MATH 100 – WORKSHEET 16
APPLICATIONS

(1) The position of a particle at time t is given by $f(t) = t\sin(\pi t)$.
  (a) Find the velocity at time t, and specifically at $t = 3$.

  (b) When is the particle accelerating? Decelerating? At rest?

  (c) Find the total distance travelled by $t = 5$. $S =$

(2) A ball is falling from rest in air. Its height at time t is given by
$$h(t) = H_0 - gt_0 \left(t + t_0 e^{-t/t_0} - t_0 \right)$$
where H_0 is the initial height and t_0 is a constant.
  (a) Find the velocity of the ball. $v(t) =$

  (b) Find the acceleration. $a(t) =$

  (c) Find $\lim_{t \to \infty} v(t)$

(3) Water is filling a cylindrical container of radius $r = 10$cm. Suppose that at time t the height of the water is $\left(t + t^2 \right)$ cm. How fast is the volume growing?

(4) A spherical baloon is expanding, so that at the time its radius is 15cm, the radius is growing at the rate of 1cm/sec. How fast is the volume of the baloon growing?

(5) A rocket is flying in space. The momentum of the rocket is given by the formula $p = mv$, where m is the mass and v is the velocity. At a time where the mass of the rocket is $m = 1000$kg and its velocity is $v = 5000\frac{\text{m}}{\text{sec}}$ the rocket is accelerating at the rate $a = 20\frac{\text{m}}{\text{sec}^2}$ and losing mass at the rate $10\frac{\text{kg}}{\text{sec}}$. Find the rate of change of the momentum with time.

(6) A metal rod of length 30cm has total mass 800gr. Suppose that the mass of the part of the rod between the left end and a point $x$cm to the right has mass $\left(x^2 - \frac{x^3}{270}\right)$ gr. Find the density of the rod in its middle.