

3.3

RS 50-5252. Power Rule: $\frac{d}{dx}(x^n) = nx^{n-1}$

$$y = 3x^2 \quad y' = 6x \quad y = -8x^5 \quad y' = -40x^4$$

$$y = x^3 \quad y' = 3x^2$$

$$y = 4x^6 \quad y' = 24x^5$$

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$$1. y = 2x + 4$$

$$y' = 2x^0 + 0$$

$$= 2$$

$$2. f(x) = x^6$$

$$f'(x) = 6x^5$$

$$3. y = 2x^3$$

$$y' = 6x^2$$

$$4. y = 2\pi^5$$

constant!

$$y' = 0$$

$$5. g(x) = \frac{x^2}{3} = \frac{1}{3}x^2$$

$$g'(x) = \frac{2}{3}x$$

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$$6. f(x) = \frac{1}{x^5} = x^{-5}$$

$$f'(x) = -5x^{-6} = \frac{-5}{x^6}$$

$$7. y = \frac{4}{x} = 4x^{-1}$$

$$y' = -4x^{-2} \quad \text{or} \quad -\frac{4}{x^2}$$

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RS 53

$$\frac{d}{dx}(u \pm v) = u' \pm v'$$

$$8. f(x) = 2x^2 - 5x + 1$$

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

$$9. y = \frac{3}{x^2} + \frac{4}{x^3} - \frac{8}{x^4} = 3x^{-2} + 4x^{-3} - 8x^{-4}$$

$$y' = -6x^{-3} - 12x^{-4} + 32x^{-5}$$

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RS 54

Product Rule: $\frac{d}{dx}(u \cdot v) = u \cdot v' + v \cdot u'$

10. $y = (x^2 + 3)(x - 2)$
 $y' = (x^2 + 3)(1) + (x - 2)(2x)$
 $= x^2 + 3 + 2x^2 - 4x$
 $= 3x^2 - 4x + 3$

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RS 55

Quotient Rule: $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \cdot u' - u \cdot v'}{v^2}$

$\frac{d}{dx}\left(\frac{\text{high}}{\text{low}}\right) = \frac{\text{low d high} - \text{high d low}}{\text{low squared}}$

11. $y = \frac{4x - 2}{x + 1}$
 $y' = \frac{(x + 1)(4) - (4x - 2)(1)}{(x + 1)^2}$
 $= \frac{\cancel{4x} + 4 - \cancel{4x} + 2}{(x + 1)^2} = \frac{6}{(x + 1)^2}$

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$$12. \quad g(x) = \frac{2x}{x^2+1}$$

$$g'(x) = \frac{(x^2+1)(2) - 2x(2x)}{(x^2+1)^2}$$

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

$$13. \quad h(x) = \frac{6x^2 - 7x}{x}$$

Simplify first!

$$h(x) = 6x - 7$$

$$h'(x) = 6$$

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$$14. \quad y = \frac{e^2}{x^3}$$

$$y' = \frac{x^3(0) - e^2(3x^2)}{x^6} = \frac{-3e^2x^2}{x^6} = \frac{-3e^2}{x^4}$$

OR

$$y = e^2 x^{-3}$$

$$y' = -3e^2 x^{-4} = \frac{-3e^2}{x^4}$$

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$$15. \quad f(x) = \frac{8}{4+x^2}$$
$$f'(x) = \frac{\cancel{(4+x^2)}(0) - 8(2x)}{(4+x^2)^2}$$
$$= \frac{-16x}{(4+x^2)^2}$$

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Second Derivative

$$f''(x) \quad \text{or} \quad \frac{d^2y}{dx^2}$$

find the deriv \rightarrow do it again!

$$y = x^4 - 7x^3 + 5x^2 - 4x + 10$$

$$y' = 4x^3 - 21x^2 + 10x - 4$$

$$y'' = 12x^2 - 42x + 10$$

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$$17. f(x) = x^2 - 4x + 1 \text{ @ } x = 3$$

$$m: f'(x) = 2x - 4$$

$$f'(3) = 2 \cdot 3 - 4 = 2$$

$$\frac{x}{3} \Big| \frac{y}{9 - 12 + 1} = -2$$

$$y = 2(x - 3) - 2$$

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$$18. V = \frac{4r + s^2}{t} + 16rst^2$$

$$\frac{dV}{dt} = \frac{t(0) - (4r + s^2)(1)}{t^2} + 32rst$$

$$= \frac{-4r - s^2}{t^2} + 32rst$$

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$$24. \quad \begin{array}{ll} u(2) = 3 & v(2) = 1 \\ u'(2) = -4 & v'(2) = 2 \end{array}$$

$$a. \quad \frac{d}{dx}(uv) = u \cdot v' + v \cdot u' \\ = 3 \cdot 2 + 1(-4) = 6 - 4 = 2$$

$$b. \quad \frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \cdot u' - u \cdot v'}{v^2} = \frac{1(-4) - 3(2)}{1} = -10$$

$$d. \quad \frac{d}{dx}(3u - 2v + 2uv) \\ = 3u' - 2v' + 2(u \cdot v' + v \cdot u') \\ = 3(-4) - 2(2) + 2(2) \\ = -12$$

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