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12.3

1) a) x^5

$f'(x) = 5x^4$

b) x^{-6}

$f'(x) = -6x^{-7}$

c) $\sqrt{x} = x^{1/2}$

$f'(x) = 1/2\, x^{-1/2}$

d) $\frac{1}{4\sqrt{x}} = x^{-1/4}$

$f'(x) = -1/4\, x^{-5/4}$

2) a) $5x^4$

$\frac{dy}{dx} = 20x^3$

b) $5x^{-2}$

$\frac{dy}{dx} = -10x^{-3}$

c) $\frac{3x^2}{12x^5} = 1/4\, x^{-3}$

$\frac{dy}{dx} = -3/4\, x^{-4}$

d) $\frac{9}{\sqrt[3]{x^2}}$ $9x^{-2/3}$

$\frac{dy}{dx} = -6x^{-5/3}$

3) $y = 2x^3$ $\frac{dy}{dx} = 6x^2$

a) $6(3)^2 = 54$

b) $6(-5)^2 = 150$

c) $6(1/2)^2 = 3/2$

d) $6(3/4)^2 = \frac{27}{8}$

4) $y = \frac{5}{x^3} = 5(x^{-3}) = 5x^{-3}$

$\frac{dy}{dx} = -15x^{-4}$

$-15(2)^{-4} = -\frac{15}{16}$

5) $y = -\frac{8}{\sqrt{x}} = -8(x^{-1/2}) = -8x^{-1/2}$

$\frac{dy}{dx} = 4x^{-3/2}$

When $x = 16$,

$\frac{dy}{16} = 4(16)^{-\frac{3}{2}} = \underline{\underline{\frac{1}{16}}}$

6) $y = 2x^4$ $\quad x = a \quad g = 27$

$\frac{dy}{dx} = 8x^3$

$8x^3 = 27$

$x = 3/2 = a$

7) $y^3 - 64x^2 = 0$ $\quad y \geq 0$

$y = \sqrt[3]{64x^2}$

$y = 4x^{2/3}$

$\frac{dy}{dx} = \frac{8}{3}x^{-1/3}$

$\frac{8}{3}(27)^{-1/3} = \text{gradient} = \frac{8}{9}$