

Solutions

Page 230 #s 2aceg, 3bc, 6ab,
7cde, 8, 10, 14cd, 16, 19

2. State the value that should be placed in each box.

a) $(2^3)^5 = 2^{\square}$

$$= 3 \times 5$$

$$= 15$$

c) $(3^4)^6 = \square^{24}$

$$4 \times 6 = 24$$

\Rightarrow

$$\text{Base} = 3$$

2. State the value that should be placed in each box.

$$\text{e) } (xy)^4 = x^4y^{\square}$$

$$= 1 \times 4$$

$$= 4$$

$$\text{g) } \left(\frac{5}{6}\right)^7 = \frac{5^7}{6^{\square}}$$

$$= 1 \times 7$$

$$= 7$$

3. State the value that should be placed in each box.

$$\text{b) } (35x^4y^6)^2 = 1225x^{\square}y^{12} \quad \text{c) } \left(\frac{x^8}{y^3}\right)^4 = \frac{x^{\square}}{y^{12}}$$

$$= 4 \times 2$$

$$= 8$$

$$= 8 \times 4$$

$$= 32$$

6. State whether the two expressions are equivalent or not equivalent.

a) $(x^6)^2$ and $(x^3)^4$

$$6 \times 2 = 12$$

$$3 \times 4 = 12$$

\Rightarrow Yes, they are equivalent

b) $(x^2y^4)^4$ and $(xy^2)^8$

$$2 \times 4 = 8$$

$$4 \times 4 = 16$$

$$1 \times 8 = 8$$

$$2 \times 8 = 16$$

\Rightarrow Yes, they are equivalent

7. Use at least one exponent rule to find an equivalent/simplified expression and then evaluate for $x = -1$ and $y = 2$.

c) $(x^2y)^2$ d) $\left(\frac{x^5}{y^3}\right)^2$ e) $\left(\frac{4}{y^2}\right)^3$

$$= x^{2 \times 2} y^{1 \times 2}$$

$$= x^4 y^2$$

$$\Rightarrow (-1)^4 (2)^2$$

$$= (1)(4)$$

$$= 4$$

$$= \frac{x^{5 \times 2}}{y^{3 \times 2}}$$

$$= \frac{x^{10}}{y^6}$$

$$\Rightarrow \frac{(-1)^{10}}{(2)^6}$$

$$= \frac{1}{64}$$

$$= \frac{4^{1 \times 3}}{y^{2 \times 3}}$$

$$= \frac{4^3}{y^6}$$

$$= \frac{64}{y^6}$$

$$\Rightarrow \frac{64}{(2)^6}$$

$$= \frac{64}{64} = 1$$

8. Express 4^3 as a power with a base of 2.

$$\begin{aligned} 4^3 &= (2^2)^3 \\ &= 2^{2 \times 3} \\ &= 2^6 \end{aligned}$$

10. Express 27^2 as a power with a base of 3.

$$\begin{aligned} 27^2 &= (3^3)^2 \\ &= 3^{3 \times 2} \\ &= 3^6 \end{aligned}$$

14. Write as a single power and then evaluate. Express all answers in exact form.

$$\begin{aligned} &\text{c) } (4^{-1})^{-3} \\ &= 4^{(-1) \times (-3)} \\ &= 4^3 \\ \Rightarrow &= 64 \end{aligned}$$

$$\begin{aligned} &\text{d) } [(-2)^2]^{-4} \\ &= (-2)^{2 \times (-4)} \\ &= (-2)^{-8} \\ \Rightarrow &\left(\frac{1}{-2}\right)^8 \\ &= \frac{1^8}{(-2)^8} \\ &= \frac{1}{256} \end{aligned}$$

16. Simplify $\left(\left(\left(m^2n^3\right)^2\right)^4\right)^5$.

$$\begin{aligned}
 &= \left(\left(m^{2 \times 2} n^{3 \times 2}\right)^4\right)^5 \\
 &= \left(\left(m^4 n^6\right)^4\right)^5 \\
 &= \left(m^{4 \times 4} n^{6 \times 4}\right)^5 \\
 &= \left(m^{16} n^{24}\right)^5 \\
 &= \left(m^{16 \times 5} n^{24 \times 5}\right) \\
 &= m^{80} n^{120}
 \end{aligned}$$

19. A cube has a side length of x^4 cm.

- Express the volume of the cube as a power of a power.
- Express the volume of the cube in simplified form.
- Determine an expression for the surface area of the cube in simplified form.

$$\text{Vol} = \text{length} \times \text{width} \times \text{height}$$

$$\begin{aligned}
 \text{a) Vol} &= x^4 \times x^4 \times x^4 \\
 &= (x^4)^3 \text{ cm}^3
 \end{aligned}$$

$$\begin{aligned}
 \text{b) Vol} &= (x^4)^3 \\
 &= x^{4 \times 3} \\
 &= x^{12} \text{ cm}^3
 \end{aligned}$$

$$\begin{aligned}
 \text{c) Surface} \\
 \text{area} &= 6 (\text{area} \\
 &\text{of one face}) \\
 &= 6 (x^4)(x^4) \\
 &= 6x^8 \text{ cm}^2
 \end{aligned}$$