

4.2] Working with Integer Exponents

Laws of Exponents: (when the bases are the same)

1. Multiplying.

$$\underline{4}^3 \times \underline{4}^2 = (4 \times 4 \times 4) \times (4 \times 4) = 4^5$$

$$a^m \times a^n = a^{m+n}$$

Law: when multiplying exponents of the same base, add the exponents

2. Dividing:

$$\frac{5^6}{5^2} = \frac{\cancel{5 \times 5 \times 5 \times 5 \times 5 \times 5}}{\cancel{5 \times 5}} = 5^4$$

$$\frac{a^m}{a^n} = a^{m-n}$$

Law: When dividing exponents of the same
base, subtract the exponents.

3. Power:

$$(3^2)^4 = (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times (3 \times 3) = 3^8$$

Law: When raising to a power, multiply the
exponents.

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

4. Zero.

$$7^0 = 1$$

Why? $\rightarrow$

$$\frac{7^2}{7^2} = \frac{49}{49} = 1 \quad \leftarrow \quad 7^{2-2} = 7^0$$

$$(200^{1000000})^0 = 1$$

Law: Anything raised to the power of zero is 1.

5. Negatives.

$$4^3 = 64$$

$$4^2 = 16$$

$$4^1 = 4$$

$$4^0 = 1$$

$$4^{-3} = \frac{1}{\underbrace{4^3}} = \frac{1}{64}$$

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

$$4^{-1} =$$

$$\frac{1}{4}$$

$\div 4$

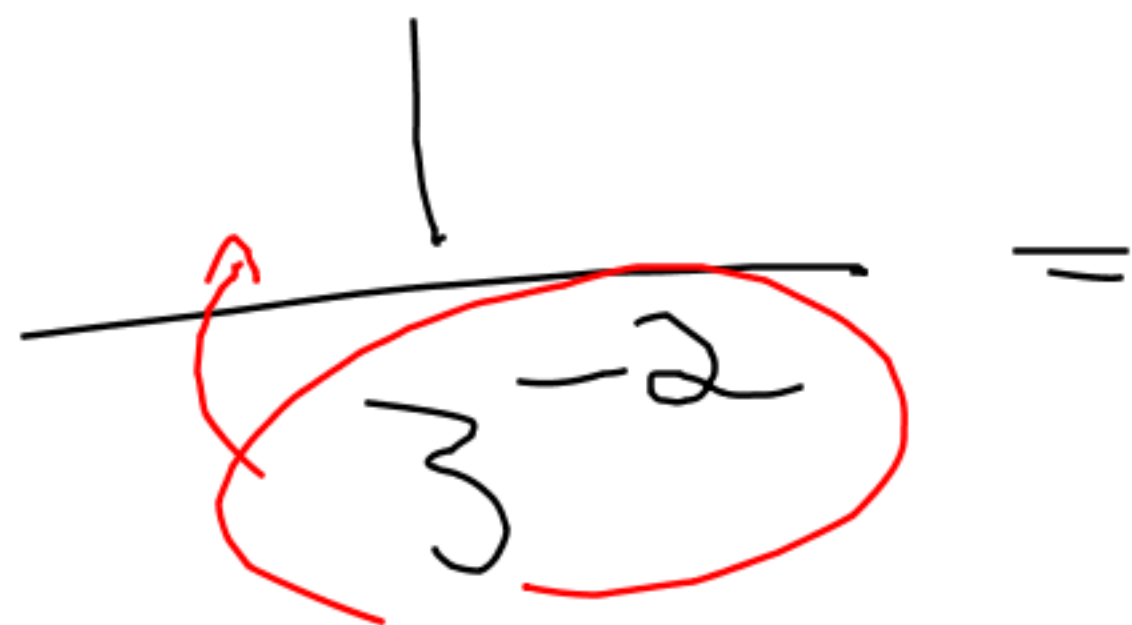
$\div 4$

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$\div 4$

Note:



A handwritten diagram showing a horizontal line. A red circle is drawn around the expression $3-2$. A red arrow points from the circle to the right. A vertical line segment is drawn above the circle, and a double equals sign is placed to the right of the circle.

$$3^2 = 9$$

Notes: - Always leave your answers with positive exponents.

- Simplify means to rewrite to 1 exponent

- Evaluate means to give a numerical answer.

Ex: Simplify, then evaluate.

$$\textcircled{1} \frac{(2^3)(2^4)}{2^2} = \frac{2^7}{2^2} = 2^5 = 32$$

$$\textcircled{2} \frac{(3^{-1})^3}{3^{-3}} = \frac{3^{-3}}{3^{-3}} = 3^{-3 - (-3)} = 3^{-3 + 3} = 3^0 = 1$$

$$\textcircled{3} \left[\frac{(4^6)(4^3)}{(4^2)(4^7)} \right]^{-2} = \left[\frac{4^9}{4^9} \right]^{-2} = (4^0)^{-2} = 4^0 = 1$$