

$$3x^3(4xy^5)^2 = 3x^3(4^2x^2(y^5)^2) = 3x^3(16x^2y^{10}) = 3 \cdot 16x^3x^2y^{10} = 48x^5y^{10}$$

$$(2x)^3(3x^3y)^2 = (2^3x^3)(3^2(x^3)^2y^2) = (8x^3)(9x^6y^2) = 8 \cdot 9x^3x^6y^2 = 72x^9y^2$$

$$\frac{(5x^3y^2)^3}{(10x)^2} = \frac{5^3(x^3)^3(y^2)^3}{10^2x^2} = \frac{125x^9y^6}{100x^2} = \frac{125}{100}x^{9-2}y^6 = \frac{5}{4}x^7y^6 = \frac{5x^7y^6}{4}$$

$$\begin{aligned}(6xy^4)^2(4xy^8)^{-3} &= (6^2x^2(y^4)^2)(4^{-3}x^{-3}(y^8)^{-3}) = (36x^2y^8)\left(\frac{1}{64}x^{-3}y^{-24}\right) \\ &= \frac{36}{64}x^2x^{-3}y^8y^{-24} = \frac{9}{16}x^{-1}y^{-16} = \frac{9}{16} \cdot \frac{1}{x} \cdot \frac{1}{y^{16}} = \frac{9}{16xy^{16}}\end{aligned}$$

$$\begin{aligned}\left(\frac{8x^5y^2}{9x^2y}\right)^{-2} &= \frac{(9x^2y)^2}{(8x^5y^2)^2} = \frac{9^2(x^2)^2y^2}{8^2(x^5)^2(y^2)^2} = \frac{81x^4y^2}{64x^{10}y^4} = \frac{81}{64}x^{4-10}y^{2-4} \\ &= \frac{81}{64}x^{-6}y^{-2} = \frac{81}{64} \cdot \frac{1}{x^6} \cdot \frac{1}{y^2} = \frac{81}{64x^6y^2}\end{aligned}$$