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

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

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

$(3x - 1)(x - 1) = 0$ ⟶ $x = \frac{1}{3}$ or $x = 1$

✓

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. $\frac{dy}{dx} = 6x^2 - 6x - 12 = 0$ ← parallel to x-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. $\frac{dy}{dx} = 3x^2 \qquad \left.\frac{dy}{dx}\right|_{x=-2} = 3(-2)^2 = 12 \qquad y(-2) = (-2)^3 = -8$

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

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

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

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