

Exercises

A

3. Evaluate each power without using a calculator.

- a) $16^{\frac{1}{2}}$ b) $36^{\frac{1}{2}}$ c) $64^{\frac{1}{3}}$
 d) $32^{\frac{1}{5}}$ e) $(-27)^{\frac{1}{3}}$ f) $(-1000)^{\frac{1}{3}}$

4. Evaluate each power without using a calculator.

- a) $100^{0.5}$ b) $81^{0.25}$
 c) $1024^{0.2}$ d) $(-32)^{0.2}$

5. Write each power as a radical.

- a) $36^{\frac{1}{3}}$ b) $48^{\frac{1}{2}}$ c) $(-30)^{\frac{1}{5}}$

6. Write each radical as a power.

- a) $\sqrt{39}$ b) $\sqrt[4]{90}$
 c) $\sqrt[3]{29}$ d) $\sqrt[5]{100}$

7. Evaluate each power without using a calculator.

- a) 8^0 b) $8^{\frac{1}{3}}$ c) $8^{\frac{1}{2}}$
 d) $8^{\frac{3}{4}}$ e) $8^{\frac{4}{3}}$ f) $8^{\frac{5}{3}}$

B

8. Write each power as a radical.

- a) $4^{\frac{2}{3}}$ b) $(-10)^{\frac{3}{5}}$ c) $2.3^{\frac{3}{2}}$

9. A cube has a volume of 350 cm^3 . Write the edge length of the cube as a radical and as a power.

10. Write each power as a radical.

- a) $48^{\frac{2}{3}}$ b) $(-1.8)^{\frac{5}{3}}$ c) $\left(\frac{3}{8}\right)^{2.5}$
 d) $0.75^{0.75}$ e) $\left(-\frac{5}{9}\right)^{\frac{2}{5}}$ f) $1.25^{1.5}$

11. Write each radical as a power.

- a) $\sqrt{3.8^3}$ b) $(\sqrt[3]{-1.5})^2$ c) $\sqrt[4]{\left(\frac{9}{5}\right)^5}$
 d) $\sqrt[3]{\left(\frac{3}{8}\right)^4}$ e) $\left(\sqrt{\frac{5}{4}}\right)^3$ f) $\sqrt[5]{(-2.5)^3}$

12. Evaluate each power without using a calculator.

- a) $9^{\frac{3}{2}}$ b) $\left(\frac{27}{8}\right)^{\frac{2}{3}}$ c) $(-27)^{\frac{2}{3}}$
 d) $0.36^{1.5}$ e) $(-64)^{\frac{2}{3}}$ f) $\left(\frac{4}{25}\right)^{\frac{3}{2}}$

13. Write an equivalent form for each number

using a power with exponent $\frac{1}{2}$, then write the answer as a radical.

- a) 2 b) 4 c) 10 d) 3 e) 5

14. Write an equivalent form for each number

using a power with exponent $\frac{1}{3}$, then write the answer as a radical.

- a) -1 b) 2 c) 3 d) -4 e) 4

15. Arrange these numbers in order from least to greatest. Describe your strategy.

$$\sqrt[3]{4}, 4^{\frac{3}{2}}, 4^2, \left(\frac{1}{4}\right)^{\frac{3}{2}}$$

16. a) Evaluate.

- i) $16^{1.5}$ ii) $81^{0.75}$
 iii) $(-32)^{0.8}$ iv) $35^{0.5}$
 v) $1.21^{1.5}$ vi) $\left(\frac{3}{4}\right)^{0.6}$

b) Which powers in part a could you have evaluated without a calculator? How can you tell before you evaluate?

17. The height, h metres, of a certain species of fir tree can be estimated from the formula

$h = 35d^{\frac{2}{3}}$, where d metres is the diameter at the base. Use the formula to determine the approximate height of a fir tree with base diameter 3.2 m.

18. Here is a student's solution for evaluating a power.

$$\begin{aligned} 1.96^{\frac{3}{2}} &= (\sqrt[3]{1.96})^2 \\ &= (1.2514\dots)^2 \\ &= 1.5661\dots \end{aligned}$$

Identify the errors the student made. Write a correct solution.

19. A formula for the approximate surface area, SA square metres, of a person's body is $SA = 0.096m^{0.7}$, where m is the person's mass in kilograms. Calculate the surface area of a child with mass 40 kg.

20. Here is an expression for the percent of caffeine that remains in your body n hours after you drink a caffeine beverage:

$$100(0.5)^{\frac{n}{5}}$$

- a) Show that this expression and the expression on page 222 give the same result, to the nearest whole number, for the percent of caffeine that remains after $\frac{1}{2}$ h.
 b) Use the expression above to determine the percent of caffeine that remains after 1.5 h.
 c) After how many hours does 50% of the caffeine remain? Explain how you know.

KEY

3. a) 4
 c) 4
 e) -3
 4. a) 10
 c) 4
 5. a) $\sqrt[3]{36}$
 c) $\sqrt[3]{-30}$
 6. a) $39^{\frac{1}{2}}$
 c) $29^{\frac{1}{3}}$
 7. a) 1
 c) 4
 e) 16
 8. a) $\sqrt[3]{4^2}$, or $(\sqrt[3]{4})^2$
 b) $\sqrt[3]{(-10)^3}$, or $(\sqrt[3]{-10})^3$
 c) $\sqrt{2 \cdot 3^3}$, or $(\sqrt{2 \cdot 3})^3$
 9. $\sqrt[3]{350}$ cm, $350^{\frac{1}{3}}$ cm
 10. a) $\sqrt[3]{48^2}$, or $(\sqrt[3]{48})^2$
 b) $\sqrt[3]{(-1.8)^5}$, or $(\sqrt[3]{-1.8})^5$
 c) $\sqrt{\left(\frac{3}{8}\right)^5}$, or $\left(\sqrt{\frac{3}{8}}\right)^5$
 d) $\sqrt[4]{0.75^3}$, or $(\sqrt[4]{0.75})^3$
 e) $\sqrt[3]{\left(-\frac{5}{9}\right)^2}$, or $\left(\sqrt[3]{-\frac{5}{9}}\right)^2$
 f) $\sqrt{1.25^3}$, or $(\sqrt{1.25})^3$

- b) 6
 d) 2
 f) -10
 b) 3
 d) -2
 b) $\sqrt{48}$
 b) $90^{\frac{1}{4}}$
 d) $100^{\frac{1}{5}}$
 b) 2
 d) 8
 f) 32

11. a) $3.8^{\frac{1}{2}}$, or $3.8^{\frac{1}{2}}$
 c) $\left(\frac{9}{5}\right)^{\frac{5}{4}}$, or $\left(\frac{9}{5}\right)^{1.25}$
 e) $\left(\frac{5}{4}\right)^{\frac{3}{2}}$, or $\left(\frac{5}{4}\right)^{1.5}$
 12. a) 27
 c) 9
 e) 16
 13. a) $4^{\frac{1}{2}}$, $\sqrt{4}$
 c) $100^{\frac{1}{2}}$, $\sqrt{100}$
 e) $25^{\frac{1}{2}}$, $\sqrt{25}$
 14. a) $(-1)^{\frac{1}{3}}$, $\sqrt[3]{-1}$
 c) $27^{\frac{1}{3}}$, $\sqrt[3]{27}$
 e) $64^{\frac{1}{3}}$, $\sqrt[3]{64}$
 15. $\left(\frac{1}{4}\right)^{\frac{3}{2}}$, $\sqrt[3]{4}$, $4^{\frac{3}{2}}$, 4^2
 16. a) i) 64
 iii) 16
 v) 1.331
 b) i, ii, iii, v
 17. Approximately 76 m
 18. 2.744
 19. Approximately 1.3 m²
 b) $(-1.5)^{\frac{2}{3}}$
 d) $\left(\frac{3}{8}\right)^{\frac{4}{3}}$
 f) $(-2.5)^{\frac{1}{5}}$, or $(-2.5)^{0.2}$
 b) $\frac{9}{4}$
 d) 0.216
 f) $\frac{8}{125}$
 b) $16^{\frac{1}{2}}$, $\sqrt{16}$
 d) $9^{\frac{1}{2}}$, $\sqrt{9}$
 b) $8^{\frac{1}{3}}$, $\sqrt[3]{8}$
 d) $(-64)^{\frac{1}{3}}$, $\sqrt[3]{-64}$
 ii) 27
 iv) 5.9160...
 vi) 0.8414...