1. Consider the curve defined by the vector function $r(t) = \langle 6t+1, t^3, -3t^2 \rangle$.

   (a) (10 pts.) Find the equation of the line tangent to the curve at the point $(7, 1, -3)$.

   (b) (10 pts.) Find the length of the portion of the curve from the point $(-5, -1, -3)$ to $(7, 1, -3)$.

2. Compute the following limits. If the limit does not exist, explain why.

   (a) (10 pts.) $\lim_{(x,y)\to(2,3)} \frac{x^2+xy+2y^2-1}{x^2-y^2+4}$

   (b) (10 pts.) $\lim_{(x,y)\to(0,0)} \frac{x^2+y^2}{x^2+xy+y^2}$

3. Let $f(x, y, z) = e^{xy^2} + \ln(y + z^3)$. Compute the following partial derivatives of f.

   (a) (5 pts.) f_x

   (b) (5 pts.) f_y

   (c) (5 pts.) f_{zx}

   (d) (5 pts.) f_{zy}

4. (20 pts.) Approximate $(\sqrt[3]{28})^2 + (\sqrt{24})^3$.

5. (20 pts.) Find all critical points of $f(x, y) = 2x^3 - 6xy + 3y^2 - 12y$. For each critical point, determine if it corresponds to a local minimum, local maximum, or saddle point.