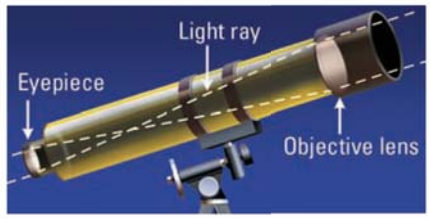
EXAMPLE 7 Use a logarithmic model

ASTRONOMY The *apparent magnitude* of a star is a measure of the brightness of the star as it appears to observers on Earth. The apparent magnitude M of the dimmest star that can be seen with a telescope is given by the function

$$M = 5 \log D + 2$$

where D is the diameter (in millimeters) of the telescope's objective lens. If a telescope can reveal stars with a magnitude of 12, what is the diameter of its objective lens?



ANOTHER WAY
For an alternative method for solving the problem in Example 7, turn to page 523 for the **Problem Solving Workshop**.

Solution

$M = 5 \log D + 2$	**Write original equation.**
$12 = 5 \log D + 2$	**Substitute 12 for *M*.**
$10 = 5 \log D$	**Subtract 2 from each side.**
$2 = \log D$	**Divide each side by 5.**
$10^2 = 10^{\log D}$	**Exponentiate each side using base 10.**
$100 = D$	**Simplify.**

▶ The diameter is 100 millimeters.

Animated Algebra at classzone.com

GUIDED PRACTICE for Example 7

11. WHAT IF? Use the information from Example 7 to find the diameter of the objective lens of a telescope that can reveal stars with a magnitude of 7.

7.6 EXERCISES

HOMEWORK KEY
- ○ = **WORKED-OUT SOLUTIONS** on p. WS1 for Exs. 15, 35, and 57
- = **TAKS PRACTICE AND REASONING** Exs. 44, 47, 58, 60, 62, and 63
- = **MULTIPLE REPRESENTATIONS** Ex. 59

SKILL PRACTICE

1. VOCABULARY Copy and complete: The equation $5^x = 8$ is an example of a(n) ? equation.

2. WRITING When do logarithmic equations have extraneous solutions?

EXAMPLE 1
on p. 515
for Exs. 3–11

SOLVING EXPONENTIAL EQUATIONS **Solve the equation.**

3. $5^{x-4} = 25^{x-6}$

4. $7^{3x+4} = 49^{2x+1}$

5. $8^{x-1} = 32^{3x-2}$

6. $27^{4x-1} = 9^{3x+8}$

7. $4^{2x-5} = 64^{3x}$

8. $3^{3x-7} = 81^{12-3x}$

9. $36^{5x+2} = \left(\frac{1}{6}\right)^{11-x}$

10. $10^{3x-10} = \left(\frac{1}{100}\right)^{6x-1}$

11. $25^{10x+8} = \left(\frac{1}{125}\right)^{4-2x}$