Ch.4 : Roots & Powers

Entire to Mixed → look in Perfect Square or Perfect cube lists.
→ go throug and find a # that divides into Radicand

1) i) $\sqrt[3]{56}$

$\sqrt[3]{8 \times 7}$

$\underbrace{\sqrt[3]{8}}_{\text{perfect cube}} \times \sqrt[3]{7}$

$2\sqrt[3]{7}$

Ex2) $\sqrt{98}$

$= \sqrt{49 \times 2}$

$= \underbrace{\sqrt{49}}_{\text{perfect sq}} \times \sqrt{2}$

$7\sqrt{2}$

cubes

1
8
27
56 → 64
125
⋮

Mixed → Entire

Coefficent is raised to the index, placed under radical then multiply by radicand

$3\sqrt[3]{5}$

$= \sqrt[3]{3^3 \times 5}$

$= \sqrt[3]{27 \times 5}$

$= \sqrt[3]{135}$

Ex2) $7\sqrt{3}$

$= \sqrt{7^2 \times 3}$

$= \sqrt{49 \times 3}$

$= \sqrt{147}$

index, exponent

$\sqrt[n]{x^m} \Rightarrow x^{\frac{m}{n}}$

exponent, index

$(\sqrt[n]{x})^m$

Radical Power

Ex) $(\sqrt[3]{2})^7$

$2^{7/3}$

3) i) $\sqrt[3]{6^2}$ $6^{\frac{2}{3}}$

ii) $15^{-\frac{2}{3}} = (\sqrt[3]{15})^{-2}$

$= \left(\frac{1}{\sqrt[3]{15}}\right)^2$

4) i) $3^{\frac{5}{2}}$ $\sqrt{3^5}$

Law

Laws of Exponents

1) Multiply powers with the same base, you add exponents

$$x^3 \cdot x^4 = x^7$$

2) Divide powers with the same base, you subtract exponents

like bases

$$\frac{x^7}{x^2 y^3} = \frac{x^5}{y^3}$$

3) Power of a power

↳ exponent attached to bracket must apply to all its insided bracket → multiply exponents

Ex) $(2 n^3)^4$

$(2^1 n^3)^4$

$\underbrace{2^4}_{\text{evaluate}} n^{12}$

$\boxed{16 n^{12}}$

Ex) $\left(\frac{x^3}{y^2}\right)^4 = \frac{x^{12}}{y^8}$

4) Zero Exponent law

↳ anything raised to the exponent "0" is 1

$x^0 = 1$ or $\left[\frac{x^3 y^{-2}}{15 z^3 y^7}\right]^0 = 1$

5) Negative Exponents

→ tied to Bracket → flip all terms inside → flip Num & Denom

$$\left(\frac{x^7}{y^3}\right)^{-2} = \underbrace{\left(\frac{y^3}{x^7}\right)^2}_{\text{power of pow}} = \frac{y^6}{x^{14}}$$

then apply laws

$\frac{x^{-14}}{y^{-6}}$

$= \frac{y^6}{x^{14}}$

Ex2) $\frac{x^{-7}}{1}$

$\frac{1}{x^7}$

Ex) $(4x^{-5} y^{-3})^{-4}$

apply power of pow law

neg so move to bottom

$= 4^{-4} x^{20} y^{12}$

$= \frac{x^{20} y^{12}}{4^4}$

$= \frac{x^{20} y^{12}}{256}$

i) $\frac{2n^4}{(4m^4 n^0)(m^1 n^1)}$

$= \frac{{}^1\cancel{2} n^4}{{}^2\cancel{4} m^5 n^1}$

$= \frac{1 n^3}{2 m^5}$

l) $\left[\frac{a^5 b^{-3}}{a^{-3} b^{-3}}\right]^2 = (a^{5+2} b^{-3+3})^2$

$= (a^7 b^0)^2$

$(1a^7)^2$

a^{14}

$\left[\frac{a^5 a^2 \cancel{b^3}}{\cancel{b^3}}\right]^2$

$(a^7)^2$

a^{14}

Prime #

$\underbrace{2, 3, 5, 7, 11, 13}$, 17, 19, 23, ...