

**EXAMPLE 5** Solve a real-world problem

**ASTRONOMY** The luminosity (in watts) of a star is the total amount of energy emitted from the star per unit of time. The order of magnitude of the luminosity of the sun is  $10^{26}$  watts. The star Canopus is one of the brightest stars in the sky. The order of magnitude of the luminosity of Canopus is  $10^{30}$  watts. How many times more luminous is Canopus than the sun?



Canopus

**Solution**

$$\frac{\text{Luminosity of Canopus (watts)}}{\text{Luminosity of the sun (watts)}} = \frac{10^{30}}{10^{26}} = 10^{30-26} = 10^4$$

► Canopus is about  $10^4$  times as luminous as the sun.

**GUIDED PRACTICE** for Example 5

10. **WHAT IF?** Sirius is considered the brightest star in the sky. Sirius is less luminous than Canopus, but Sirius appears to be brighter because it is much closer to Earth. The order of magnitude of the luminosity of Sirius is  $10^{28}$  watts. How many times more luminous is Canopus than Sirius?

**8.2 EXERCISES****HOMEWORK KEY**

= **WORKED-OUT SOLUTIONS**  
on p. WS1 for Exs. 33 and 51

= **TAKS PRACTICE AND REASONING**  
Exs. 19, 37, 46, 54, and 55

= **MULTIPLE REPRESENTATIONS**  
Ex. 49

**SKILL PRACTICE**

- VOCABULARY** Copy and complete: In the power  $4^3$ , 4 is the ? and 3 is the ?.
- WRITING** Explain when and how to use the quotient of powers property.

**SIMPLIFYING EXPRESSIONS** Simplify the expression. Write your answer using exponents.

3.  $\frac{5^6}{5^2}$

4.  $\frac{2^{11}}{2^6}$

5.  $\frac{3^9}{3^5}$

6.  $\frac{(-6)^8}{(-6)^5}$

7.  $\frac{(-4)^7}{(-4)^4}$

8.  $\frac{(-12)^9}{(-12)^3}$

9.  $\frac{10^5 \cdot 10^5}{10^4}$

10.  $\frac{6^7 \cdot 6^4}{6^6}$

11.  $\left(\frac{1}{3}\right)^5$

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

13.  $\left(-\frac{5}{4}\right)^4$

14.  $\left(-\frac{2}{5}\right)^5$

15.  $7^9 \cdot \frac{1}{7^2}$

16.  $\frac{1}{9^5} \cdot 9^{11}$

17.  $\left(\frac{1}{3}\right)^4 \cdot 3^{12}$

18.  $4^9 \cdot \left(-\frac{1}{4}\right)^5$

**EXAMPLES 1 and 2**

on pp. 495–496  
for Exs. 3–20