F Michaelmas Indices

1. Simplify fully:

   (a) $x^2 \times x^3 \times x^5$. $\boxed{x^{10}}$

   (b) $2 \times (x^2)^3$. $\boxed{2x^6}$

   (c) $(x^{-3})^{-5}$. $\boxed{x^{15}}$

   (d) $(3x^2)^3$. $\boxed{27x^6}$

   (e) $(12x^9) \div (4x^3)$. $\boxed{3x^6}$

   (f) $4x \times (3x^{-2})^2$. $\boxed{36x^{-3}}$

   (g) $\dfrac{(3x^2)^3}{3x^{-2}}$. $\boxed{9x^8}$

   (h) $\dfrac{12x^8}{6x^4} + 6x^4$. $\boxed{8x^4}$

   (i) $2x^5(2x^5 + 2x^5)$. $\boxed{8x^{10}}$

2. Simplify fully:

   (a) $\dfrac{(2x^{-2})^3 \times (2x^3)^2}{6^2 \times x^{-4}}$. $\boxed{\frac{8x^4}{9}}$

   (b) $\dfrac{2x^8 \times (2x)^8}{2x \times (2x)^5}$. $\boxed{8x^{10}}$

   (c) $\dfrac{(3x^{-1})^3 \times (2x^{-2})^4}{(6x^2)^3}$. $\boxed{2x^{-17}}$

   (d) $\dfrac{3x^3(2xy)^2}{6x^5y^2}$. $\boxed{2}$

   (e) $\dfrac{a^3b^7}{a^{-2}b^4}$. $\boxed{a^5b^3}$

   (f) $\dfrac{64(x^{-3}y^7)^2x^6y}{(4x^4y^2)^2}$. $\boxed{\frac{4y^{11}}{x^8}}$

   (g) $\dfrac{7pq^{-1}(2pq^3)^3}{14p(2p^2q)^2}$. $\boxed{\frac{q^6}{p}}$

   (h) $\dfrac{(4m^7n)^3}{8n^3m^{-7}}$. $\boxed{8m^{28}}$

   (i) $\dfrac{(uv)^2(2u^2v)^3}{(u^3v^8)^2(uv^{-1})^4}$. $\boxed{\frac{8}{u^2v^7}}$

   (j) $\dfrac{3x(x^4y^8)^3}{x^3(3x^5y)^2}$. $\boxed{\frac{y^{22}}{3}}$

   (k) $\dfrac{6u^2v^3}{3u^{-2}v^5} \times \dfrac{4(u^3v^4)^2}{2uv^{-1}}$. $\boxed{4u^9v^7}$

   (l) $\dfrac{(2x^3)^3y}{3x^{-2}y^3} \div \dfrac{4(xy)^{-8}}{(3x^{-4})^2}$. $\boxed{6x^{11}y^6}$

   (m) $\dfrac{4x^3y}{7xy^2} \div \dfrac{8x(yz)^2}{14zx^2y^3}$. $\boxed{\frac{x^3}{z}}$

   (n) $\dfrac{\frac{6x}{y^2}}{(3xy^3)}$. $\boxed{\frac{2}{y^5}}$

3. Evaluate without a calculator:

   (a) 3^{-1}. $\boxed{\frac{1}{3}}$

   (b) 5^{-2}. $\boxed{\frac{1}{25}}$

   (c) 4^{-3}. $\boxed{\frac{1}{64}}$

4. Evaluate without a calculator:

   (a) $\dfrac{2^8 \times 2^{-3}}{2^4}$. $\boxed{2}$

   (b) $8^4 \div 4^6$. $\boxed{1}$

   (c) $27^3 \div 9^4$. $\boxed{2}$

   (d) $\dfrac{64^2}{8 \times 16}$. $\boxed{32}$

5. Solve for x

   (a) $2^x = 8$. $\boxed{x = 3}$

   (b) $3^x = 81$. $\boxed{x = 4}$

   (c) $5^x = \frac{1}{25}$. $\boxed{x = -2}$

   (d) $3^{-x} = \frac{1}{27}$. $\boxed{x = 3}$