

Homework #1

1. $y = x^7 + x^3$; $y' = 7x^6 + 3x^2$

2. $y = 5x^8$; $y' = 40x^7$

3. $y = 6\sqrt{x} = 6x^{1/2}$; $y' = 3x^{-1/2} = \frac{3}{\sqrt{x}}$

4. $y = x^7 + 3x^5 + 1$; $y' = 7x^6 + 15x^4$

5. $y = \frac{3}{x} = 3x^{-1}$; $y' = -3x^{-2} = -\frac{3}{x^2}$

6. $y = x^4 - \frac{4}{x} = x^4 - 4x^{-1}$; $y' = 4x^3 + 4x^{-2} = 4x^3 + \frac{4}{x^2}$

7. $y = \frac{3}{4}x^{4/3} + \frac{4}{3}x^{3/4}$; $y' = x^{1/3} + x^{-1/4}$

8. $y = \frac{1}{4\sqrt{x}} = x^{-1/4}$; $y' = -\frac{1}{4}x^{-5/4} = -\frac{1}{4x^{5/4}}$

9. $f(x) = 5$; $f'(x) = \emptyset$ (constants differentiate to zero)

10. $f(x) = \frac{5x}{2} - \frac{2}{5x} = \frac{5}{2}x - \frac{2}{5}x^{-1}$; $f'(x) = \frac{5}{2} + \frac{2}{5}x^{-2} = \frac{5}{2} + \frac{2}{5x^2}$

11. $f(t) = t^{10} - 10t^9$; $f'(t) = 10t^9 - 90t^8$

12. $g(t) = 3\sqrt{t} - \frac{3}{\sqrt{t}} = 3t^{1/2} - 3t^{-1/2}$; $g'(t) = \frac{3}{2}t^{-1/2} + \frac{3}{2}t^{-3/2}$

13. $h(t) = 3\sqrt{2}$; $h'(t) = \emptyset$ (constants differentiate to zero)

14. $g(p) = 4p^{0.7}$; $g'(p) = 2.8p^{-0.3}$

15. $h(x) = \frac{3}{2}x^{3/2} - 6x^{2/3}$; $h'(x) = \frac{9}{4}x^{1/2} - 4x^{-1/3}$

$$16. \frac{d}{dx} (x^4 - 2x^2) = \boxed{(4x^3 - 4x) dx}$$

$$17. \frac{d}{dt} (t^{5/8} + 2t^{3/8} - t^{1/2}) = \boxed{\left(\frac{5}{8}t^{3/8} + 3t^{1/8} - \frac{1}{2}t^{-1/2}\right) dt}$$

$$18. \frac{d}{dn} (n^{-5}) = \boxed{-5n^{-6} dn}$$

$$19. \frac{d}{dt} (2\sqrt{t}) = \frac{d}{dt} (2t^{1/2}) = \boxed{t^{-1/2} dt = \frac{dt}{\sqrt{t}}}$$

$$20. \frac{d}{dx} \left(\frac{x^3 - 4x^2 + 3}{x} \right) = \frac{d}{dx} (x^2 - 4x + 3x^{-1}) = \boxed{(2x - 4 - 3x^{-2}) dx}$$

$$= \boxed{\left(2x - 4 - \frac{3}{x^2}\right) dx}$$

$$21. \int x(1+x^3) dx = \int (x + x^4) dx = \boxed{\frac{1}{2}x^2 + \frac{1}{5}x^5 + C}$$

$$22. \int x^{1/3} (2-x)^2 dx = \int x^{1/3} (4 - 4x + x^2) dx = \int (4x^{1/3} - 4x^{4/3} + x^{7/3}) dx$$

$$= \boxed{3x^{4/3} - \frac{12}{7}x^{7/3} + \frac{3}{10}x^{10/3} + C}$$

$$23. \int \frac{x^6 + 2x^2 - 1}{x^2} dx = \int (x^4 + 2 - x^{-2}) dx = \boxed{\frac{1}{5}x^5 + 2x + x^{-1} + C}$$

$$= \boxed{\frac{1}{5}x^5 + 2x + \frac{1}{x} + C}$$

$$24. \int (x^{-3} + \sqrt{x} - 3x^{1/4} + x^2) dx = \int (x^{-3} + x^{1/2} - 3x^{1/4} + x^2) dx$$

$$= \boxed{-\frac{1}{2}x^{-2} + \frac{2}{3}x^{3/2} - \frac{12}{5}x^{5/4} + \frac{1}{3}x^3 + C}$$

$$25. \int_2^3 (1 - \frac{1}{2}x) dx = \left(x - \frac{1}{4}x^2\right) \Big|_2^3 = \left(3 - \frac{9}{4}\right) - \left(2 - 1\right) = \boxed{-\frac{1}{4}}$$

$$26. \int_{-10}^{-5} 6 dx = 6x \Big|_{-10}^{-5} = -30 - (-60) = \boxed{30}$$

$$27. \int_{-3}^0 (x^2 - 4x + 7) dx = \left(\frac{1}{3}x^3 - 2x^2 + 7x\right) \Big|_{-3}^0$$

$$= 0 - (-9 - 18 - 21) = \boxed{48}$$

Homework #1 (cont.)

$$\begin{aligned} 28. \int_4^9 (2x\sqrt{x}) dx &= \int_4^9 (2x \cdot x^{1/2}) dx = \int_4^9 (2x^{3/2}) dx = \frac{4}{5} x^{5/2} \Big|_4^9 \\ &= \frac{4}{5} x^2 \sqrt{x} \Big|_4^9 = \frac{4}{5} (81)(3) - \frac{4}{5} (16)(2) = \frac{972}{5} - \frac{128}{5} \\ &= \boxed{\frac{844}{5} = 168 \frac{4}{5}} = 168.8 \end{aligned}$$

$$\begin{aligned} 29. \int_1^3 \frac{1}{x^2} dx &= \int_1^3 x^{-2} dx = -x^{-1} \Big|_1^3 = -\frac{1}{x} \Big|_1^3 = -\frac{1}{3} - (-1) \\ &= \boxed{2/3} \end{aligned}$$

$$\begin{aligned} 30. \int_{-1}^0 \frac{x^2 - x + 3}{\sqrt[3]{x}} dx &= \int_{-1}^0 x^{-1/3} (x^2 - x + 3) dx = \int_{-1}^0 (x^{5/3} - x^{2/3} + 3x^{-1/3}) dx \\ &= \left(\frac{3}{8} x^{8/3} - \frac{3}{5} x^{5/3} + \frac{9}{2} x^{2/3} \right) \Big|_{-1}^0 = 0 - \left(\frac{3}{8} + \frac{3}{5} + \frac{9}{2} \right) \\ &= - \left(\frac{15 + 24 + 180}{40} \right) = \boxed{-\frac{219}{40} = -5 \frac{19}{40}} = -5.475 \end{aligned}$$