

Ch 1 Chapter Review

① A. $d^6 e^2 \times 3d^4 e^3$
 $= 3 \times d^6 \times d^4 \times e^2 \times e^3$
 $= 3 \times d^{6+4} \times e^{2+3}$
 $= 3d^{10} e^5$

not what we need.

B. $\frac{6d^{10}e^5}{2e^2} = \frac{6}{2} \times d^{10} \times e^{5-2}$

$= 3 \times d^{10} \times e^3$

not what we need.

C. $(3d^5e^2)^2 = 3^{2} \times d^{5 \times 2} \times e^{2 \times 2}$
 $= 3^2 \times d^{10} \times e^4$
 $= 9d^{10} e^4$

not what we need.

D. $3e(d^5)^2 \times e^3 = 3 \times e \times d^{5 \times 2} \times e^3$

$= 3 \times e^1 \times e^3 \times d^{10}$

$= 3 \times e^{1+3} \times d^{10}$

$= 3 \times e^4 \times d^{10}$

$= 3d^{10}e^4$

as required.

$\therefore \boxed{D}$

② $8m^3n \times n^4 \times 2m^2n^3$
 $= 8 \times 2 \times m^3 \times m^2 \times n \times n^4 \times n^3$
 $= 16 \times m^{3+2} \times n^{1+4+3}$
 $= 16 \times m^5 \times n^8$
 $= 16m^5n^8$
 $\therefore \boxed{C}$

collect like terms.
 $a^m \times a^n = a^{m+n}$

③ $8x^3 \div 4x^{-3}$

$= \frac{8x^3}{4x^{-3}}$

$= \frac{8}{4} \times \frac{x^3}{x^{-3}}$

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

$= 2 \times x^{3-(-3)}$

$= 2 \times x^6$

simplify powers.

$= 2x^6$

$\therefore \boxed{C}$

$$\begin{aligned}
 & \textcircled{4} \quad \frac{12x^2 \times 2x^7}{6x^9 \times x^5} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{collect like terms} \\
 & = \frac{12 \times 2 \times 2^2 \times 2^7}{6 \times 2^9 \times 2^5} \\
 & = \frac{4 \times 2^{9+7}}{1 \times 2^{9+5}} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \boxed{a^m \times a^n = a^{m+n}} \\
 & = \frac{4 \times 2^{15}}{2^{14}} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{simplify} \\
 & = 4 \times 2^{15-14} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \boxed{\frac{a^m}{a^n} = a^{m-n}} \\
 & = 4 \times 2^1 \\
 & = 4 \times 2
 \end{aligned}$$

∴ \boxed{C}

$$\begin{aligned}
 & \textcircled{5} \quad \frac{(a^2 b^3)^5}{(2a^2 b)^2} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \boxed{(a^m)^n = a^{m \times n}} \\
 & = \frac{a^{2 \times 5} b^{3 \times 5}}{2^{1 \times 2} \times a^{2 \times 2} \times b^{1 \times 2}} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{simplify} \\
 & = \frac{a^{10} \times b^{15}}{2^2 \times a^4 \times b^2} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \boxed{\frac{a^m}{a^n} = a^{m-n}} \\
 & = \frac{1}{2^2} \times a^{10-4} \times b^{15-2} \\
 & \quad \quad \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{simplify} \\
 & = \frac{1}{2^2} \times a^6 \times b^{13} \\
 & = \frac{a^6 b^{13}}{2^2}
 \end{aligned}$$

∴ \boxed{A}

$$(6) \frac{(p^2 q)^4}{(2p^5 q^2)^3} \div \frac{(p^5 q^2)^2}{2pq^5}$$

$$(a^m)^n = a^{mn}$$

$$= \frac{p^{2 \times 4} q^{1 \times 4}}{2^{1 \times 3} p^{5 \times 3} q^{2 \times 3}} \div \frac{p^{5 \times 2} q^{2 \times 2}}{2pq^5}$$

simplify powers.

$$= \frac{p^8 q^4}{2^3 p^{15} q^6} \div \frac{p^{10} q^4}{2pq^5}$$

\div fraction $\Rightarrow \times$ reciprocal.
(flipped fraction)

$$= \frac{p^8 q^4}{2^3 p^{15} q^6} \times \frac{2pq^5}{p^{10} q^4}$$

multiply fractions.

$$= \frac{2 \times p^8 \times p \times q^4 \times q^5}{2^3 \times p^{15} \times p^{10} \times q^6 \times q^4}$$

$$a^m \times a^n = a^{m+n}$$

$$= \frac{2 \times p^{8+1} \times q^{4+5}}{2^3 \times p^{15+10} \times q^{6+4}}$$

simplify powers.

$$= \frac{2 \times p^9 \times q^9}{2^3 \times p^{25} \times q^{10}}$$

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

$$= 2^{1-3} \times p^{9-25} \times q^{9-10}$$

simplify powers.

$$= 2^{-2} \times p^{-16} \times q^{-1}$$

$$= \frac{1}{2^2} \times \frac{1}{p^{16}} \times \frac{1}{q}$$

$$a^{-m} = \frac{1}{a^m} \quad \text{write with positive powers.}$$

$$= \frac{1}{4p^{16}q} \quad \therefore \boxed{A}$$

$$(7) \quad 16^{-\frac{3}{4}} \div 9^{\frac{3}{2}}$$

$$= (2^4)^{-\frac{3}{4}} \div (3^2)^{\frac{3}{2}}$$

$$= 2^{4 \times -\frac{3}{4}} \div 3^{2 \times \frac{3}{2}}$$

$$= 2^{-3} \div \frac{3^3}{1}$$

$$= \frac{1}{2^3} \times \frac{1}{3^3}$$

$$= \frac{1}{8} \times \frac{1}{27}$$

$$= \frac{1}{216}$$

$$\therefore \boxed{B}$$

write 16 as 2^4
9 as 3^2

$$\text{expand } (a^m)^n = a^{mn}$$

simplify

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

and \div fraction = \times reciprocal

$$(8) \quad \frac{(2l^{\frac{2}{3}}m^{-1})^{-3}}{8\left(\frac{1}{16}lm^{-2}\right)^2}$$

$$\frac{1}{16} = \frac{1}{4^2} = 4^{-2} = \frac{2^{1 \times -3} \times l^{\frac{2}{3} \times -3} \times m^{-1 \times -3}}{8 \times 4^{-2 \times 2} \times l^{1 \times 2} \times m^{-2 \times 2}}$$

$$= \frac{2^{-3} \times l^{-\frac{2}{3}} \times m^3}{8 \times 4^{-4} \times l^2 \times m^{-4}}$$

$$= \frac{2^{-3}}{2^3 \times (2^2)^{-4}} \times l^{-\frac{2}{3} - 2} \times m^{3 - (-4)}$$

$$= \frac{2^{-3}}{2^3 \times 2^{-8}} \times l^{-\frac{2}{3} - \frac{6}{3}} \times m^7$$

$$= \frac{2^{-3}}{2^5} \times l^{-\frac{8}{3}} \times m^7$$

$$= 2^{-3-(-5)} \times \frac{1}{l^{\frac{2}{3}}} \times m^7$$

$$= 2^2 \times \frac{1}{l^{\frac{2}{3}}} \times m^7$$

$$= 4 \times \frac{1}{l^{\frac{2}{3}}} \times m^7$$

$$= \frac{4m^7}{l^{\frac{2}{3}}}$$

$$\therefore \boxed{C}$$

$$\textcircled{9} \quad \sqrt[5]{32 i^{\frac{10}{7}} j^{\frac{5}{11}} k^2} \quad \rightarrow \quad \boxed{\sqrt[m]{a} = a^{\frac{1}{m}}}$$

$$= (2^5 i^{\frac{10}{7}} j^{\frac{5}{11}} k^2)^{\frac{1}{5}}$$

$$= 2^{5 \times \frac{1}{5}} \times i^{\frac{10}{7} \times \frac{1}{5}} \times j^{\frac{5}{11} \times \frac{1}{5}} \times k^{2 \times \frac{1}{5}}$$

$$= 2^1 \times i^{\frac{2}{7}} \times j^{\frac{1}{11}} \times k^{\frac{2}{5}}$$

$$= 2 i^{\frac{2}{7}} j^{\frac{1}{11}} k^{\frac{2}{5}}$$

$$\therefore \boxed{B}$$

$$\textcircled{10} \text{ a) } 5x^3 \times 3x^5y^4 \times \frac{3}{5} \times x^2y^6$$

$$= 5^1 \times 3 \times \frac{3}{5} \times x^3 \times x^5 \times x^2 \times y^4 \times y^6$$

$$= 9 \times x^{3+5+2} \times y^{4+6}$$

$$= 9 \times x^{10} \times y^{10}$$

$$= 9x^{10}y^{10}$$

collect like terms.

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$b) \frac{26a^4 b^6 c^5}{12a^3 b^3 c^3}$$

$$= \frac{13 \cdot 26}{6 \cdot 12} \times a^{4-3} \times b^{6-3} \times c^{5-2}$$

$$= \frac{13}{6} \times a^1 \times b^3 \times c^3$$

$$= \frac{13ab^3c^3}{6}$$

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

$$c) \left(\frac{20m^5 n^2}{3} \right)^3$$

$$= \frac{20^{1 \times 3} \times m^{5 \times 3} \times n^{2 \times 3}}{3^{1 \times 3}}$$

$$= \frac{10^3 \times m^{15} \times n^6}{3^3}$$

$$= \frac{1000 m^{15} n^6}{27}$$

$$d) \left(\frac{14p^7}{21q^3} \right)^4$$

$$= \left(\frac{2p^7}{3q^3} \right)^4$$

$$= \frac{2^4 p^{28}}{3^4 q^{12}}$$

$$= \frac{16 p^{28}}{81 q^{12}}$$

$$\frac{14}{21} = \frac{2 \times 7}{3 \times 7} = \frac{2}{3}$$

$$(a^m)^n = a^{mn}$$

$$\begin{aligned}
 \textcircled{11} \text{ a) } & 5a^0 - \left(\frac{2a}{3}\right)^0 + 12 \\
 & = 5 \times a^0 - (\quad)^0 + 12 \\
 & = 5 \times 1 - 1 + 12 \\
 & = 5 - 1 + 12 \\
 & = 16.
 \end{aligned}$$

$$\text{b) } - (3b)^0 - \frac{(4b)^0}{2}$$

$$= -1 - \frac{1}{2}$$

$$= -\frac{2}{2} - \frac{1}{2}$$

$$= -\frac{3}{2}$$

$$a^0 = 1$$

to add fractions... make them of the same size pieces... halves.

$$\textcircled{12} \text{ a) } 2a^{-5}b^2 \times 4a^{-6}b^{-4}$$

$$= 2 \times 4 \times a^{-5} \times a^{-6} \times b^2 \times b^{-4}$$

$$= 8 \times a^{-5+(-6)} \times b^{2+(-4)}$$

$$= 8 \times a^{-11} \times b^{-2}$$

$$= 8 \times \frac{1}{a^{11}} \times \frac{1}{b^2}$$

$$= \frac{8}{a^{11}b^2}$$

collect like terms

$$a^m \times a^n = a^{m+n}$$

simplify powers

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

b) $4x^{-5}y^{-3} \div 20x^{12}y^{-5}$ write the division as a fraction.

$$= \frac{4x^{-5}y^{-3}}{20x^{12}y^{-5}}$$

$$\boxed{\frac{a^m}{a^n} = a^{m-n}}$$

$$= \frac{1}{5} \times x^{-5-12} \times y^{-3-(-5)}$$

simplify powers

$$= \frac{1}{5} \times x^{-17} \times y^2$$

$$\boxed{a^{-m} = \frac{1}{a^m}}$$

$$= \frac{1}{5} \times \frac{1}{x^{17}} \times y^2$$

simplify.

$$= \frac{y^2}{5x^{17}}$$

c) $(2m^{-3}n^2)^{-4}$

$$= 2^{1 \times -4} \times m^{-3 \times -4} \times n^{2 \times -4}$$

$$\boxed{(a^m)^n = a^{mn}}$$

$$= 2^{-4} \times m^{12} \times n^{-8}$$

simplify powers

$$= \frac{1}{2^4} \times m^{12} \times \frac{1}{n^8}$$

$$\boxed{a^{-m} = \frac{1}{a^m}}$$

simplify.

$$= \frac{m^{12}}{16n^8}$$

13) a)

$$\left(\frac{1}{2}\right)^{-3}$$

$$\boxed{\frac{1}{a^m} = a^{-m}}$$

$$= (2^{-1})^{-3}$$

$$\boxed{(a^m)^n = a^{mn}}$$

$$= 2^{-1 \times -3}$$

simplify.

$$= 2^3$$

$$= 8.$$

$$b) \quad 2 \times 3^{-3} \times \left(\frac{9}{2}\right)^2 \quad 9=3^2$$

$$= 2 \times 3^{-3} \times \left(\frac{3^2}{2^1}\right)^2 \quad (a^m)^n = a^{mn}$$

$$= 2 \times 3^{-3} \times \frac{3^{2 \times 2}}{2^{1 \times 2}} \quad \text{simplify fraction}$$

$$= 2 \times 3^{-3} \times \frac{3^4}{2^2}$$

$$= 2 \times 3^{-3} \times 3^4 \times \frac{1}{2^2}$$

$$= 2^1 \times 3^{-3} \times 3^4 \times 2^{-2}$$

$$= 2^1 \times 2^{-2} \times 3^{-3} \times 3^4 \quad \text{collect like terms}$$

$$= 2^{1+(-2)} \times 3^{-3+4} \quad a^m \times a^n = a^{m+n}$$

$$= 2^{-1} \times 3^1 \quad \text{simplify}$$

$$= \frac{1}{2^1} \times 3 \quad a^{-m} = \frac{1}{a^m}$$

$$= \frac{3}{2}$$

$$c) \quad 4^{-3} \times \frac{5}{8^{-2}} - 5 \quad 4=2^2 \quad 8=2^3$$

$$= (2^2)^{-3} \times \frac{5}{(2^3)^{-2}} - 5$$

$$= 2^{2 \times -3} \times \frac{5}{2^{3 \times -2}} - 5$$

$$= 2^{-6} \times \frac{5}{2^{-6}} - 5$$

$$= \frac{2^{-6}}{1} \times \frac{5}{2^{-6}} - 5$$

cancel down

$$= \frac{5}{1} - 5$$

$$= 5 - 5$$

$$= 0.$$

(14) a) $2a^{\frac{4}{5}}b^{\frac{1}{2}} \times 3a^{\frac{1}{2}}b^{\frac{3}{4}} \times 5a^{\frac{3}{4}}b^{\frac{2}{5}}$

Collect like terms.

$$= 2 \times 3 \times 5 \times a^{\frac{4}{5}} \times a^{\frac{1}{2}} \times a^{\frac{3}{4}} \times b^{\frac{1}{2}} \times b^{\frac{3}{4}} \times b^{\frac{2}{5}}$$

$$\boxed{a^m \times a^n = a^{m+n}}$$

$$= 30 \times a^{\frac{4}{5} + \frac{1}{2} + \frac{3}{4}} \times b^{\frac{1}{2} + \frac{3}{4} + \frac{2}{5}}$$

$$\frac{\frac{4}{5} \times \frac{4}{4} + \frac{1}{2} \times \frac{6}{6} + \frac{3}{4} \times \frac{3}{4}}{\frac{16}{20} + \frac{16}{20} + \frac{15}{20}}$$

$$= 30 \times a^{\frac{16}{20} + \frac{16}{20} + \frac{15}{20}} \times b^{\frac{10}{20} + \frac{15}{20} + \frac{8}{20}}$$

simplify powers.

$$= 30 \times a^{\frac{41}{20}} \times b^{\frac{33}{20}}$$

$$= 30a^{\frac{41}{20}}b^{\frac{33}{20}}$$

b) $\frac{4^3 x^{\frac{3}{4}} y^{\frac{1}{9}}}{16 x^{\frac{4}{5}} y^{\frac{1}{3}}} = \frac{4^3 x^{\frac{3}{4}} y^{\frac{1}{9}}}{4^2 x^{\frac{4}{5}} y^{\frac{1}{3}}}$

$$\boxed{\frac{a^m}{a^n} = a^{m-n}}$$

$$= 4^{3-2} \times x^{\frac{3}{4} - \frac{4}{5}} \times y^{\frac{1}{9} - \frac{1}{3}}$$

$$= 4^1 \times x^{\frac{15}{20} - \frac{16}{20}} \times y^{\frac{1}{9} - \frac{3}{9}}$$

$$= 4^1 \times x^{-\frac{1}{20}} \times y^{-\frac{2}{9}}$$

$$= 4 \times \frac{1}{x^{\frac{1}{20}}} \times \frac{1}{y^{\frac{2}{9}}}$$

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

$$= \frac{2^{2 \times \frac{1}{2}} \times a^{\frac{1}{3} \times \frac{1}{2}}}{b^{3 \times \frac{1}{2}}}$$

$$= \frac{2 \times a^{\frac{1}{6}}}{b^{\frac{3}{2}}}$$

$$(a^m)^n = a^{mn}$$

simplify powers.

(15) a)

$$\frac{16^{\frac{3}{4}} \times 81^{\frac{1}{4}}}{6 \times 16^{\frac{1}{2}}}$$

$$16 = 4^2$$

$$16 = 2^4$$

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

$$= \frac{2^{4 \times \frac{3}{4}} \times 3^{4 \times \frac{1}{4}}}{2 \times 3 \times 4^{2 \times \frac{1}{2}}}$$

$$= \frac{2^3 \times 3^1}{2 \times 3 \times 4}$$

$$= \frac{8 \times 3}{2 \times 3 \times 4}$$

$$= \frac{24}{24}$$

$$= 1$$

$$(a^m)^n = a^{mn}$$

simplify powers.