EXAMPLE 4 Solve equations using *n*th roots

Solve the equation.

a. $4x^5 = 128$

$x^5 = 32$ Divide each side by 4.

$x = \sqrt[5]{32}$ Take fifth root of each side.

$x = 2$ Simplify.

b. $(x - 3)^4 = 21$

AVOID ERRORS
When n is even and $a > 0$, be sure to consider both the positive and negative nth roots of a.

$x - 3 = \pm\sqrt[4]{21}$ Take fourth roots of each side.

$x = \pm\sqrt[4]{21} + 3$ Add 3 to each side.

$x = \sqrt[4]{21} + 3$ or $x = -\sqrt[4]{21} + 3$ Write solutions separately.

$x \approx 5.14$ or $x \approx 0.86$ Use a calculator.

EXAMPLE 5 Use *n*th roots in problem solving

BIOLOGY A study determined that the weight w (in grams) of coral cod near Palawan Island, Philippines, can be approximated using the model

$$w = 0.0167\ell^3$$

where ℓ is the coral cod's length (in centimeters). Estimate the length of a coral cod that weighs 200 grams.

Solution

$w = 0.0167\ell^3$ Write model for weight.

$200 = 0.0167\ell^3$ Substitute 200 for w.

$11{,}976 \approx \ell^3$ Divide each side by 0.0167.

$\sqrt[3]{11{,}976} \approx \ell$ Take cube root of each side.

$22.9 \approx \ell$ Use a calculator.

▶ A coral cod that weighs 200 grams is about 23 centimeters long.

GUIDED PRACTICE for Examples 4 and 5

Solve the equation. Round the result to two decimal places when appropriate.

13. $x^3 = 64$

14. $\frac{1}{2}x^5 = 512$

15. $3x^2 = 108$

16. $\frac{1}{4}x^3 = 2$

17. $(x - 2)^3 = -14$

18. $(x + 5)^4 = 16$

19. WHAT IF? Use the information from Example 5 to estimate the length of a coral cod that has the given weight.

a. 275 grams **b.** 340 grams **c.** 450 grams