

## ANSWER KEY

1. (a)  $\frac{1}{2}$  (b) 0 (c) -1 (d)  $\frac{1}{6}$  (e)  $1 - \cos 1$
2. (a)  $y = (x^{4/3} + C)^{3/4}$   
 (b)  $x(t) = A \sin \omega t + B \cos \omega t$   
 (c)  $x(t) = -\frac{g}{2}t^2 + v_0 t + x_0$
3. 22:  $x(t) = -\frac{k}{2}t^2 + v_0 t$ , set  $v(t^*) = -kt^* + v_0 = 0$  solve for  $t^* = \frac{v_0}{k}$ ,  $x(t^*) = \frac{v_0^2}{2k}$
- 35: (a)  $\frac{dV}{dt} = k\sqrt{V}$ ,  $V(0) = 1600, V(40) = 0$  (b)  $V(t) = (40-t)^2$  (c)  $V(10) = 900$ .
- 36: (a)  $\frac{dP}{dt} = kP^{1/3}, P(1980) = 1000, P(1990) = 1700$  .  
 (b)  $P(t) = (\frac{2}{3}(kt + C))^{3/2}$   

$$k = \frac{3}{20}(1700^{2/3} - 1000^{2/3}) \approx 6.36.$$
  

$$C = \frac{3}{20}(1990 \cdot 1000^{2/3} - 1980 \cdot 1700^{2/3}) \approx -12454.74$$
- (c) In the year 2017.
4. (a) integrable -  $f(x)$  is bounded and continuous  
 (b) not integrable -  $f(x) \sim \frac{1}{x^{3/2}}$  as  $x \rightarrow 0$ ,  $3/2 > 1$   
 (c) not integrable - integral depends on choice of sample points
5.  $\int_1^2 (3x^2 - 2)dx = 3 \int_1^2 x^2 dx - 2$ ,  $x_i = 1 + \frac{i}{n}$ ,  $\Delta x = \frac{1}{n}$ ,  
 $\int_1^2 x^2 dx = \lim_{n \rightarrow \infty} \sum_{i=1}^n x_i^2 \Delta x$ , final answer = 5
6. (a) 16/3 (b) 1 (c)  $-11\frac{1}{3}$   
 (d)  $\int_0^\pi \sin^2 x dx = \frac{1}{2} \int_0^\pi (\sin^2 x + \cos^2 x) dx = \pi/2$   
 (e)  $\frac{1}{2}(\sin \pi(\pi + 1))$  (f) 0
7.  $2x \tan x^2$