

Section 11-3:

Dividing Variables with Exponents

Objectives:

- **To divide variables that contain exponents.**
- **To explain what it means to "cancel."**

Ex 1:

$$\frac{3^5}{3^2} = \frac{\cancel{3} \cdot \cancel{3} \cdot 3 \cdot 3 \cdot 3}{\cancel{3} \cdot \cancel{3}} = \frac{3^3}{1} = 3^3 = 27$$

Ex 2:

$$\frac{x^3}{x^5} = \frac{\cancel{x} \cdot \cancel{x} \cdot \cancel{x}}{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot x \cdot x} = \frac{1}{x^2}$$

Rule: When dividing variables with exponents, subtract the exponents.

(Bases must match.)

Ex 3:

$$\frac{x^5}{x^3} = x^{5-3} = x^2$$

Ex 4:

$$\frac{\cancel{ab}}{\cancel{5a}} = \left(\frac{b}{5} \right)$$

Ex 5:

$$\frac{4x^4}{2x} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{x} \cdot \cancel{x} \cdot x \cdot x}{\cancel{2} \cdot \cancel{x}} = \frac{2x^3}{1} = \left(2x^3 \right)$$

Ex 6:

$$\frac{3^3}{3^0} = \frac{3 \cdot 3 \cdot 3}{1} = 27$$

$$3^{3-0} = 3^3 = 27$$

1. $\frac{2^5}{2^3} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}}$ (expanded form)

$= 2^2 = 4$ (actual value)

2. $\frac{x^4}{x^2} = \frac{\cancel{x} \cdot \cancel{x} \cdot x \cdot x}{\cancel{x} \cdot \cancel{x}}$ (expanded form)

$= x^2$ (actual value)

$$\begin{aligned} 3. \quad \frac{6a^4}{2a^2} &= \frac{\cancel{2} \cdot 3 \cdot \cancel{a} \cdot \cancel{a} \cdot a \cdot a}{\cancel{2} \cdot \cancel{a} \cdot \cancel{a}} \quad (\text{expanded form}) \\ &= 3a^2 \quad (\text{actual value}) \end{aligned}$$

$$\begin{aligned} 4. \quad \frac{4a^2b}{2ab^2} &= \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{a} \cdot a \cdot \cancel{b}}{\cancel{2} \cdot \cancel{a} \cdot b \cdot \cancel{b}} \quad (\text{expanded form}) \\ &= \frac{2a}{b} \quad (\text{actual value}) \end{aligned}$$

$$\begin{aligned} 5. \quad \frac{a^3}{a^7} &= \frac{\cancel{a} \cdot \cancel{a} \cdot \cancel{a}}{\cancel{a} \cdot \cancel{a} \cdot \cancel{a} \cdot a \cdot a \cdot a \cdot a} \\ &= \frac{1}{a^4} \end{aligned}$$

$$\begin{aligned} 6. \quad \frac{3^5}{3^3} &= \frac{\cancel{3} \cdot \cancel{3} \cdot \cancel{3} \cdot 3 \cdot 3}{\cancel{3} \cdot \cancel{3} \cdot \cancel{3}} \\ &= 9 \end{aligned}$$

$$7. \frac{9^2}{9^0} = \frac{9^2}{1} = 9^2 = 81$$

$$8. \frac{\cancel{5^2}}{\cancel{5^2}} = \frac{1}{1}$$

$$9. \frac{6a^5}{15a^3} = \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{a} \cdot \cancel{a} \cdot \cancel{a} \cdot a \cdot a}{\cancel{5} \cdot \cancel{3} \cdot \cancel{a} \cdot \cancel{a} \cdot \cancel{a}}$$
$$= \frac{2a^2}{5}$$

$$10. \frac{10b^4}{5b^3} = \frac{\cancel{2} \cdot \cancel{5} \cdot b \cdot b \cdot \cancel{b} \cdot b}{\cancel{5} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{b}}$$
$$= 2b$$