CHECK Your Understanding

1. Write in radical form. Then evaluate without using a calculator.

a) $49^{\frac{1}{2}}$ **c)** $(-125)^{\frac{1}{3}}$ **e)** $81^{\frac{1}{4}}$

b) $100^{\frac{1}{2}}$ **d)** $16^{0.25}$ **f)** $-(144)^{0.5}$

2. Write in exponent form, then evaluate. Express answers in rational form.

a) $\sqrt[9]{512}$ **c)** $\sqrt[3]{27^2}$ **e)** $\sqrt[5]{\frac{-32}{243}}$

b) $\sqrt[3]{-27}$ **d)** $(\sqrt[3]{-216})^5$ **f)** $\sqrt[4]{\left(\frac{16}{81}\right)^{-1}}$

3. Write as a single power.

a) $8^{\frac{2}{3}}(8^{\frac{1}{3}})$ **d)** $(7^{\frac{5}{6}})^{-\frac{6}{5}}$

b) $8^{\frac{2}{3}} \div 8^{\frac{1}{3}}$ **e)** $\frac{9^{\frac{-1}{5}}}{9^{\frac{2}{3}}}$

c) $(-11)^2(-11)^{\frac{3}{4}}$ **f)** $10^{-\frac{4}{5}}(10^{\frac{1}{15}}) \div 10^{\frac{2}{3}}$

PRACTISING

4. Write as a single power, then evaluate. Express answers in rational form.

a) $\sqrt{5}\sqrt{5}$ **b)** $\frac{\sqrt[3]{-16}}{\sqrt[3]{2}}$ **c)** $\frac{\sqrt{28}\sqrt{4}}{\sqrt{7}}$ **d)** $\frac{\sqrt[4]{18}\,(\sqrt[4]{9})}{\sqrt[4]{2}}$

5. Evaluate.

a) $49^{\frac{1}{2}} + 16^{\frac{1}{2}}$ **d)** $128^{-\frac{5}{7}} - 16^{0.75}$

b) $27^{\frac{2}{3}} - 81^{\frac{3}{4}}$ **e)** $16^{\frac{3}{2}} + 16^{-0.5} + 8 - 27^{\frac{2}{3}}$

c) $16^{\frac{3}{4}} + 16^{\frac{3}{4}} - 81^{-\frac{1}{4}}$ **f)** $81^{\frac{1}{2}} + \sqrt[3]{8} - 32^{\frac{4}{5}} + 16^{\frac{3}{4}}$

6. Write as a single power, then evaluate. Express answers in rational form.

a) $4^{\frac{1}{5}}(4^{0.3})$ **c)** $\frac{64^{\frac{4}{3}}}{64}$ **e)** $\frac{(16^{-2.5})^{-0.2}}{16^{\frac{3}{4}}}$

b) $100^{0.2}(100^{\frac{-7}{10}})$ **d)** $\frac{27^{-1}}{27^{\frac{-2}{3}}}$ **f)** $\frac{(8^{-2})(8^{2.5})}{(8^6)^{-0.25}}$

7. Predict the order of these six expressions in terms of value from lowest to highest. Check your answers with your calculator. Express answers to three decimal places.

a) $\sqrt[4]{623}$ **c)** $\sqrt[10]{10.24}$ **e)** $17.5^{\frac{5}{8}}$

b) $125^{\frac{2}{5}}$ **d)** $80.9^{\frac{1}{4}}$ **f)** $21.4^{\frac{3}{2}}$

8. The volume of a cube is 0.015 625 m^3. Determine the length of each side.

A

9. Use your calculator to determine the values of $27^{\frac{4}{3}}$ and $27^{1.3333}$. Compare the two answers. What do you notice?

10. Explain why $(-100)^{0.2}$ is possible to evaluate while $(-100)^{0.5}$ is not.

C

11. Write $125^{\frac{-2}{3}}$ in radical form, then evaluate. Explain each of your steps.

K

12. Evaluate.

a) $-256^{0.375}$

b) $15.625^{\frac{4}{3}}$

c) $\sqrt[3]{-0.027^4}$

d) $(-3.375)^{\frac{2}{3}}$

e) $\sqrt[4]{(0.0016)^3}$

f) $(-7776)^{1.6}$

13. The power 4^3 means that 4 is multiplied by itself three times. Explain the meaning of $4^{2.5}$.

14. State whether each expression is true or false.

a) $9^{\frac{1}{2}} + 4^{\frac{1}{2}} = (9 + 4)^{\frac{1}{2}}$

b) $9^{\frac{1}{2}} + 4^{\frac{1}{2}} = (9 \times 4)^{\frac{1}{2}}$

c) $\left(\frac{1}{a} + \frac{1}{b}\right)^{-1} = a + b$

d) $\left(\frac{1}{a} \times \frac{1}{b}\right)^{-1} = ab$

e) $\left(x^{\frac{1}{3}} + y^{\frac{1}{3}}\right)^6 = x^2 + y^2$

f) $\left[\left(x^{\frac{1}{3}}\right)\left(y^{\frac{1}{3}}\right)\right]^6 = x^2y^2$

15. **a)** What are some values of m and n that would make $(-2)^{\frac{m}{n}}$ undefined?

T **b)** What are some values of m and n that would make $(6)^{\frac{m}{n}}$ undefined?

Extending

16. Given that $x^y = y^x$, what could x and y be? Is there a way to find the answer graphically?

17. Mary must solve the equation $1.225 = (1 + i)^{12}$ to determine the value of each dollar she invested for a year at the interest rate i per year. Her friend Bindu suggests that she begin by taking the 12th root of each side of the equation. Will this work? Try it and solve for the variable i. Explain why it does or does not work.

18. Solve.

a) $\left(\frac{1}{16}\right)^{\frac{1}{4}} - \sqrt[3]{\frac{8}{27}} = \sqrt{x^2}$

b) $\sqrt[3]{\frac{1}{8}} - \sqrt[4]{x^4} + 15 = \sqrt[4]{16}$