1. Give the following evaluations if \( \vec{a} = 4\vec{i} + 7\vec{j} \) and \( \vec{b} = <5, 12> \).

   (a) \( ||\vec{b}|| = \) ____________  \( -3\vec{a} + \vec{b} = \) ____________

   (b) Determine \( \cos \theta \), where \( \theta \) is the angle between \( \vec{a} \) and \( \vec{b} \).

   (c) Determine \( \vec{P} \), where \( \vec{P} \) is the projection of \( \vec{a} \) onto \( \vec{b} \).

2. Determine the parametric (or vector) equations for:

   (a) A body moving along a straight line passing through point \( P = (-10, 7) \) at 
       time \( t = 0 \) with a direction of \( \vec{d} = < -1, 4 > \) every minute.

   (b) A body moving along a circular path of radius 3 ft completing 2 revolutions 
       every second.

3. Determine Cartesian equations to the following parametric equations:

   (a) \( \vec{r}(t) = < 4 \sin t, 4 \cos t > \) ____________

   (b) \( \vec{r}(t) = < 2t - 1, 4t + 3 > \) ____________
4. (a) Determine the velocity vector to $\mathbf{s}(t) = \langle t \cos 2t, \sin t \rangle$ for any given $t$.

(b) Determine $\frac{dy}{dx}$ at $t = 0$ if $\langle x(t), y(t) \rangle = \langle t \cos 2t, \sin t \rangle$.

(c) Determine the speed of the body along the path $\mathbf{s}(t)$ at $t = 0$.

5. Using Newton’s Method, determine the first approximation to the solution $e^{-x} = 3x$ with $x_0 = 0$.

6. (a) Determine the linearization to the function $f(x) = e^{-x} - 3x$ at $x = 0$ and approximate $f(0.2)$.

(b) Is this an overestimate or an underestimate? Explain.

7. Determine the limit:

(a) $\lim_{x \to 1} \frac{\ln x}{\sqrt{x} - 1}$

(b) $\lim_{x \to 0} \frac{1 - e^{-5x}}{x + \sin x}$
8. (a) Given the function \( f(x) = x^4 - 2x^3 - 2x^2 + 2 \) determine all critical points and indicate if each is a local max, local min or inflection point.

(b) Determine the range of the function \( f(x) \) above on the interval \([0, 3]\).

9. Determine the point(s) on the curve \( x = y^2 - 1 \) closest to the point \((4, 0)\).

10. (a) A television camera is positioned 4000 ft from the base of a rocket launching pad. A rocket rises vertically and its speed is 600 ft/s when it has risen 3000 ft. How fast is the distance from the television camera to the rocket changing at that moment?

(b) (bonus question) If the television camera is always kept focused on the rocket, how fast is the camera’s angle of elevation changing at that moment?