

3.3 HW Solutions

$$1. f'(x) = x^2 + x + 1$$

$$2. \frac{dy}{dx} = -1 + 2x - 3x^2 + \frac{5}{2}x^{-1/2} + 30x^{-6}$$

$$3. g'(x) = \frac{(3x-2)(2) - (2x+5)(3)}{(3x-2)^2}$$

$$4. \frac{dy}{dx} = \frac{(7x^5 - 2x)(15x^2 - 2 - x^{-2}) - (5x^3 - 2x + \frac{1}{x})(35x^4 - 2)}{(7x^5 - 2x)^2}$$

$$5. h'(x) = (x^2 + 1)(3x^2 + 5) + (x^3 + 5x - 4)(2x)$$

$$6. \frac{dy}{dx} = (3x^{-2} + 5x^2 - x)\left(\frac{1}{2}x^{-1/2} + 2\right) + (\sqrt{x} + 2x - 1)(-6x^{-3} + 10x - 1)$$

$$7. f'(x) = \frac{(4x^{-2} - 8x)\left(x^{-1/2} + \frac{1}{2}x^{-3/2}\right) - (2\sqrt{x} - \frac{1}{\sqrt{x}} + 3)(-8x^{-3} - 8)}{(4x^{-2} - 8x)^2}$$

$$8. \frac{dy}{dx} = 3x^2 - 4x + 1 = 0 \quad \rightarrow \quad x = \frac{1}{3} \text{ or } x = 1$$

$$(3x - 1)(x - 1) = 0$$

$$9. \frac{dy}{dx} = f'(x) = 4x^3 + 3x^2 - 4x + 1$$

$$\frac{d^2y}{dx^2} = f''(x) = 12x^2 + 6x - 4$$

$$\frac{d^3y}{dx^3} = f'''(x) = 24x + 6$$

$$\frac{d^4y}{dx^4} = f^{(4)}(x) = 24$$

$$10. \frac{dy}{dx} = 3x^2 + 1 = 4$$

$$3x^2 = 3$$

$$x^2 = 1 \quad x = \pm 1$$

$$y(1) = (1)^3 + (1) = 2$$

$$y(-1) = (-1)^3 + (-1) = -2$$

$y - 2 = 4(x - 1)$
$y + 2 = 4(x + 1)$

✓ 11. $\frac{dy}{dx} = 6x^2 - 6x - 12 = 0 \leftarrow \text{parallel to } x\text{-axis}$

$$x^2 - x - 2 = 0 \quad y(2) = 0 \rightarrow (2, 0)$$

$$(x-2)(x+1) = 0 \quad y(-1) = 27 \rightarrow (-1, 27)$$

$$x = 2 \quad x = -1$$

✓ 12. $\frac{dy}{dx} = 3x^2 \quad \left. \frac{dy}{dx} \right|_{x=-2} = 3(-2)^2 = 12 \quad y(-2) = (-2)^3 = -8$

$$\boxed{y + 8 = 12(x + 2)}$$

✓ 13. $\frac{dy}{dx} = \frac{(x^2+1)(4) - 4x(2x)}{(x^2+1)^2}$

$$\left. \frac{dy}{dx} \right|_{x=0} = \frac{4}{1} = 4 \quad y(0) = 0 \quad \boxed{y = 4x}$$

$$\left. \frac{dy}{dx} \right|_{x=1} = 0 \quad y(1) = 2 \quad y - 2 = 0(x) \rightarrow \boxed{y = 2}$$