Average Rates of Change Problems Name Key

Show all work leading to your answer. There will often be more than one way to solve the problem. You may use a calculator on * problems.

1. Suppose that the velocity function of a particle moving along a coordinate line is $v(t) = 3t^3 + 2$.

a) Find the average velocity over the time interval $1 \le t \le 4$.

$\frac{1}{3}\int_1^4 v(t)\,dt = \frac{1}{3}\left(\frac{3t^4}{4} + 2t\Big|_1^4\right) = \frac{1}{3}\left(3\cdot 64 + 8 - \frac{3}{4} - 2\right) = \frac{263}{4}$ or 65.75

b) Find the average acceleration over the time interval $1 \le t \le 4$.

$\frac{v(4) - v(1)}{4 - 1} = \frac{194 - 5}{3} = 63$

2. Suppose that the acceleration function of a particle moving along a coordinate line is $a(t) = t + 1$. Find the average acceleration of the particle over the time interval $0 \le t \le 5$.

$\frac{1}{5}\int_0^5 a(t)\,dt = \frac{1}{5}\left(\frac{t^2}{2} + t\Big|_0^5\right) = \frac{1}{5}\left(\frac{25}{2} + 5 - 0\right) = \frac{7}{2}$ or 3.5

*3. During the first 40 seconds of a rocket flight, the rocket is propelled straight up so that in t seconds it reaches of height of $s(t) = \frac{t^3}{\sqrt{10}}$ feet.

a) What is the average height of the rocket during the first 40 seconds?

$\frac{1}{40}\int_0^{40} s(t)\,dt$ = 5059.644 ft

b) What is the average velocity of the rocket during the first 40 seconds?

$v(t) = \frac{3}{\sqrt{10}}t^2$

$\frac{1}{40}\int_0^{40} v(t)\,dt$ = 505.964 ft/sec

c) What is the average acceleration of the rocket during the first 40 seconds?

$a(t) = \frac{6}{\sqrt{10}}t$

$\frac{1}{40}\int_0^{40} a(t)\,dt$ = 37.947 ft/sec^2