

Intermediate Algebra
Skill-Builder # AE - 5
Applying the Negative Exponent Rule

Following is the negative exponent rule: For $a \neq 0$ and n a positive integer,

$$a^{-n} = \frac{1}{a^n} \quad (7)$$

Examples

$$1. \ 7^{-2} = \frac{1}{7^2} = \frac{1}{49}$$

$$2. \ \frac{1}{2^{-5}} = \frac{1}{\frac{1}{2^5}} = 1 \cdot \frac{2^5}{1} = 2^5 = 32$$

Note: $\frac{1}{2^{-5}} = \frac{2^5}{1} = 2^5$. Thus, $\frac{1}{a^{-n}} = a^n$.

$$3. \ \left(\frac{2}{3}\right)^{-3} = \frac{1}{\left(\frac{2}{3}\right)^3} = \frac{1}{\frac{2^3}{3^3}} = \frac{3^3}{2^3} = \frac{27}{8}$$

Note: $\left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3$. Thus, $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$.

$$4. \ x^{-3}y^2 = \frac{1}{x^3} \cdot y^2 = \frac{y^2}{x^3}$$

$$5. \ \frac{a^4}{b^{-2}} = a^4 \cdot \frac{1}{b^{-2}} = a^4b^2$$

$$6. \ \frac{x^2y^{-1}}{z^{-2}p^5} = \frac{x^2}{p^5} \cdot y^{-1} \cdot \frac{1}{z^{-2}} = \frac{x^2}{p^5} \cdot \frac{1}{y} \cdot z^2 = \frac{x^2z^2}{p^5y}$$

Note: Examples 4 – 6 show that

- when an expression is raised to a negative exponent and it is in the numerator, bring it down in the denominator and make the exponent positive.
- when an expression is raised to a negative and it is in the denominator, bring it up to the numerator and make the exponent positive.

This is NOT TRUE when the numerator and/or the denominator involves terms.

$$7. \ \frac{x^{-2} - 3^{-2}}{x^{-1} + 3^{-1}} \neq \frac{x^1 + 3^1}{x^2 - 3^2} \quad \text{This will be treated separately.}$$

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Simplify.

1. 5^{-3}

2. $\frac{1}{4^{-3}}$

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

4. $\left(\frac{3}{2}\right)^{-4}$

5. $2^{-3}a^4$

6. 3^3b^{-6}

7. $\frac{5^{-1}n}{2}$

8. $\frac{2w}{3^{-2}}$

9. $\frac{3^{-3}x^2y}{2^{-1}z^{-4}}$

10. $\frac{5a^{-3}bc^{-1}}{4^{-2}d^3}$

11. $\frac{-2y^4z^{-1}}{5^{-2}w^3}$

12. $\frac{-6^{-2}n^2y^{-4}}{x^{-2}z^{-3}}$

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Answers

1. $1/125$

2. 64

3. 81

4. $16/81$

5. $a^4/8$

6. $27/b^6$

7. $n/10$

8. $18w$

9. $2x^2yz^4/27$

10. $80b/a^3cd^3$

11. $-50y^4/w^3z$

12. $-n^2x^2z^3/36y^4$

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