Evaluate.

$$\int_2^5 (5x^3+9)\,dx = \frac{5x^4}{4} + 9x \Big|_2^5 =$$

$$\left[\frac{5(5)^4}{4} + 9(5)\right] - \left[\frac{5(2)^4}{4} + 9(2)\right] =$$

$$\left[\frac{3125}{4} + \frac{180}{4}\right] - \left[\frac{80}{4} + \frac{72}{4}\right] =$$

$$\frac{3125 + 180 - 80 - 72}{4} = \frac{3153}{4}$$

Evaluate.

$$\int_1^9 (\sqrt{x} - 2)\,dx = \int_1^9 \left(x^{\frac{1}{2}} - 2\right) dx =$$

$$\left[\frac{x^{3/2}}{3/2} - 2x\right]_1^9 = \left[\frac{2}{3}x^{3/2} - 2x\right]_1^9$$

$$\left[\frac{2}{3}(27) - 18\right] - \left[\frac{2}{3}(1) - 2\right] =$$

$$0 - \left(\frac{2}{3} - \frac{6}{3}\right) = 0 - \left(\frac{-4}{3}\right)$$

$$= \frac{4}{3}$$

Find s(t), where s(t) represents the position function and v(t) represents the velocity function.

$v(t) = 12t^2$, $s(0) = 6$

$$s(t) = \int 12t^2\,dt = \frac{12t^3}{3} + C$$

$$= 4t^3 + C$$

$$s(0) = 6 \Rightarrow s(0) = 4(0)^3 + C \Rightarrow 6 = C$$

$$s(t) = 4t^3 + 6$$

Find s(t), where s(t) represents the position function, v(t) represents the velocity function, and a(t) represents the acceleration function.

$a(t) = -6t + 4$, with $v(0) = 9$ and $s(0) = 6$

$$v(t) = \int(-6t+4)\,dt = -\frac{6t^2}{2} + 4t + C$$

$$v(0) = C \Rightarrow v(0) = 9 \Rightarrow C = 9$$

$$v(t) = -3t^2 + 4t + 9$$

$$s(t) = \int(-3t^2 + 4t + 9)\,dt = \frac{-3t^3}{3} + \frac{4t^2}{2} + 9t + k$$

$$= -t^3 + 2t^2 + 9t + k$$

$$s(0) = k \;;\; s(0) = 6 \Rightarrow k = 6$$

$$s(t) = -t^3 + 2t^2 + 9t + 6$$

If a race car increases speed at constant acceleration so that it goes from 0 to 120 miles per hour in 5 seconds, how far has the car traveled during the 5 seconds?

$$a(t) = \frac{v(5) - v(0)}{5 - 0} = \frac{(120 - 0)\,mph}{(5)\,sec}$$

$$= \frac{120\,\cancel{mi}}{\cancel{hr} \cdot sec} \cdot \frac{1\,\cancel{hr}}{3600\,sec} \cdot \frac{5280\,ft}{1\,\cancel{mi}}$$

$$= \frac{176\,ft}{sec^2}$$

```
120*5280/3600
                176
```

$$v(t) = \int 176\,dt = 176t + C^{\nearrow 0}$$

since $v(0) = 0$

$$v(t) = 176t$$

$$s(t) = \int 176t\,dt = \frac{176t^2}{2} + k$$

since $s(0) = 0$

$$= 88t^2 + k^{\nearrow 0}$$

$$s(t) = 88t^2$$

$$s(5) = 88(5)^2 = 2200 \text{ feet}$$

A particle is released as part of an experiment. Its speed t seconds after release is given by $v(t) = -0.6t^2 + 4t$, where $v(t)$ is in meters per second.

a) How far does the particle travel during the first 2 sec?
b) How far does it travel during the second 2 sec?

$$s(t) = \int(-0.6t^2 + 4t)\,dt$$

$$= \frac{-0.6t^3}{3} + \frac{4t^2}{2} + \cancel{c}^{\,0}$$

$$s(t) = -0.2t^3 + 2t^2$$

a) $s(2) - s(0) = -0.2(2)^3 + 2(2)^2$

$= -1.6 + 8 = 6.4\text{ m}$

b) $s(4) - s(2) =$

$s(4) = -0.2(4)^3 + 2(4)^2$

$= -0.2(64) + 32$

$= -12.8 + 32 = 19.2\text{ m}$

$s(4) - s(2) = (19.2 - 6.4)\text{ m}$

$= 12.8\text{ m}$

Evaluate.

$$\int_4^8 \frac{x^2-1}{x-1}\,dx = \int_4^8 \frac{(x+1)(x-1)}{x-1}\,dx =$$

$$\int_4^8 (x+1)\,dx = \frac{x^2}{2}+x\Big|_4^8 =$$

$$\left(\frac{64}{2}+8\right)-\left(\frac{16}{2}+4\right) = 32+8-8-4$$

$$= 28$$

Evaluate.

$$\frac{7t}{t^{1/2}} + \frac{4}{t^{1/2}}$$

$$\int_4^{16} \frac{7t+4}{5\sqrt{t}}\,dt = \frac{1}{5}\int_4^{16} \frac{7t+4}{t^{1/2}}\,dt =$$

$$\frac{1}{5}\int_4^{16} \frac{7t}{t^{1/2}}\,dt + \frac{1}{5}\int_4^{16} 4t^{-\frac{1}{2}}\,dt =$$

$$\underline{\frac{7}{5}\int_4^{16} t^{1/2}\,dt} + \underline{\frac{4}{5}\int_4^{16} t^{-\frac{1}{2}}\,dt} =$$

$$\frac{7}{5}\int_4^{16} t^{1/2}\,dt = \frac{7}{5}\left(\frac{t^{3/2}}{3/2}\right)\Big|_4^{16} = \frac{7}{5}\left(\frac{2}{3}t^{3/2}\right)\Big|_4^{16}$$

$$= \frac{14}{15}t^{3/2}\Big|_4^{16} = \frac{14}{15}(64-8)$$

$$= \frac{14}{15}(56) = \underline{\underline{\frac{784}{15}}}$$

$$\frac{4}{5}\int_4^{16} t^{-\frac{1}{2}}\,dt = \frac{4}{5}\left(\frac{t^{1/2}}{\frac{1}{2}}\right)\Big|_4^{16}$$

$$= \frac{4}{5}\left(2t^{1/2}\right)\Big|_4^{16}$$

$$= \frac{8}{5}\left(t^{1/2}\right)\Big|_4^{16} = \frac{8}{5}(4-2)$$

$$= \underline{\underline{\frac{16}{5}}}$$

$$\frac{784}{15} + \frac{48}{15} = \frac{832}{15}$$