

4.4A The FTC

pp 284-287 (5-39 odds, omit 9, 19, 25, 37)

$$5. \int_0^1 2x dx = 2 \left[ \frac{x^2}{2} \right]_0^1 = x^2 \Big|_0^1 = 1^2 - 0^2 = \boxed{1}$$

$$7. \int_1^0 (x-2) dx = \left[ \frac{x^2}{2} - 2x \right]_1^0 = \left( \frac{0^2}{2} - 2 \cdot 0 \right) - \left( \frac{1^2}{2} - 2(1) \right) = -\left( \frac{1}{2} + 2 \right) = \boxed{-\frac{5}{2}}$$

omit 9.  $\int_1^3 (t^2-2) dt = \left[ \frac{t^3}{3} - 2t \right]_1^3 = \left( \frac{3^3}{3} - 2 \cdot 3 \right) - \left( \frac{1^3}{3} - 2(1) \right) = \left( \frac{27}{3} - 6 \right) - \left( \frac{1}{3} - 2 \right) = \boxed{-\frac{10}{3}}$

$$11. \int_0^1 (2t-1)^2 dt = \int_0^1 (4t^2 - 4t + 1) dt = \left[ \frac{4t^3}{3} - \frac{4t^2}{2} + t \right]_0^1 = \boxed{\frac{1}{3}}$$

$$\left( \frac{4 \cdot 1^3}{3} - \frac{4 \cdot 1^2}{2} + 1 \right) - \left( \frac{4 \cdot 0^3}{3} - \frac{4 \cdot 0^2}{2} + 0 \right)$$

$$13. \int_1^4 \left( \frac{3}{x^2} - 1 \right) dx = \int_1^4 (3x^{-2} - 1) dx = \left[ \frac{3x^{-1}}{-1} - x \right]_1^4 = \left[ -\frac{3}{x} - x \right]_1^4 = \left( -\frac{3}{4} - 4 \right) - \left( -\frac{3}{1} - 1 \right) = (-3.5) - (-4) = \boxed{\frac{1}{2}}$$

$$15. \int_1^4 \frac{u-2}{\sqrt{u}} du = \int_1^4 \left( \frac{u}{u^{1/2}} - \frac{2}{u^{1/2}} \right) du = \int_1^4 (u^{1/2} - 2u^{-1/2}) du = \left[ \frac{2u^{3/2}}{3} - 2 \cdot 2u^{1/2} \right]_1^4$$

$$\left[ \frac{2}{3} u^{3/2} - 4u^{1/2} \right]_1^4 = \left( \frac{2}{3} \cdot 4^{3/2} - 4 \cdot 4^{1/2} \right) - \left( \frac{2}{3} \cdot 1^{3/2} - 4 \cdot 1^{1/2} \right) = \left( -\frac{8}{3} \right) - \left( -\frac{10}{3} \right) = \boxed{\frac{2}{3}}$$

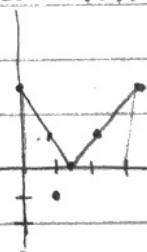
$$17. \int_1^4 (\sqrt[3]{t} - 2) dt = \int_1^4 (t^{1/3} - 2) dt = \left[ \frac{3t^{4/3}}{4} - 2t \right]_1^4 = \left( \frac{3}{4} \cdot 4^{4/3} - 2 \cdot 4 \right) - \left( \frac{3}{4} \cdot 1^{4/3} - 2 \cdot 1 \right) = \left( -\frac{5}{4} \right) - \left( \frac{1}{4} \right) = -\frac{6}{4} = \boxed{-\frac{3}{2}}$$

omit 19.  $\int_0^1 x - \sqrt{x} dx = \frac{1}{3} \int_0^1 (x - x^{1/2}) dx = \frac{1}{3} \left[ \frac{x^2}{2} - \frac{2x^{3/2}}{3} \right]_0^1 = \frac{1}{3} \left[ \left( \frac{1}{2} - \frac{2}{3} \right) - \left( \frac{0}{2} - \frac{0}{3} \right) \right] = \left( \frac{1}{5} \right) \left( -\frac{1}{6} \right) = \boxed{-\frac{1}{30}}$

$$21. \int_{-1}^0 (t^{1/3} - t^{2/3}) dt = \left[ \frac{3t^{4/3}}{4} - \frac{3t^{5/3}}{5} \right]_{-1}^0 = \left( \frac{3 \cdot 0^{4/3}}{4} - \frac{3 \cdot 0^{5/3}}{5} \right) - \left( \frac{3(-1)^{4/3}}{4} - \frac{3(-1)^{5/3}}{5} \right)$$

$$0 - \left( \frac{3}{4} + \frac{3}{5} \right) = \boxed{-\frac{27}{20}}$$

$$23. \int_0^3 |2x-3| dx = \int_0^{1.5} (-2x+3) dx + \int_{1.5}^3 (2x-3) dx = 2 \int_0^{1.5} (-2x+3) dx =$$



$$2 \left[ \frac{-2x^2 + 3x}{2} \right]_0^{1.5} = 2 \left[ -x^2 + 3x \right]_0^{1.5} =$$

$$2 \left[ (-1.5^2 + 3 \cdot 1.5) - (-0^2 + 3 \cdot 0) \right] = \boxed{\frac{9}{2}}$$

$$A = 2 \cdot \frac{1}{2} b h$$

$$A = 2 \cdot \frac{1}{2} \cdot 1.5 \cdot 2 = 4.5 = \boxed{\frac{9}{2}}$$

$$27. \int_0^{\pi} (1 + \sin x) dx = \left[ x - \cos x \right]_0^{\pi} = (\pi - \cos \pi) - (0 - \cos 0) =$$

$$\pi - (-1) + 1 = \boxed{2 + \pi}$$

$$29. \int_{-\pi/6}^{\pi/6} \sec^2 x dx = \left[ \tan x \right]_{-\pi/6}^{\pi/6} = \tan \pi/6 - \tan(-\pi/6) = \frac{\sqrt{3}}{3} - \left( -\frac{\sqrt{3}}{3} \right) = \boxed{\frac{2\sqrt{3}}{3}}$$

$$31. \int_{-\pi/3}^{\pi/3} 4 \sec \theta \tan \theta d\theta = 4 \left[ \sec \theta \right]_{-\pi/3}^{\pi/3} = 4 \sec \theta \Big|_{-\pi/3}^{\pi/3}$$

$$4 \left( \sec \frac{\pi}{3} - \sec \left( -\frac{\pi}{3} \right) \right)$$

$$4 \left( \frac{1}{2} - \frac{1}{2} \right) = \boxed{0}$$

$$33. \frac{dV}{dt} = 10,000(t-6) \quad 0 \leq t \leq 5$$

$$\int_0^5 10,000(t-6) dt = 10,000 \int_0^5 (t-6) dt = 10,000 \left( \frac{t^2}{2} - 6t \right) \Big|_0^5$$

$$10,000 \left[ \left( \frac{3^2}{2} - 6 \cdot 3 \right) - \left( \frac{0^2}{2} - 6 \cdot 0 \right) \right] = \boxed{-135,000}$$

$$35. \int_0^1 (x-x^2) dx = \left[ \frac{x^2}{2} - \frac{x^3}{3} \right]_0^1 = \left( \frac{1^2}{2} - \frac{1^3}{3} \right) - \left( \frac{0^2}{2} - \frac{0^3}{3} \right) = \boxed{\frac{1}{6}}$$

omit 37.  $y = (3-x)\sqrt{x} = (3-x)x^{1/2} = 3x^{1/2} - x^{3/2}$

$$\int_0^3 (3x^{1/2} - x^{3/2}) dx = \left[ 2 \cdot \frac{3x^{3/2}}{3} - \frac{2x^{5/2}}{5} \right]_0^3 = \left[ 2x^{3/2} - \frac{2}{5}x^{5/2} \right]_0^3 \approx \boxed{4.157}$$

$$(2 \cdot 3^{3/2} - \frac{2}{5} \cdot 3^{5/2}) - (2 \cdot 0^{3/2} - \frac{2}{5} \cdot 0^{5/2})$$

$$39. y = \cos x \quad \int_0^{\pi/2} \cos x dx = \sin x \Big|_0^{\pi/2} = \sin\left(\frac{\pi}{2}\right) - \sin(0) = 1 - 0 = \boxed{1}$$