

Discuss the Ideas

- When a is a rational number and n is a natural number, what does a^n represent?
- When a is a rational number and m and n are natural numbers, what does $a^{\frac{m}{n}}$ represent?

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) $8^{\frac{2}{3}}$
 d) $8^{\frac{3}{3}}$ 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.

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

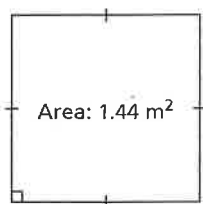
16. a) Evaluate.

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

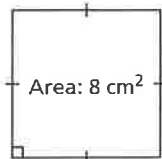
- b) Which powers in part a could you have evaluated without a calculator? How can you tell before you evaluate?

8. Areas of squares may vary. For example:

a)



b)



9. a) $3\sqrt{5}$ b) $2\sqrt[3]{12}$
 c) Cannot be simplified d) $2\sqrt[4]{3}$
 e) $2\sqrt[3]{10}$ f) Cannot be simplified
11. a) $\sqrt{63}$ b) $\sqrt[3]{32}$
 c) $\sqrt{147}$ d) $\sqrt[4]{192}$
 e) $\sqrt[3]{270}$ f) $\sqrt{396}$

4.4 Fractional Exponents and Radicals, page 227

3. a) 4 b) 6
 c) 4 d) 2
 e) -3 f) -10
4. a) 10 b) 3
 c) 4 d) -2
5. a) $\sqrt[3]{36}$ b) $\sqrt{48}$
 c) $\sqrt[3]{-30}$
6. a) $39^{\frac{1}{2}}$ b) $90^{\frac{1}{4}}$
 c) $29^{\frac{1}{3}}$ d) $100^{\frac{1}{5}}$
7. a) 1 b) 2
 c) 4 d) 8
 e) 16 f) 32
8. a) $\sqrt[3]{4^2}$, or $(\sqrt[3]{4})^2$
 b) $\sqrt[5]{(-10)^3}$, or $(\sqrt[5]{-10})^3$
 c) $\sqrt{2.3^3}$, or $(\sqrt{2.3})^3$
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) $\sqrt[5]{\left(\frac{-5}{9}\right)^2}$, or $\left(\sqrt[5]{\frac{-5}{9}}\right)^2$
 f) $\sqrt{1.25^3}$, or $(\sqrt{1.25})^3$
11. a) $3.8^{\frac{3}{2}}$, or $3.8^{1.5}$ b) $(-1.5)^{\frac{2}{3}}$
 c) $\left(\frac{9}{5}\right)^{\frac{5}{4}}$, or $\left(\frac{9}{5}\right)^{1.25}$ d) $\left(\frac{3}{8}\right)^{\frac{4}{3}}$
 e) $\left(\frac{5}{4}\right)^{\frac{3}{2}}$, or $\left(\frac{5}{4}\right)^{1.5}$ f) $(-2.5)^{\frac{3}{3}}$, or $(-2.5)^{0.6}$
12. a) 27 b) $\frac{9}{4}$
 c) 9 d) 0.216
 e) 16 f) $\frac{8}{125}$
13. a) $4^{\frac{1}{2}}$, $\sqrt{4}$ b) $16^{\frac{1}{2}}$, $\sqrt{16}$
 c) $100^{\frac{1}{2}}$, $\sqrt{100}$ d) $9^{\frac{1}{2}}$, $\sqrt{9}$
 e) $25^{\frac{1}{2}}$, $\sqrt{25}$
14. a) $(-1)^{\frac{1}{3}}$, $\sqrt[3]{-1}$ b) $8^{\frac{1}{3}}$, $\sqrt[3]{8}$
 c) $27^{\frac{1}{3}}$, $\sqrt[3]{27}$ d) $(-64)^{\frac{1}{3}}$, $\sqrt[3]{-64}$
 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 ii) 27
 iii) 16 iv) 5.9160...
 v) 1.331 v) 0.8414...
17. Approximately 76 m
18. 2.744
19. Approximately 1.3 m²