EXAMPLE 4 TAKS PRACTICE: Multiple Choice

What is the simplified form of $\frac{(x^{-2}y^3)^3}{x^4y^9}$?

Ⓐ x^2y Ⓑ $\frac{1}{x^{10}}$ Ⓒ $\frac{1}{x^2y}$ Ⓓ $\frac{1}{x^{10}y}$

Solution

$$\frac{(x^{-2}y^3)^3}{x^4y^9} = \frac{(x^{-2})^3(y^3)^3}{x^4y^9}$$ **Power of a product property**

$$= \frac{x^{-6}y^9}{x^4y^9}$$ **Power of a power property**

$$= x^{-6-4}y^{9-9}$$ **Quotient of powers property**

$$= x^{-10}y^0$$ **Simplify exponents.**

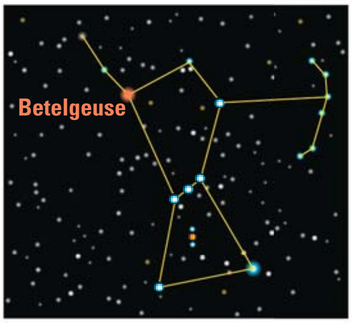
$$= x^{-10} \cdot 1$$ **Zero exponent property**

$$= \frac{1}{x^{10}}$$ **Negative exponent property**

▶ The correct answer is B. Ⓐ Ⓑ Ⓒ Ⓓ

EXAMPLE 5 Compare real-life volumes

ASTRONOMY Betelgeuse is one of the stars found in the constellation Orion. Its radius is about 1500 times the radius of the sun. How many times as great as the sun's volume is Betelgeuse's volume?



Solution

Let r represent the sun's radius. Then $1500r$ represents Betelgeuse's radius.

$$\frac{\text{Betelgeuse's volume}}{\text{Sun's volume}} = \frac{\frac{4}{3}\pi(1500r)^3}{\frac{4}{3}\pi r^3}$$ **The volume of a sphere is $\frac{4}{3}\pi r^3$.**

$$= \frac{\frac{4}{3}\pi 1500^3 r^3}{\frac{4}{3}\pi r^3}$$ **Power of a product property**

$$= 1500^3 r^0$$ **Quotient of powers property**

$$= 1500^3 \cdot 1$$ **Zero exponent property**

$$= 3{,}375{,}000{,}000$$ **Evaluate power.**

▶ Betelgeuse's volume is about 3.4 billion times as great as the sun's volume.