

4.6 Applying the Exponent Laws – Part 2

Working with Fractional exponents

A. Adding and Subtracting Fractions

- requires a common denominator
- add/subtract numerator only
- fraction should be in lowest terms

Examples: Simplify

$$a) x^{\frac{3}{2}} \cdot x^{\frac{1}{2}} = x^{\frac{3}{2} + \frac{1}{2}} = x^{\frac{4}{2}} = x^2$$

← Simplify

$$b) -3b^{\frac{1}{2}} \cdot -2b^{\frac{4}{3}} = 6b^{\frac{1 \times 3}{2 \times 3} + \frac{4 \times 2}{3 \times 2}} = 6b^{\frac{3}{6} + \frac{8}{6}} = 6b^{\frac{11}{6}}$$

$$c) 2m^2 \cdot 4m^{\frac{3}{2}} \cdot 4m^{-2} = 32m^{2 + \frac{3}{2} + (-2)} = 32m^{\frac{3}{2}}$$

$$d) x^{\frac{5}{2}} \div x^2 = x^{\frac{5}{2} - \frac{2 \times 2}{1 \times 2}} = x^{\frac{5}{2} - \frac{4}{2}} = x^{\frac{1}{2}} = \sqrt{x}$$

$$e) 4x^{\frac{3}{4}} \cdot 4x^{\frac{1}{2}} = 16x^{\frac{3}{4} + (-\frac{1 \times 2}{2 \times 2})} = 16x^{\frac{3}{4} - \frac{2}{4}} = 16x^{\frac{1}{4}}$$

$$f) \frac{0.6^{\frac{1}{2}}}{0.6^{\frac{3}{2}}} = 0.6^{\frac{1}{2} - \frac{3}{2}} = 0.6^{-\frac{2}{2}} = 0.6^{-1} = \frac{1 \times 10}{0.6 \times 10} = \frac{10}{6} = \frac{5}{3}$$

$$g) \frac{15x^{\frac{3}{7}}}{5x^{\frac{1}{7}}} = 3x^{\frac{3}{7} - \frac{1}{7}} = 3x^{\frac{2}{7}} = \frac{3}{x^{\frac{4}{7}}}$$

$$a^{-n} = \frac{1}{a^n}$$

$$h) \frac{0.49^{\frac{5}{2}}}{0.49^4} = 0.49^{\frac{5}{2} - \frac{4 \times 2}{1 \times 2}} = 0.49^{\frac{5}{2} - \frac{8}{2}} = 0.49^{-\frac{3}{2}} = \frac{1}{0.49^{\frac{3}{2}}}$$

$$= \frac{1}{(\sqrt{0.49})^3} = \frac{1 \times 1000}{0.343 \times 1000} = \frac{1000}{343} \text{ Marsh}$$

$$i) \frac{y^{\frac{2}{3}} y^{\frac{1}{2}}}{y^{\frac{1}{4}}} = \frac{y^{\frac{2}{3} + \frac{1}{2}}}{y^{\frac{1}{4}}} = \frac{y^{\frac{4}{6} + \frac{3}{6}}}{y^{\frac{1}{4}}} = \frac{y^{\frac{7}{6}}}{y^{\frac{1}{4}}} = y^{\frac{14}{12} - \frac{3}{12}} = y^{\frac{11}{12}}$$

B. Multiplying Fractions $(a^m)^n$

- cross simplify if possible
- fraction should be in lowest terms

Examples: *Simplify*

$$a) (n^4)^{\frac{3}{2}} = n^{\frac{2}{1} \times \frac{3}{2}} = n^6$$

$$b) (8a^3b^6)^{\frac{1}{3}} = 8^{\frac{1}{3}} a^{\frac{3}{1} \times \frac{1}{3}} b^{\frac{6}{1} \times \frac{1}{3}} = \sqrt[3]{8} ab^2 = 2ab^2$$

$$c) (x^3y^2)^{\frac{3}{2}} = x^{\frac{3}{1} \times \frac{3}{2}} y^{\frac{2}{1} \times \frac{3}{2}} = x^{\frac{9}{2}} y^3$$

$$d) \left(\frac{x^2}{y^4}\right)^{\frac{3}{2}} = \frac{x^{\frac{2}{1} \times \frac{3}{2}}}{y^{\frac{4}{1} \times \frac{3}{2}}} = \frac{x^3}{y^6}$$

$$e) \left(m^{-\frac{1}{2}}\right)^{\frac{4}{3}} = m^{-\frac{1}{2} \times \frac{4}{3}} = m^{-\frac{2}{3}} = \frac{1}{m^{\frac{2}{3}}}$$

$$f) \left(\frac{a^{\frac{3}{4}}}{b^2}\right)^{-\frac{1}{3}} = \frac{a^{\frac{3}{4} \times -\frac{1}{3}}}{b^{\frac{2}{1} \times -\frac{1}{3}}} = \frac{a^{-\frac{1}{4}}}{b^{-\frac{2}{3}}} = \frac{b^{\frac{2}{3}}}{a^{\frac{1}{4}}}$$

$$g) \frac{\left(4a^{\frac{5}{2}}b^4c^{-3}\right)^2}{\left(2a^{\frac{2}{3}}b^2c^{\frac{8}{3}}\right)^3} = \frac{16a^{\frac{5}{2} \times 2} b^{4 \times 2} c^{-3 \times 2}}{8a^{\frac{2}{3} \times 3} b^{2 \times 3} c^{\frac{8}{3} \times 3}} = \frac{16a^5 b^8 c^{-6}}{8a^2 b^6 c^8} = 2a^3 b^2 c^{-8}$$