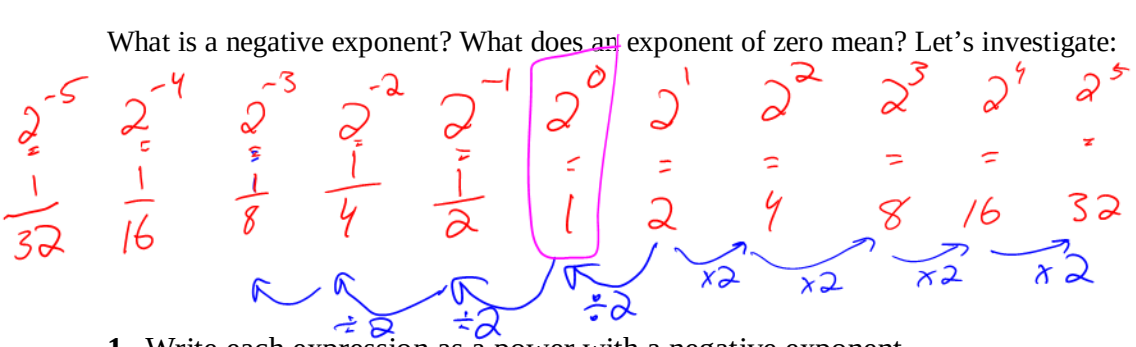
MBF3C Chapter 7 – Exponents **Name:** Mr. Hagen

7.2 Zero and Negative Exponents

Learning Goal: We are learning to work with negative exponents and the exponent zero.

What is a negative exponent? What does an exponent of zero mean? Let's investigate:



Negative exponents are reciprocals. ↓ Flip the number.

1. Write each expression as a power with a negative exponent.

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

c) $\frac{1}{9^8} = 9^{-8}$ **d)** $\frac{1}{8^2}$

Flipping the number gets rid of the negative.

2. Write each power as an expression with a positive exponent.

a) $3^{-4} = \frac{1}{3^4}$ **b)** 7^{-6}

c) $2^{-1} = \frac{1}{2^1}$ **d)** 5^{-6}

3. Evaluate. Express your answers as whole numbers or fractions.

a) $3^2 = 9$ $3^{-2} = \frac{1}{9}$ (since $\frac{1}{3^2} \rightarrow \frac{1}{9}$) **b)** 5^3 5^{-3}

c) 10^4 $10^{-4} = \frac{1}{10000}$ $= 10000$ **d)** $(-3)^3$ $(-3)^{-3}$

→ give a numerical answer.

4. Evaluate.

a) $(10)^{-2}$

$= \frac{1}{10^2}$

$= \frac{1}{100}$

b) $(4)^{-3}$

c) $\left(\frac{1}{4}\right)^{-4}$

$= \left(\frac{4}{1}\right)^4 = 256$

d) $\left(\frac{1}{3}\right)^{-3}$

5. Write each expression as a single power. Then, evaluate.

First use the exponent laws to simplify.

$\times \rightarrow +$

$\div \rightarrow -$

$(\ )^{\square} \rightarrow \times$

a) $8^4 \times 8^{-2}$

$= 8^{4+-2}$

$= 8^2 = 64$

b) $\frac{4^2}{4^3}$

Flip

$= 4^{-1}$

$= \frac{1}{4}$

c) $\left(\frac{1}{3}\right)^{-5} \times \left(\frac{1}{3}\right)^{7}$

$= \left(\frac{1}{3}\right)^2$

$= \frac{1}{9}$

d) $\frac{1}{(3^2)^2}$

e) $(2^{-5})^2$

$= 2^{-10}$

$= \frac{1}{2^{10}}$

$= 1024$

f) $\frac{5^4}{5^{-2}}$

g) $\left(\frac{1}{4}\right)^{-5}\left(\frac{1}{4}\right)^{3}$

$= \left(\frac{1}{4}\right)^{-2}$

$= 4^2 = 16$

h) $(-5)^4(-5)^{-2}$

i) $(4^{-3})^2$

j) $\left(-\frac{1}{3}\right)^{5}\left(-\frac{1}{3}\right)^{-7}$

6. A radioactive material decays by 2^{-1} of its original mass in 8 h. How much of a 200-mg sample would remain after

$= \frac{1}{2}$

a) 1 day? = 24h

Day 1
① 0–8 ⇒ 100 mg
② 8–16 ⇒ 50 mg
③ 16–24 ⇒ 25 mg

Day 2
④ 12.5 mg
⑤ 6.25 mg
⑥ 3.125 mg

Day 3
⑦ 1.5625 mg
⑧ 0.78125 mg
⑨ 0.39ish mg

b) 3 days?

7. Refer to question 6. Would the amount of radioactive material ever reach 0 mg? Explain.

Technically no. Whenever you cut something in half, half is left.

8. Use each indicated base to write each numerator and denominator as a power. Then, simplify. Express your answer as a power with a whole number base.

a) $\frac{625}{125}$ base 5

$= \frac{5^4}{5^3}$ subtract

$= 5$

b) $\frac{256}{16}$ base 4

c) $\frac{6561}{243}$ base 3

$= \frac{3^8}{3^5}$ subtract

$= 3^3 = 27$

d) $\frac{343}{49}$ base 7

9. Evaluate Any base to the power of zero equals one.

a) $7^0 = 1$

b) $(-10009)^0$

c) $(2x^4)^0 = 1$

d) $(17y - 19x + 5z)^0 = 1$

$(\text{anything})^0 = 1$

Success Criteria:

- I can rewrite a negative exponent as a positive exponent by using the reciprocal.
- I can understand that anything to the power of zero is equal to one.