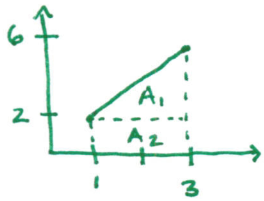
3. find the area under $f(x) = 2x$ on $[1,3]$ using the FTC. Then verify using geometry.

$$\text{Area} = \int_1^3 2x\,dx = x^2\Big|_1^3 = 3^2 - 1^2 = 9 - 1 = 8$$



$$\text{Area} = A_1 + A_2$$
$$= \tfrac{1}{2}(2)(4) + 2(2)$$
$$= 4 + 4 = 8$$

8. find the area under $f(x) = 4x - x^2$ on $[0,4]$

$$\text{Area} = \int_0^4 (4x - x^2)\,dx$$
$$= 2x^2 - \tfrac{1}{3}x^3\Big|_0^4$$
$$= \left(2\cdot 4^2 - \tfrac{1}{3}\cdot 4^3\right) - 0$$
$$= 32 - \tfrac{1}{3}\cdot 64$$
$$= 32/3 \quad \text{OR} \quad 10.\overline{6}$$

18. $\int_{-1}^{2} -2\,dx$

$$= -2x\Big|_{-1}^{2} = [-2(2)] - [-2(-1)]$$
$$= -4 - 2 = -6$$

22. $\int_0^2 8x^3\,dx$

$$= 2x^4\Big|_0^2 = [2\cdot 2^4] - [2\cdot 0^4]$$
$$= 32$$

30. $\int_1^3 \frac{2}{x}\,dx$

$$= 2\ln x\Big|_1^3 = 2\ln 3 - 2\ln 1$$
$$= 2\ln 3$$

34. $\int_{-1}^{1} (x^2-1)^2\,dx$

$$= \int_{-1}^{1} (x^4 - 2x^2 + 1)\,dx = \tfrac{1}{5}x^5 - \tfrac{2}{3}x^3 + x\Big|_{-1}^{1}$$
$$= \left(\tfrac{1}{5} - \tfrac{2}{3} + 1\right) - \left(-\tfrac{1}{5} + \tfrac{2}{3} - 1\right) = \frac{16}{15} \quad \text{or} \quad 1.0\overline{6}$$

38. $\int_0^1 \sqrt{2x}\left(\sqrt{x} + \sqrt{2}\right)dx$

$$= \int_0^1 \sqrt{2x^2} + \sqrt{4x}\;dx$$
$$= \int_0^1 \sqrt{2}\,x + 2\sqrt{x}\;dx$$
$$= \frac{\sqrt{2}}{2}x^2 + \frac{4}{3}x^{3/2}\Big|_0^1$$
$$= \left(\frac{\sqrt{2}}{2} + \frac{4}{3}\right) - 0 = \frac{3\sqrt{2} + 8}{6} = 2.04044$$

39. $\int_1^4 \frac{3x^3 - 2x^2 + 4}{x^2}\,dx$

$$= \int_1^4 3x - 2 + 4x^{-2}\,dx$$
$$= \tfrac{3}{2}x^2 - 2x - 4x^{-1}\Big|_1^4$$
$$= \left(\tfrac{3}{2}\cdot 16 - 8 - 1\right) - \left(3/2 - 2 - 4\right)$$
$$= (24 - 9) - 3/2 + 6 = \frac{39}{2} \;\overset{\text{or}}{=}\; 19.5$$

43. $P'(x) = -.0003x^2 + .02x + 2$

(a) find $P(200)$

$$P(200) - P(0) = \int_0^{200} P'(x)\,dx$$
$$P(200) = \int_0^{200} P'(x)\,dx + P(0)$$
$$= \int_0^{200} (-.0003x^2 + .02x + 2)\,dx - 800$$
$$= (-.0001x^3 + .01x^2 + 2x)\Big|_0^{200} - 800$$
$$= (3600 - 0) - 800$$
$$= 2800$$

(b) find $P(220) - P(200)$

$$P(220) - P(200) = \int_{200}^{220} P'(x)\,dx$$
$$= -.0001x^3 + .01x^2 + 2x\Big|_{200}^{220}$$
$$= 3819.2 - 3600$$
$$= 219.2$$

47. $v(t) = -t^2 + 20t + 440, \quad 0 \le t \le 20$
find distance over $[0,20]$

$$\text{distance} = \int_0^{20} v(t)$$
$$= \int_0^{20} (-t^2 + 20t + 440)\,dt$$
$$= -\tfrac{1}{3}t^3 + 10t^2 + 440t\Big|_0^{20}$$
$$= -\tfrac{1}{3}(20)^3 + 10(20)^2 + 440(20)$$
$$= 10133.\overline{3} \;\overset{\text{or}}{=}\; \frac{30400}{3}$$