Problem Set 2

Problem 1. The expression $a = \left(3t^2 - 17t + 2\right)\dfrac{m}{s^2}$ defines the acceleration of a particle moving along the y-axis. When $t = 0$, the particle is located at $y_o = y\left(0\right) = 3\text{ m}$ and is moving with initial velocity $v_o = v\left(0\right) = 21\dfrac{m}{s}$. Determine (a) expressions for the particle's velocity and position, (b) evaluate its position, velocity, and acceleration when $t = 5\text{ s}$, (c) evaluate in maximum and minimum velocities over the interval $0 \le t \le 10\text{ s}$, and (d) evaluate its average speed over the interval $0 \le t \le 10\text{ s}$.

Problem 2. The expression $a = -\left(3v\right)\dfrac{\text{in.}}{s^2}$ defines the acceleration of a marble falling through a tube of glycerin. The sphere begins with an initial velocity $v_o = 50\dfrac{\text{in.}}{s}$ at initial position $y_o = 0$, where s defines the distance the marble had descended into the glycerin. Determine expressions for (a) v in terms of t, (b) v in terms of y, and (c) y in terms of t. Evaluate the appropriate expressions to find the sphere's position and velocity when (d) $t = 1\text{ s}$, (e) $t = 5\text{ s}$, (f) $t = 10\text{ s}$, and (g) $t = 100\text{ s}$.

Problem 3. The expression $a = -4x\dfrac{ft}{s^2}$. At time $t = 1\text{ s}$, the particle is located at $x = 2\text{ ft}$ it moves with velocity $v = 5\dfrac{ft}{s}$. Determine expressions for (a) v as a function of x, (b) x as a function of t, (c) v as a function of t, and (d) a as a function of t.

Problem 4. The graph below shows the acceleration of a race car versus time as it moves along a straight road. We measure time in seconds and distance in feet. The race car begins moving at time $t = 0$ at position $x_o = x\left(0\right) = 0$ with initial velocity $v_o = v\left(0\right) = 0$. Determine (a) the maximum velocity the race car achieves, (b) the time it stops, and (c) the total distance it travels.