1. A cannonball is fired from a cannon with a muzzle velocity of 1000 ft/s, inclined at an angle of 60° with the horizontal. The position of the cannonball t seconds after the cannon is fired is given by

\[ x = 500t \text{ and } y = 500\sqrt{3}t - 16t^2. \]

a. Compute the velocity, speed and acceleration of the cannonball at the time the ball hits the ground.

b. Compute the velocity, speed and acceleration of the cannonball when the ball reaches its maximum height.

2. Compute the velocity, speed and acceleration for \( \overrightarrow{r(t)} = < t\sin t, t^2\cos t > \)

3. Find the point(s) on the curve \( x = \sin 2t, y = \sin t, 0 \leq t \leq 2\pi \), where the tangent line is horizontal or vertical.

4. Show that the curve \( x = \sin t, y = \sin t\cos t, 0 \leq t \leq 2\pi \), has two tangent lines at (0, 0) and find their equations. Find all points where the tangent line is horizontal/vertical.

5. Solve parts (a) and (b) below.

   a. Find equations of the tangent line(s) to the curve \( x(t) = 3t^2 + 1, \ y(t) = 2t^3 + 1 \) that pass through the point (4, 3).

   b. At which point(s) on the curve is the tangent line parallel to the line \( 2x + 5y + 4 = 0 \)?

6. If a snowball melts so that its surface area decreases at a rate of 1 cm\(^2\)/min, find the rate at which the diameter decreases when the diameter is 10 cm.

7. A man starts walking north at 4 ft/s from a point \( P \). Five minutes later a woman starts walking south at 5 ft/s from a point 500 ft due east of \( P \). At what rate are the people moving apart 15 min after the woman starts walking?

8. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the string and the horizontal decreasing when 200 feet of string have been let out?

9. Find the following derivatives:

   a. \( \frac{d^{50}[5^{50}\cos(-2x)]}{dx^{50}} \)

   b. \( \frac{d^{50}}{dx^{50}}\left(\frac{1}{(x+1)^3}\right) \)