

What's Going On?

Checking In

Minds on

Exponent Basics

Action!

Collaborating, Extremely

Consolidation

Exit Questions

**Learning Goal - I will review the exponent laws
I learned in Grade 11.**

Minds on

Exponent Basics

base exponent expanded form

$$\underbrace{2^5}_{\text{exponential form}} = \overbrace{2 \times 2 \times 2 \times 2 \times 2}^{\text{expanded form}} = \underset{\text{solution}}{32}$$

$$3^4 = 3 + 3 + 3 + 3$$

Action!

Collaborating, Extremely

$$3^3 \times 3^2 = 3^x$$

h Skibkik

$$x =$$

0

5
5
5

6
6

243
243
81
81

Action!

Collaborating, Extremely

$$3^4 \times 3^5 = 3^x$$

X =

9

9

9

9

9

9

9

9

Minor niner

9

9

9

20
20

Action!

Collaborating, Extremely

$$3^4 \times 3^1 = 3^x$$

X =

5

5

5

5

5

5

5

5

5

5

5

Five

4

4⁴

Action!

Collaborating, Extremely

The Product Rule

When **multiplying** two powers with the same base, **add the exponents**

$$\begin{aligned}3^7 \times 3^5 &= 3^{7+5} \\ &= 3^{12}\end{aligned}$$

Action!

Collaborating, Extremely

$$3^5 \div 3^2 = 3^x$$

X =

3

3

3

3

3

10

3

10

3

3

3

3

Action!

Collaborating, Extremely

$$3^8 \div 3^3 = 3^x$$

X =

5

5

5

5

5

5

5

5

5

5

Five and a five minus five

Five

5

Action!

Collaborating, Extremely

$$3^6 \div 3 = 3^x$$

X =

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

5

Five #genieus

Action!

Collaborating, Extremely

The Quotient Rule

When **dividing** two powers with the same base, **subtract the exponents**

$$3^7 \div 3^5 = 3^{7-5}$$
$$= 3^2$$

Handwritten diagram illustrating the quotient rule for exponents. It shows 3^7 divided by 3^5 . The numerator is written as $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$, with the last two 3s boxed. The denominator is written as $3 \times 3 \times 3 \times 3 \times 3$. Blue diagonal lines cross out the five 3s in both the numerator and denominator, leaving the boxed 3×3 in the numerator.

Action!

Collaborating, Extremely

$$(3^4)^2 = 3^x$$

x =

8

8

8

8

8

8?

8

8

8

8

8

Eight

Eight... i think

8

Action!

Collaborating, Extremely

$$(3^3)^4 = 3^x$$

X =

12

12

12 to the power of nothing!!

12

12

12

12

12

12 (joe)

12

12

12

Tw

Action!

Collaborating, Extremely

$$(3)^5 = 3^x$$

X =
5 joe
5
5
5
5
5
5
Five
5

Over 9000

Action!

Power of a Power

What is $(2^3)^2$?It is just 2^3 twice!

$$= (2^3) \times (2^3)$$

$$= (2^{3+3})$$

$$= 2^6$$

Action!

Power of a Power

What is $(2^3)^2$?It is just $2 \times 2 \times 2$ twice!

$$\begin{aligned} &= (2 \times 2 \times 2) \times (2 \times 2 \times 2) \\ &= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \\ &= 2^6 \end{aligned}$$

Action!

Collaborating, Extremely

The Power of a Power Rule

When **raising** a power to an exponent,
multiply the exponents

$$\begin{aligned}(3^4)^3 &= 3^{4 \times 3} \\ &= 3^{12}\end{aligned}$$

Action!

Collaborating, Extremely

$$5^0 = x$$

$$x =$$

Started from the top now we here 1

0 joe

0 0

0 0

0 0

11
11

Action!

Collaborating, Extremely

$$8^0 = x$$

x =
1
1
1
1
1
1
1 joe
1
1
1
1.
1

Action!

Collaborating, Extremely

$$a^0 = x$$

X =
1
1
1
\$1.00
1
1
Eh
1 joe

Action!

Zero Exponents

Anything to the exponent 0 equals 1

$$3^0 = 1$$

Action!

Zero Exponents

Let's take a look at this idea using the quotient rule and expanded form!

Quotient Rule $3^4 \div 3^4 = 3^0$

Expanded Form

$$3^4 \div 3^4 = \frac{\cancel{3} \times \cancel{3} \times \cancel{3} \times \cancel{3}}{\cancel{3} \times \cancel{3} \times \cancel{3} \times \cancel{3}}$$
$$\frac{3^4}{3^4}$$

Action!

What Do You Think?

If you entered 2^{-1} into your calculator (**don't do it!!**), what do you think you would get?

$$2^{-1} = 0.5$$

$$3^{-1} = 0.\overline{333}$$

$$4^{-1} = 0.25$$

$$2^{-2} = 0.25$$

$$10^{-2} = 0.01$$

$$2^2 \div 2^4 = 2^{-2}$$

$$\frac{\cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2} \times 2 \times 2} = \frac{1}{2^2}$$

$$3^2 \div 3^5 = 3^{-3}$$

$$\frac{\cancel{3 \times 3}}{\cancel{3} \times \cancel{3} \times 3 \times 3 \times 3} = \frac{1}{3^3}$$

$$= \frac{1}{27}$$

$$3^{-5} = \frac{1}{3^5} = \frac{1}{243}$$

Action!

Fill in the Blanks

Negative Exponents

When you have a negative exponent, move everything into the denominator and change the exponent's sign to positive.

$$3^{-4} = \frac{1}{3^4}$$

Action!

Negative Exponents

Let's take a look at this idea using the quotient rule and expanded form!

Quotient Rule $3^3 \div 3^5 = 3^{-2}$

Expanded Form $3^3 \div 3^5 = \frac{\cancel{3} + \cancel{3} + \cancel{3}}{\cancel{3} \times \cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{1}{3^2}$

Practice Questions

$$(3^7 \div 3^6) \times (3^2)^3$$

$$= 3^{7-6} \times 3^{2 \times 3}$$

$$= 3^1 \times 3^6$$

$$= 3^{1+6}$$

$$= 3^7$$

$$= 2187$$

$$(4^2 \times 4^5) \div (4^3)^3$$

$$= 4^{2+5} \div 4^{3 \times 3}$$

$$= 4^7 \div 4^9$$

$$= 4^{7-9}$$

$$= 4^{-2}$$

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

$$= \frac{1}{16}$$

$$= 0.0625$$

Consolidation

Assignment - Leave all Answers in
Power Form

a. $(6^8 \div 6^4)^3$

b. $(8^2 \times 8^3)^4 \times (8^6 \div 8^5)^2$

c. $(5^9 \div 5^4)^3 \times (5^5 \div 5^8)^2$

d. $(4^7 \div 4^3)^6 \div (4^3 \times 4^4)^2$

e. $(3^6 \times 3^{-3}) \div (3^3)^3$

f. $(7^9 \div 7^{10}) \div (7^{13} \div 7^{-5})^{-2}$