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,

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

Examples

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

2. $\dfrac{1}{2^{-5}} = \dfrac{1}{\frac{1}{2^5}} = 1 \cdot \dfrac{2^5}{1} = 2^5 = 32$ 　　　　 **Note:** $\dfrac{1}{2^{-5}} = \dfrac{2^5}{1} = 2^5$. Thus, $\dfrac{1}{a^{-n}} = a^n$.

3. $\left(\dfrac{2}{3}\right)^{-3} = \dfrac{1}{\left(\frac{2}{3}\right)^3} = \dfrac{1}{\frac{2^3}{3^3}} = \dfrac{3^3}{2^3} = \dfrac{27}{8}$ 　　　 **Note:** $\left(\dfrac{2}{3}\right)^{-3} = \left(\dfrac{3}{2}\right)^3$. Thus, $\left(\dfrac{a}{b}\right)^{-n} = \left(\dfrac{b}{a}\right)^n$.

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

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

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

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. $\dfrac{x^{-2} - 3^{-2}}{x^{-1} + 3^{-1}} \neq \dfrac{x^1 + 3^1}{x^2 - 3^2}$ 　 This will be treated separately.

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Simplify.

1. 5^{-3}

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

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

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

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

6. $3^3 b^{-6}$

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

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

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

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

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

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

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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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