Solutions

2.1

(a) add the powers: $7^{5+2} = \mathbf{7^7}$

(b) subtract the powers: $x^{9-4} = \boldsymbol{x^5}$

(c) multiply the powers: $y^{3\times4} = \boldsymbol{y^{12}}$

2.2

(a) any non-zero number to the power 0 is 1: **1**

(b) $2^{-3} = \dfrac{1}{2^3} = \mathbf{\dfrac{1}{8}}$

2.3

(a) $\mathbf{4.3 \times 10^5}$

(b) the point moves 5 places right to make 5.2: $\mathbf{5.2 \times 10^{-5}}$

2.4

- negative power: move the point 4 places left: **0.000306**

2.5

- $5 \times 7 = 35$ and $10^{3+(-8)} = 10^{-5}$: 35×10^{-5}
- re-normalise: $35 = 3.5 \times 10^1$, so $\mathbf{3.5 \times 10^{-4}}$

2.6

(a) $16^{\frac{1}{2}} = \sqrt{16} = \mathbf{4}$

(b) cube root first: $8^{\frac{2}{3}} = \left(\sqrt[3]{8}\right)^2 = 2^2 = \mathbf{4}$

(c) negative means reciprocal: $25^{-\frac{1}{2}} = \dfrac{1}{\sqrt{25}} = \mathbf{\dfrac{1}{5}}$

3.1

- top: $3^{7+4} = 3^{11}$; then $3^{11} \div 3^9 = 3^{11-9} = 3^2 = \mathbf{9}$

3.2

- $3 \div 6 = 0.5$ and $10^{4-(-3)} = 10^7$: 0.5×10^7
- re-normalise: $\mathbf{5 \times 10^6}$

3.3

- the base stays 2 when you multiply powers of 2; only the indices are added. Sam also multiplied the bases
- $2^3 \times 2^4 = 2^{3+4} = \mathbf{2^7}$

3.4

- divide: $\dfrac{5.97 \times 10^{24}}{7.35 \times 10^{22}}$
- $5.97 \div 7.35 = 0.8122\ldots$ and $10^{24-22} = 10^2$, so $0.8122\ldots \times 100 = 81.2\ldots$
- the Earth is about **81 times** heavier

3.5

- write each term as a power of 2: $8^{\frac{2}{3}} = (2^3)^{\frac{2}{3}} = 2^2$ and $4^{-3} = (2^2)^{-3} = 2^{-6}$
- $2^2 \times 2^{-6} = 2^{2+(-6)} = 2^{-4}$
- $\boldsymbol{n = -4}$