

Section 6.4: 1-39 odd

$$1. y = \int_0^x \sin^2 t \, dt \Rightarrow \frac{dy}{dx} = \sin^2 x$$

$$3. y = \int_0^x (t^3 - t)^5 \, dt \Rightarrow (x^3 - x)^5 = \frac{dy}{dx}$$

$$5. y = \int_2^x (\tan^3 u) \, du \Rightarrow \tan^3 x = \frac{dy}{dx}$$

$$7. y = \int_7^x \frac{1+t}{1+t^2} \, dt \Rightarrow \frac{1+x}{1+x^2} = \frac{dy}{dx}$$

$$9. y = \int_0^{x^2} e^{t^2} \, dt \Rightarrow \frac{dy}{dx} = e^{(x^2)^2} \cdot 2x = 2xe^{x^4}$$

$$11. y = \int_2^{5x} \frac{\sqrt{1+u^2}}{u} \, du \Rightarrow \frac{dy}{dx} = \frac{\sqrt{1+25x^2}}{\cancel{x}} \cdot \cancel{x} = \frac{\sqrt{1+25x^2}}{x}$$

$$13. y = \int_x^6 \ln(1+t^2) \, dt = -\int_6^x \ln(1+t^2) \, dt \Rightarrow \frac{dy}{dx} = -\ln(1+x^2)$$

$$15. y = \int_{x^3}^5 \frac{\cos t}{t^2+2} \, dt = -\int_5^{x^3} \frac{\cos t}{t^2+2} \, dt \Rightarrow \frac{-\cos(x^3) \cdot 3x^2}{x^6+2} = \frac{dy}{dx}$$

$$17. y = \int_{\sqrt{x}}^x \sin(t^2) \, dt \Rightarrow \frac{dy}{dx} = \sin x^2 - \sin(\sqrt{x})^2 \cdot \frac{1}{2} x^{-1/2} = \sin(x^2) - \frac{\sin x}{2\sqrt{x}}$$

$$19. y = \int_{x^2}^{x^3} \cos(2t) \, dt \Rightarrow \cos(2x^3) \cdot 3x^2 - \cos(2x^2) \cdot 2x = \frac{dy}{dx}$$

$$21. \frac{dy}{dx} = \sin^3 x, y=0 \text{ when } x=5 \Rightarrow y = \int_5^x \sin^3 t \, dt$$

$$23. \frac{dy}{dx} = \ln(\sin x + 5), y=3 \text{ when } x=2 \Rightarrow y = \int_2^x \ln(\sin t + 5) \, dt + 3$$

$$25. \frac{dy}{dx} = \cos^2 5x, \quad y = -2 \text{ when } x = 7 \rightarrow y = \int_7^x \cos^2 5t \, dt - 2$$

$$27. \int_{1/2}^3 \left(2 - \frac{1}{x}\right) dx = \left. 2x - \ln x \right|_{1/2}^3 = (2 \cdot 3 - \ln 3) - (2 \cdot 1/2 - \ln 1/2) = 6 - \ln 3 - 1 + \ln 1/2 \\ = 5 + \ln 1/2 - \ln 3 \approx 3.208$$

$$29. \int_0^1 (x^2 + x^{1/2}) dx = \left. \frac{1}{3}x^3 + \frac{2}{3}x^{3/2} \right|_0^1 = \left(\frac{1}{3} + \frac{2}{3}\right) - (0 + 0) = 1 - 0 = 1$$

$$31. \int_1^{32} x^{-6/5} dx = \left. -5x^{-1/5} \right|_1^{32} = \left. \frac{-5}{\sqrt[5]{x}} \right|_1^{32} = \frac{-5}{\sqrt[5]{32}} - \frac{-5}{\sqrt[5]{1}} = \frac{-5}{2} + \frac{5}{1} = \frac{5}{2}$$

$$33. \int_0^{\pi} \sin x \, dx = \left. -\cos x \right|_0^{\pi} = -\cos \pi - (-\cos 0) = -(-1) + 1 = 1 + 1 = 2$$

$$35. \int_0^{\pi/3} 2 \sec^2 \theta \, d\theta = \left. 2 \tan \theta \right|_0^{\pi/3} = 2 \tan \frac{\pi}{3} - 2 \tan 0 = 2 \cdot \sqrt{3} - 2 \cdot 0 = 2\sqrt{3}$$

$$37. \int_{\pi/4}^{3\pi/4} \csc x \cot x \, dx = \left. -\csc x \right|_{\pi/4}^{3\pi/4} = \left. \frac{-1}{\sin x} \right|_{\pi/4}^{3\pi/4} = \frac{-1}{1/\sqrt{2}} - \frac{-1}{1/\sqrt{2}} = -\sqrt{2} + \sqrt{2} = 0$$

$$39. \int_{-1}^1 (r+1)^2 dr = \int_{-1}^1 (r^2 + 2r + 1) dr = \left. \frac{1}{3}r^3 + r^2 + r \right|_{-1}^1 = \left(\frac{1}{3} + 1 + 1\right) - \left(-\frac{1}{3} + 1 - 1\right) \\ \frac{1}{3} + 2 + \frac{1}{3} = \frac{8}{3}$$