = 2^6$ ✓	64 ✓
$3^2 \times 3^4$	product rule ✓	$3^{2+4} = 3^6$ ✓	729 ✓
$\frac{(-6)^4}{(-6)^2}$	quotient rule ✓	$(-6)^{4-2} = (-6)^2$ ✓ <i>needs brackets</i>	36 ✓
$5^3 - 5^2$	none of these laws ✓	impossible / N/A or (accept 100 or 10^2) ✓	100 ✓

K 12

125-25

don't leave blank!

2. Write each expression as a single power. Do not evaluate!

a) $(-13)^3 \times (-13)^5$
 $= (-13)^8$

brackets necessary!

b) $(4n^2)^3$
 $= 4^3 n^{2 \times 3}$
 $= 64 n^6$

accept $4^3 n^6$

c) $6^a \div 6^b \times 6^c$
 $= 6^{a-b+c}$

d) $\frac{x^4}{x^{-3}}$
 $= x^{4-(-3)}$
 $= x^7$

e) $(8^3)^5 \div (8^6)^2$
 $= 8^{15} \div 8^{12}$
 $= 8^3$

Do not evaluate!

K 1, 1, 1

K 2, 2

3. Simplify and Evaluate. Do not use decimals! (final answers should be integers or reduced fractions.)

a) $(-12b)^0$
 $= 1$

7 is not part of the base!

b) $7x^0$
 $= 7(1)$
 $= 7$

c) $(-3)^3 \div (-3)^4 \times (-3)^{-2}$
 $= (-3)^{3-4+(-2)}$
 $= (-3)^{-3}$
 $= -\frac{1}{27}$

d) $\left(\frac{2}{5}\right)^3 = \frac{2^3}{5^3}$
 $= \frac{8}{125}$

e) $(2^{-1})^{-3}$
 $= 2^{(-1)(-3)}$
 $= 2^3$
 $= 8$

K 1, 1, 2

K 2, 2

4. Fully simplify:

a) $(2p^4) \times (3p)^3$
 $= 2p^4 \times 27p^3$
 $= 54p^7$

b) $\left(\frac{3}{5}\right)^2 \times \left(\frac{3}{5}\right)^4$
 $= \left(\frac{3}{5}\right)^{2+4}$
 $= \left(\frac{3}{5}\right)^6$
 $= \left(\frac{3}{5}\right)^{2+4-5}$
 $= \left(\frac{3}{5}\right)^1$
 $= \frac{3}{5}$
 simplify

c) $\frac{18m^9n^2}{9m^4n}$
 $= \frac{18}{9} m^{9-4} n^{2-1}$
 $= 2m^5n$
 not n!

A 2, 2, 2

$$d) \frac{-6s^5t^4(-4s^3t^{-1})}{2s^2t(3s^4t^{-2})}$$

A 4, 4

$$= \frac{(-6)(-4)}{(2)(3)} s^{5+3-2-4} t^{4+(-1)-1-(-2)}$$

$$= \frac{24}{6} s^2 t^4$$

$$= 4s^2 t^4$$

OR

$$= \frac{(-6)(4)}{(2)(3)} s^{5+3} t^{4+(-1)}$$

$$= \frac{24 s^8 t^3}{6 s^6 t^{-1}}$$

$$= \frac{24}{6} s^{8-6} t^{3-(-1)}$$

$$= 4s^2 t^4$$

$$e) \frac{4c^{-3}d \times (-3c^3d^2)^2}{6c^2d^2} = \frac{4c^{-3}d(9c^6d^4)}{6c^2d^2}$$

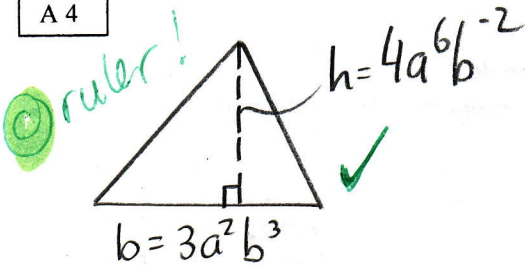
$$= \frac{(4)(9)}{(6)} c^{-3+6-2} d^{1+4-2}$$

$$= 6c^1d^3$$

$$= 6cd^3$$

5. A triangle has a base of $3a^2b^3$ and a height of $4a^6b^{-2}$. Find a simplified expression for the area of this triangle. Include a labeled drawing!

A 4



$$A_{TRI} = \frac{1}{2}bh$$

$$= \frac{1}{2}(3a^2b^3)(4a^6b^{-2})$$

$$= \left(\frac{1}{2}\right)(3)(4)a^{2+6}b^{3+(-2)}$$

$$= 6a^8b$$

let b rep. the base and
let h rep. the height

let

∴ Area is $6a^8b$ units squared

6. Given that $x = 3st^3$ and $y = 6s^2t^5$, then evaluate:

A 2, 3

a) $\frac{y}{x}$

$$= \frac{(6s^2t^5)}{(3st^3)}$$

brackets

$$= \frac{6}{3} s^{2-1} t^{5-3}$$

$$= 2st^2$$

b) $(xy)^2 = \left((3st^3)(6s^2t^5)\right)^2$

$$= (3 \times 6 s^{1+2} t^{3+5})^2$$

$$= (18s^3t^8)^2$$

$$= 18^2 s^{3 \times 2} t^{8 \times 2}$$

$$= 324s^6t^{16}$$

7. simplify: a) $\frac{2}{(-6)^{-2}}$

P 3, 3, 4

OR

$$= \frac{2}{\left(\frac{1}{-6}\right)^2} = 72$$

$$= \frac{2}{\left(\frac{1}{36}\right)}$$

$$= 2 \times \frac{36}{1}$$

$$= 2(-6)^2$$

$$= 2(36)$$

$$= 72$$

b) $2^{-3} + 3^{-1}$

$$= \frac{1}{2^3} + \frac{1}{3}$$

$$= \frac{1}{8} + \frac{1}{3}$$

$$= \frac{3}{24} + \frac{8}{24}$$

$$= \frac{11}{24}$$

c) $\frac{(-5x^{-3}y^3)(-2x^2y^{-5})}{x^{-1}y^5}$

$$= (-5)(-2) x^{-3+2-(-1)} y^{3+(-5)-5}$$

$$= 10 x^0 y^{-7}$$

$$= \frac{10(1)}{y^7} \text{ or } \frac{10}{y^7}$$

C 5

8. On a math quiz, Kendra made many mistakes simplifying this expression. Identify 3 errors where she used the exponent rules incorrectly, then show the correct simplification.

$$\frac{(-4a^2b)^3}{2a^6b^{-2}}$$

$$= -4a^6b^3$$

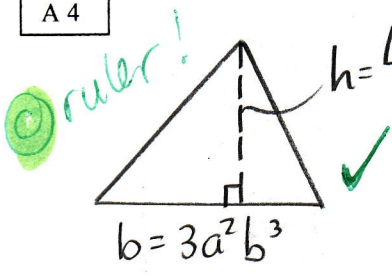
① she forgot power of a power...
"-4" is also part of the base
so it also needs to be cubed

corrected work:

$$\frac{(-4)^3 a^{2 \times 3} b^{1 \times 3}}{2a^6b^{-2}}$$

5. A triangle has a base of $3a^2b^3$ and a height of $4a^6b^{-2}$. Find a simplified expression for the area of this triangle. Include a labeled drawing!

A 4



$$A_{TRI} = \frac{1}{2}bh$$

$$= \frac{1}{2}(3a^2b^3)(4a^6b^{-2})$$

$$= \left(\frac{1}{2}\right)(3)(4)a^{2+6}b^{3+(-2)}$$

$$= 6a^8b$$

let b rep. the base and
let h rep. the height

let

∴ Area is $6a^8b$ units squared

6. Given that $x = 3st^3$ and $y = 6s^2t^5$, then evaluate:

A 2.3

a) $\frac{y}{x}$

$$= \frac{(6s^2t^5)}{(3st^3)}$$

brackets

$$= \frac{6}{3}s^{2-1}t^{5-3}$$

$$= 2st^2$$

b) $(xy)^2 = (3st^3)(6s^2t^5)^2$

$$= (3 \times 6s^{1+2}t^{3+5})^2$$

$$= (18s^3t^8)^2$$

$$= 18^2s^{3 \times 2}t^{8 \times 2}$$

$$= 324s^6t^{16}$$

7. simplify: a) $\frac{2}{(-6)^{-2}}$

b) $2^{-3} + 3^{-1}$

$$= \frac{1}{2^3} + \frac{1}{3}$$

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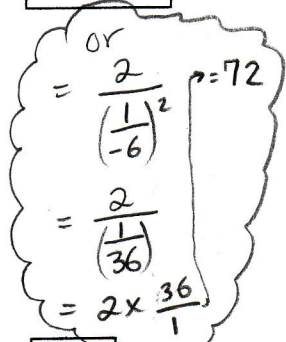
c) $\frac{(-5x^{-3}y^3)(-2x^2y^{-5})}{x^{-1}y^5}$

$$= (-5)(-2)x^{-3+2-(-1)}y^{3+(-5)-5}$$

$$= 10x^0y^{-7}$$

$$= \frac{10(1)}{y^7} \text{ or } \frac{10}{y^7}$$

P 3, 3, 4



or

$$= \frac{2}{\left(\frac{1}{-6}\right)^2} = 72$$

$$= \frac{2}{\left(\frac{1}{36}\right)}$$

$$= 2 \times \frac{36}{1}$$

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8. On a math quiz, Kendra made many mistakes simplifying this expression. Identify 3 errors where she used the exponent rules incorrectly, then show the correct simplification.

$$\frac{(-4a^2b)^3}{2a^6b^{-2}}$$

$$= \frac{-4a^6b^3}{2a^6b^{-2}}$$

$$= \frac{-4}{2} a^{6-6} b^{3-(-2)}$$

$$= -2(a^0 b^5)$$

- she forgot power of a power... "-4" is also part of the base so it also needs to be cubed
- confusion over quotient rule. She should subtract: $b^{3-(-2)}$
- mistake about zero exponent law. a^{6-6} is a^0 , which equals one.

corrected work:

$$\frac{(-4)^3 a^{2 \times 3} b^{1 \times 3}}{2a^6b^{-2}}$$

$$= \frac{-64a^6b^3}{2a^6b^{-2}}$$

$$= \frac{-64}{2} a^{6-6} b^{3-(-2)}$$

$$= -32a^0b^5$$

$$= -32b^5$$