

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. $2x \tan x^2$