

$$\textcircled{19} \quad V(t) = 40(1 - e^{-2t}) \quad s(0) = 0 \quad b = 4$$

$$\int_0^4 40(1 - e^{-2t}) dt$$

$$\textcircled{37} \quad \lim_{n \rightarrow \infty} \left[ \frac{1}{b-a} \sum_{i=1}^n f(x_i) \Delta x \right] \quad f(x) = x^2 - 1 \quad [1, 3]$$

$$\Delta x = \frac{3-1}{n} = \frac{2}{n}$$

$$\sum_{i=1}^n \left( \frac{4i^2}{n^2} + \frac{4i}{n} \right) \frac{2}{n} \quad x_i = 1 + \frac{2}{n} i = 1 + \frac{2i}{n}$$

$$f(x_i) = \left( 1 + \frac{2i}{n} \right)^2 - 1 = \frac{4i^2}{n^2} + \frac{4i}{n} + 1 - 1$$

$$\frac{8}{n^3} \sum_{i=1}^n i^2 + \frac{8}{n^2} \sum_{i=1}^n i$$

$$\frac{4}{n} \left( \frac{(n+1)(2n+1)}{6} \right) + \frac{4}{n} \left( \frac{(n+1)}{2} \right) \quad \frac{1}{b-a} = \frac{1}{3-1} = \frac{1}{2}$$

$$\frac{1}{2} \left( \frac{8n^3}{3n^2} + \frac{12n^2}{3n^2} + \frac{4}{3n^2} + \frac{4n}{n} + \frac{4}{n} \right)$$

$$\lim_{n \rightarrow \infty} \left( \frac{4n^2}{3n^2} + \frac{2n^0}{n^2} + \frac{2^0}{3n^2} + \frac{2n}{n} + \frac{2^0}{n} \right) = \frac{4}{3} + 2$$

$$= \frac{10}{3}$$

$$(47) \quad b(t) = 410 - .3t \quad a(t) = 390 + .2t$$

$$\int_0^{12} [b(t) - a(t)] dt = \int_0^{12} b(t) dt - \int_0^{12} a(t) dt$$

$\downarrow$        $\downarrow$

$b(t) > a(t)$        $\frac{\text{total # of births}}{\text{12 months}} - \frac{\text{total # of deaths}}{\text{12 months}}$

$$410 - .3t > 390 + .2t$$

$$20 > .5t$$

$$40 > t$$

Incr.  $t \leq 40$  months

decr.  $t > 40$  months

max  
 $t = 40$

$$(22) \quad \int_0^2 [3x^2] dx = 8$$

$a = 0$   
 $b = 2$

$$f(a) = \frac{1}{b-a} \int_a^b f(x) dx$$

$\frac{1}{b-a} = \frac{1}{2-0}$

$$f(a) = \frac{1}{2} \cdot 8 = 4$$

$$f(c) = 3c^2 = 4$$

$$c^2 = \frac{4}{3}$$

$$c = \pm \sqrt{\frac{4}{3}} = \pm \frac{2}{\sqrt{3}}$$

$$(7) \quad \int_1^3 (x^2 - 3) dx$$

$\Delta x = \frac{3-1}{n} = \frac{2}{n}$   
 $x_i = 1 + \frac{2i}{n}$

$$\sum_{i=1}^n \left( \frac{(1+2i)^2 - 3}{n^2} \right) \frac{2}{n}$$

$f(x_i) = (1+\frac{2i}{n})^2 - 3$   
 $= \frac{4i^2}{n^2} + \frac{4i}{n} - 3$

$$\frac{8}{n^3} \sum_{i=1}^n i^2 + \frac{8}{n^2} \sum_{i=1}^n i - \frac{1}{n} \sum_{i=1}^n 4$$

$$\frac{8}{n^3} \left( \frac{(n+1)(2n+1)}{6} \right) + \frac{8}{n^2} \left( \frac{(n+1)n}{2} \right) - \frac{1}{n} (4n)$$

$$\lim_{n \rightarrow \infty} \left( \frac{8n^3}{3n^3} + \frac{10n^2}{6n^2} + \frac{4n}{6n^2} + \frac{4n}{n} + \frac{4}{n} - 4 \right)$$

$$= \frac{8}{3} + 4 - 4 = \left( \frac{8}{3} \right)$$