powers and Roots Basic:

↳ indices and surds

power:

e.g $2^3 = 2 \times 2 \times 2$

$3^5 = 3 \times 3 \times 3 \times 3 \times 3$

2, 3 → Bases

3, 5 → indices, exponents.

Root:

e.g $\sqrt{9} = \sqrt{3^2} = (3^2)^{1/2}$ ∴ $\sqrt{} = 1/2$

$= 3$ ∴ $\sqrt[3]{} = 1/3$

∴ $\sqrt[4]{} = 1/4$

$\sqrt[3]{8} \Rightarrow \sqrt[3]{2^3} = (2^3)^{1/3} = 2$

$\sqrt[4]{16} = \sqrt[4]{2^4} \Rightarrow (2^4)^{1/4} = 2$

power ⇒ Raises

Root → Reduces

Laws of indices

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{m \times n}$
4. $a^0 = 1$
5. $a^{-n} = \frac{1}{a^n}$

Q.1: Simplify $a^5 \times a^3 \times a^4$

Sol: $a^5 \times a^3 \times a^4 = a^{5+3+4}$ ∴ $a^m \times a^n = a^{m+n}$

$= a^{12}$

Q.2: $12c^9 \div 4c^3$ ∴ $a^m \div a^n = a^{m-n}$

Sol: $\frac{12c^9}{4c^3} = \frac{12}{4} \times c^9 \times c^{-3}$

$= 3 \times c^{9-3} \Rightarrow 3 \times c^6$

$= 3c^6$

Q.3: $(2g^3)^3$

Sol: $(2^3)^3 \times (g^3)^3$ ∴ $(a^m)^n = a^{m \times n}$

$= 2^{3 \times 3} \times g^{3 \times 3} \Rightarrow 2^9 g^6 \Rightarrow$

Q.4: $3m(2m^6)^3$

Sol: $3m(2)^3 \times (m^6)^3$ ∴ $(a^m)^n = a^{m \times n}$

$= 3m \times 2^3 \times m^6$

$= 3m \times 8 \times m^6 \Rightarrow 24m^{1+6} \Rightarrow \boxed{24m^7}$

Q.5: $\frac{2a^8 + 2a^8}{2a^8}$

① Sol: $\frac{2a^8 + 2a^8}{2a^8} \Rightarrow \frac{4a^8}{2a^8} = \frac{\cancel{4}^2}{\cancel{2}_1} \times \frac{\cancel{a^8}}{\cancel{a^8}} = 2$

② $\frac{2a^8 + 2a^8}{2a^8} \Rightarrow \frac{2a^8(1+1)}{2a^8} = 2$ Ans

Q.6: $\frac{b^4 + b^4 + b^4 + b^4 + b^4 + b^4}{b^4}$

Sol: ① $\frac{6b^4}{b^4} = \frac{6\cancel{b^4}}{\cancel{b^4}} = 6$

② $\frac{\cancel{b^4}(1+1+1+1+1+1)}{\cancel{b^4}} = 6$

Q.7: $\frac{12b^8}{6b^4} + 6b^4$

Sol: $\frac{12b^8}{6b^4} + 6b^4$

$= \frac{12b^8}{6b^4} + 6b^4 \Rightarrow \frac{12}{6} \times \frac{b^8}{b^4} + 6b^4$

$= 2b^8 \times b^{-4} + 6b^4$

$= 2b^{8-4} + 6b^4$

$= 2b^4 + 6b^4 \Rightarrow \boxed{8b^4}$ Ans.