

Section 2: Indices

Solutions to Exercise level 2

$$1. \quad (i) \quad \frac{2^5 \times 4^{1/2}}{2} = \frac{2^5 \times (2^2)^{1/2}}{2} = \frac{2^5 \times 2^1}{2} = 2^{5+1-1} = 2^5 = 32$$

$$(ii) \quad (3^5)^{3/2} \times 9^{-7/4} = (3^5)^{3/2} \times (3^2)^{-7/4} = 3^{15/2} \times 3^{-7/2} = 3^{\frac{15}{2}-\frac{7}{2}} = 3^4 = 81$$

$$(iii) \quad \sqrt{\frac{x^{4/3}}{x^{1/3} \times x^{8/3}}} = \sqrt{x^{\frac{4}{3}-\frac{1}{3}-\frac{8}{3}}} = \sqrt{x^{-\frac{5}{3}}} = (x^{-\frac{5}{3}})^{\frac{1}{2}} = x^{-\frac{5}{6}}$$

$$2. \quad (i) \quad \frac{16x^{\frac{1}{2}}}{2^3 x^{-\frac{1}{2}}} = \frac{2^4 x^{\frac{1}{2}}}{2^3 x^{-\frac{1}{2}}} \\ = 2x$$

$$(ii) \quad \frac{x^{\frac{5}{4}} \cdot x^{-1}}{\sqrt[4]{x^3}} = \frac{x^{\frac{1}{4}}}{x^{\frac{3}{4}}} \\ = x^{-\frac{1}{2}}$$

$$3. \quad (i) \quad 3^{5/2} - 3^{1/2} = 3^{1/2} \times 3^2 - 3^{1/2} \\ = 3^{1/2}(3^2 - 1) \\ = \sqrt{3} \times 8 \\ = 8\sqrt{3}$$

$$(ii) \quad 2^{1/2} + 2^{3/2} + 2^{5/2} = 2^{1/2} + 2^{1/2} \times 2^1 + 2^{1/2} \times 2^2 \\ = 2^{1/2}(1 + 2 + 2^2) \\ = 7\sqrt{2}$$

$$(iii) \quad y^{1/2} - y^{-1/2} = \sqrt{y} - \frac{1}{\sqrt{y}} = \frac{y-1}{\sqrt{y}}$$

$$4. \quad (i) \quad \frac{2^{\frac{5}{2}} - 2^{\frac{3}{2}}}{2^{\frac{1}{2}}} = \frac{2^{\frac{3}{2}}(2-1)}{2^{\frac{1}{2}}} \\ = 2$$

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$$\begin{aligned} \text{(ii)} \quad \left(\frac{x^{\frac{7}{4}} - x^{\frac{3}{4}} + x \cdot x^{\frac{7}{4}}}{x^{\frac{1}{4}}} \right)^2 &= \left(\frac{x^{\frac{3}{4}} [x - 1 + x^2]}{x^{\frac{1}{4}}} \right)^2 \\ &= \left(x^{\frac{1}{2}} [x^2 + x - 1] \right)^2 \\ &= x(x^2 + x - 1)^2 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad \left[\frac{y^{\frac{1}{2}}}{x^{\frac{3}{4}}} - \frac{x^{\frac{5}{4}}}{y^{\frac{3}{2}}} \right]^4 &= \left[\frac{y^{\frac{1}{2}} \cdot y^{\frac{3}{2}} - x^{\frac{5}{4}} \cdot x^{\frac{3}{4}}}{x^{\frac{3}{4}} \cdot y^{\frac{3}{2}}} \right]^4 \\ &= \left[\frac{y^2 - x^2}{x^{\frac{3}{4}} \cdot y^{\frac{3}{2}}} \right]^4 \\ &= \frac{(y^2 - x^2)^4}{x^3 \cdot y^6} \end{aligned}$$