

Name: KEY  
Date: \_\_\_\_\_

**Chapter 1 Group Problem Solving**

1) Let's start by investigating a negative sign on a fraction:

a) Answer each: i)  $-4 \div 2 = -2$  ii)  $4 \div -2 = -2$  iii)  $-(4 \div 2) = -2$   
 $-2$

b) What do you notice about the three answers? *They are all negative; all the same*

c) How would you write each of the division statements as a fraction?

i)  $\frac{-4}{2}$       ii)  $\frac{4}{-2}$       iii)  $-\frac{4}{2}$

d) Since all three fractions equal the same answer, what can you conclude about the position of a negative sign on a fraction?

*it doesn't matter where the negative sign is on a fraction.  
If there is one negative, the answer is negative*

**It is always a smart mathematical practice, no matter where a negative originates on a fraction, to move it to the numerator before proceeding.**

e) Answer each: i)  $4 \div 2 = 2$       ii)  $-4 \div -2 = 2$

f) What do you notice about the two answers? *they are the same*

g) How would you write each of the division statements as a fraction?

i)  $\frac{4}{2}$       ii)  $\frac{-4}{-2}$

h) Since both fraction statements equal the same answer, how could you simplify a fraction that has two negative signs on it? *get rid of them, because*

*dividing two negatives just equals a positive*

**It is always a smart mathematical practice to eliminate the negatives if there are two on the same fraction, as the fraction is positive.**

i) Simplify, then evaluate  $\left(-\frac{1}{3}\right)^4$ . Show all work very clearly and answer should be a fraction in lowest terms.

$$\left(\frac{-1}{3}\right)^4 = \frac{(-1)^4}{3^4} = \frac{1}{81}$$

2a) Simplify using exponent laws & answer as a single power, then evaluate:

$$\frac{(2^3)^2 \times (2^2)^2}{2^5 \times 2^3} = \frac{2^6 \times 2^4}{2^8} = \frac{2^{10}}{2^8} = 2^2 = 4$$

b) Now, answer the same question using expanded form (repeated multiplication) and cancelling:

$$\frac{2^3 \times 2^3 \times 2^2 \times 2^2}{2^5 \times 2^3} = \frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2} = 2^2 = 4$$

c) Are the two answers the same? Which method do you prefer and why?

Yes.

opinion

3) Simplify as a single power using exponent laws:  $\frac{x^2(x^5)}{(x^2)^3}$  Show all work clearly:

$$\frac{x^7}{x^6} = x^1 = x$$

4a) Evaluate as a single power using exponent laws. Your final answer should be a fraction in lowest terms:

$$\frac{4^5}{4^7} = 4^{5-7} = 4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

b) Complete the question using expanded form (repeated multiplication):

$$\frac{4^5}{4^7} = \frac{4 \times 4 \times 4 \times 4 \times 4}{4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4} = \frac{1}{4 \times 4} = \frac{1}{4^2} = \frac{1}{16}$$

c) Therefore, explain what a negative exponent represents in math:

A negative exponent means that extra bases are trapped in the denominator

5) Simplify using exponent laws (NO CALCULATOR), then evaluate:

$$\begin{aligned} & \left[ \frac{-(2 \times 3)^9}{(2^2)^4 \times (3^3)^3} \right]^4 = [-2 \times 1]^4 \\ & = \left[ \frac{-2^9 \times 3^9}{2^8 \times 3^9} \right]^4 = [-2]^4 \\ & = [-2^1 \times 3^0]^4 = 16 \end{aligned}$$

6) Simplify to a single power:  $[(-m)^2(-m)^{-5}]^3 \div [(-m)^3]^{-2}$       $-9 - (-6) = -9 + 6 = -3$

$$\begin{aligned} & [(-m)^{-3}]^3 \div (-m)^{-6} \quad (-m)^{-3} = \frac{1}{(-m)^3} \\ & (-m)^{-9} \div (-m)^{-6} \end{aligned}$$

7a) In 2008, 1.7 million (1 700 000) people in North America had a smart phone. Each year, smart phone owners have increased exponentially by **2.2 times** per year. How many people owned a smart phone in: 2009 3 740 000, 2010 8 228 000, 2011 18 101 600, 2012 39 823 520, 2013 87 611 744, 2014 192 745 836, 2015 424 040 841, 2016 932 889 850.

b) Can you develop an **exponential** formula for this exponential increase?

The formula will include:

- U for 'smart phone users'
- the initial amount of users (1.7 million)
- the amount of increase per year (2.2 times)
- the number of years since the initial amount (*n* years).

$$U = 1.7(2.2)^n$$

↑  
in millions

Test your formula to see if you get the same answers for each year as above. *yes*

c) If this trend continues, use your formula to estimate the number of smart phone owners in 2028:

$$U = 1.7(2.2)^{20} = 11\,992\,301\,480\,000$$

d) Do you think your estimate for 2028 will come true? Or do you think the trend will no longer continue? Explain: *Trend won't continue as there are only about 7 billion people on earth*

Use your smart phone to learn more about how exponents are used in the real world:

<http://passyworldofmathematics.com/exponents-in-the-real-world/>

