AP Calculus
4.1 Integration Application Notes

1. The rate of growth of a particular population is given by $\frac{dP}{dt} = 50t^2 - 100t^{3/2}$ where *P* is the population size and *t* is the time in years. The initial population was 25,000.

   a) Find a model for the population size, *P*, at any time *t*.
   b) Find the population after 19 years.

2. Given that an object shot straight up from a platform 3 m above the ground has constant acceleration of *a(t)* = -9.8 and an initial velocity of 160 m/sec, find:

   a) The velocity as a function of time *t*.
   b) The position as a function of time *t*.
   c) The maximum height of the object.

3. You are driving along a highway at a steady 60 mph (88 ft/sec) when you see an accident ahead and slam on the brakes. What constant deceleration is needed to stop your car in 242 ft?

AP Calculus
4.1 Integration Application Problems *name*_____*p*____

1. Find the particular solution of $\frac{dy}{dx} = 2\sqrt{x}$ when $y(4) = 12$.

2. An evergreen nursery usually sells a certain shrub after 6 years of growth and shaping. The growth rate during those 6 years is approximated by $\frac{dh}{dt} = 1.5t + 5$, where t is the time in years and h is the height in centimeters. The seedlings are 12 centimeters tall when planted.

   a) Find the height after t years.
   b) How tall are the shrubs when they are sold?

3. Given the position of a particle as $x(t) = t^3 - 6t^2 + 9t - 2$.
   a) Find the velocity and acceleration of the particle at any time t.
   b) Find the velocity of the particle when the acceleration is 0.

4. A particle moves along the x-axis at a velocity of $v(t) = \frac{1}{\sqrt{t}}$ for $t > 0$. At time $t = 1$, its position is $x = 4$. Find the acceleration and position functions for the particle.

5. A particle, initially at rest, moves along the x-axis such that its acceleration is given by $a(t) = \cos t$. At time $t = 0$, its position is $x = 3$.

   a) Find the velocity and position functions for the particle.
   b) Find the values of t for which the particle is at rest.

6. A ball is thrown vertically upward from a height of 6 feet with an initial velocity of 60 ft/sec. Using acceleration due to gravity as $a(t) = -32$ ft/sec^2.

   a) Find the position function giving the height s as a function of time t.
   b) When does the ball hit the ground?
   c) How long does it take for the ball to reach it's maximum height?

7. The State of Illinois Cycle Rider Safety Program requires riders to be able to brake from 30 mph (44 ft/sec) to 0 in 45 feet. What constant deceleration does it take to do that?