

(1) Simplify (without a calculator):

Write the answers as positive exponents!

$$\begin{aligned}
 \text{(a)} \quad & x^3 \times x^{-2} \times x^5 \div x^4 \\
 &= x^{3-2+5-4} \\
 &= x^2
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & (2^1 m^3 n^{-2})^3 \\
 &= 2^3 m^9 n^{-6} \\
 &= \frac{8m^9}{n^6}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & p^3(p^3)^0 \\
 &= p^3 \times 1 \\
 &= p^3
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad & y^{a+2b} \div y^{a-b} \\
 &= y^{a+2b-(a-b)} \\
 &= y^{a+2b-a+b} \\
 &= y^{3b}
 \end{aligned}$$

$$\begin{aligned}
 \text{(e)} \quad & \sqrt{\frac{81m^7n^1}{25m^1n^{-9}}} \\
 &= \sqrt{\frac{81m^{7-1}n^{1-(-9)}}{25}} \\
 &= \frac{\sqrt{81}}{\sqrt{25}} \sqrt{m^6} \sqrt{n^{10}} \\
 &= \frac{9}{5} m^{\frac{6}{2}} n^{\frac{10}{2}} \\
 &= \frac{9m^3n^5}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(f)} \quad & \frac{12a^3b^7}{-4a^4b^8} \\
 &= \frac{12}{-4} a^{3-4} b^{7-8} \\
 &= -3 a^{-1} b^{-1} \\
 &= \frac{-3}{ab}
 \end{aligned}$$

$$\begin{aligned}
 \text{(g)} \quad & \left(\frac{3m^3p^2t^1}{15m^1p^2t^{-2}} \right)^3 \\
 &= \left(\frac{3}{15} \right)^3 (m^{3-1}p^{2-2}t^{1-(-2)})^3 \\
 &= \left(\frac{3}{15} \right)^3 (m^2p^0t^3)^3 \\
 &= \left(\frac{1}{5} \right)^3 m^6p^0t^9 \\
 &= \frac{1}{5^3} m^6 \times 1 \times t^9 \\
 &= \frac{m^6t^9}{125}
 \end{aligned}$$

$$\begin{aligned}
 \text{(h)} \quad & \frac{a^5 \times b^3 \div (a^4 \cdot b^{-1})}{a^8b^7} \\
 &= \frac{a^5 \times b^3 \div a^4 \div b^{-1}}{a^8b^7} \\
 &= \frac{a^{5-4} \times b^{3-(-1)}}{a^8b^7} \\
 &= \frac{a^1 \times b^4}{a^8b^7} \\
 &= a^{1-8} b^{4-7} = a^{-7} b^{-3} \\
 &= \frac{1}{a^7b^3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(i)} \quad & \sqrt[3]{27x^9y^{12}} + 4x^3(y^8)^{\frac{1}{2}} \\
 &= \sqrt[3]{3^3x^9y^{12}} + 4x^3y^{8 \times \frac{1}{2}} \\
 &= 3^{\frac{3}{3}}x^{\frac{9}{3}}y^{\frac{12}{3}} + 4x^3y^4 \\
 &= 3^1x^3y^4 + 4x^3y^4 \\
 &= 3x^3y^4 + 4x^3y^4 \\
 &= 7x^3y^4
 \end{aligned}$$

$$\begin{aligned}
 \text{(j)} \quad & (k^{x-2})^2 \\
 &= k^{2(x-2)} \\
 &= k^{2x-4}
 \end{aligned}$$

(2) Solve x :

$$\begin{aligned}
 \text{(a)} \quad & 27^x = 9^{x-1} \\
 \therefore & (3^3)^x = (3^2)^{x-1} \\
 \therefore & 3^{3x} = 3^{2x-2} \\
 \therefore & \text{EB} \Leftrightarrow \text{EE} \\
 \therefore & 3x = 2x - 2 \\
 \therefore & 3x - 2x = -2 \\
 \therefore & x = -2
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & 5^{3x+4} = 1 \\
 \therefore & 5^{3x+4} = 5^0 \\
 \therefore & \text{EB} \Leftrightarrow \text{EE} \\
 \therefore & 3x + 4 = 0 \\
 \therefore & 3x = -4 \\
 \therefore & x = \frac{-4}{3} \\
 \therefore & x = -1\frac{1}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & x^{\frac{3}{4}} = 8 \\
 \therefore & \left(x^{\frac{3}{4}}\right)^{\frac{4}{3}} = \left(2^{\frac{3}{1}}\right)^{\frac{4}{3}} \\
 \therefore & \left(x^{\frac{3}{4}}\right)^{\frac{4}{3}} = \left(2^{\frac{3}{1}}\right)^{\frac{4}{3}} \\
 \therefore & x^1 = 2^4 \\
 \therefore & x = 16
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad & 32^{x-1} = \frac{1}{2^1} \\
 \therefore & (2^5)^{x-1} = 2^{-1} \\
 \therefore & 2^{5x-5} = 2^{-1} \\
 \therefore & \text{EB} \Leftrightarrow \text{EE} \\
 \therefore & 5x - 5 = -1 \\
 \therefore & 5x = 5 - 1 = 4 \\
 \therefore & x = \frac{4}{5}
 \end{aligned}$$

$$(e) \quad 0,25 = 4^{1-2x}$$

$$\therefore \frac{25}{100} = 4^{1-2x}$$

$$\therefore \frac{1}{4} = 4^{1-2x}$$

$$\therefore 4^{-1} = 4^{1-2x}$$

$$\therefore EB \Leftrightarrow EE$$

$$\therefore -1 = 1 - 2x$$

$$\therefore 2x = 1 + 1$$

$$\therefore 2x = 2$$

$$\therefore x = 1$$

$$(f) \quad 49^{x+3} = \sqrt[2]{71}$$

$$\therefore (7^2)^{x+3} = 7^{\frac{1}{2}}$$

$$\therefore 7^{2x+6} = 7^{\frac{1}{2}}$$

$$\therefore EB \Leftrightarrow EE$$

$$\therefore 2x + 6 = \frac{1}{2}$$

$$\therefore 4x + 12 = 1 \quad \text{LCD} = 2$$

$$\therefore 4x = 1 - 12$$

$$\therefore 4x = -11$$

$$\therefore x = \frac{-11}{4} = -2\frac{3}{4}$$

(3) Simplify and write the answer in scientific notation: (Without a calculator.)

$$(a) \quad (2 \times 10^3) \times (3,5 \times 10^{-2})$$

$$= 2 \times 3,5 \times 10^3 \times 10^{-2}$$

$$= 7 \times 10^{3-2}$$

$$= 7 \times 10^1$$

$$(b) \quad 800 \times 400 \div 5\,000$$

$$= 320\,000 \div 5\,000$$

$$= 64 \rightarrow \frac{320\,000}{5\,000}$$

$$= 6,4 \times 10^1$$

$$(c) \quad (4,2 \times 10^5) + (1,346 \times 10^{-1})$$

$$= 420\,000 + 0,1346$$

$$= 420\,000,1346$$

$$= 4,200001346 \times 10^5$$

$$(d) \quad 3(8,3 \times 10^7)$$

$$= 3 \times 8,3 \times 10^7$$

$$= 24,9 \times 10^7$$

$$= 2,49 \times 10^1 \times 10^7$$

$$= 2,49 \times 10^8$$