

Solutions

1 $y = \frac{9}{x^6} - \frac{5}{x} = 9x^{-6} - 5x^{-1}$

$$\frac{dy}{dx} = -54x^{-7} + 5x^{-2} = \boxed{\frac{-54}{x^7} + \frac{5}{x^2}}$$

2 $f(x) = \frac{x^4}{3} - 10x$

$$f'(x) = \frac{4x^3}{3} - 10$$

$$f'(-2) = \frac{4(-2)^3}{3} - 10 = -\frac{8 \cdot 4}{3} - 10 = -\frac{32}{3} - 10 = \boxed{-\frac{62}{3}}$$

3 $f(y) = (y^{-1} + y^{-2})(9y^{-3} - 10y^{-4})$

$$f'(y) = (y^{-1} + y^{-2}) \cdot \frac{d}{dy}(9y^{-3} - 10y^{-4}) + (9y^{-3} - 10y^{-4}) \cdot \frac{d}{dy}(y^{-1} + y^{-2})$$

$$= \boxed{(y^{-1} + y^{-2})(-27y^{-4} + 40y^{-5}) + (9y^{-3} - 10y^{-4})(-y^{-2} - 2y^{-3})}$$

4 $f(y) = \frac{x^2 - 5x + 1}{x^2 + 4}$

$$f'(y) = \frac{(x^2 + 4) \frac{d}{dx}(x^2 - 5x + 1) - (x^2 - 5x + 1) \frac{d}{dx}(x^2 + 4)}{(x^2 + 4)^2}$$

$$= \boxed{\frac{(x^2 + 4)(2x - 5) - (x^2 - 5x + 1)(2x)}{(x^2 + 4)^2}}$$

5 $f(x) = \sqrt{4x^2 + 7}$

$$f'(x) = \frac{1}{2}(4x^2 + 7)^{-1/2} \cdot 8x$$

$$= \boxed{\frac{4x}{\sqrt{4x^2 + 7}}}$$