Class exercises for Week 1. To be done in class. These exercises do not need to be returned, and they are not marked.

1. Find the equation of the line passing though the points $(1, 0, 2)$ and $(5, 4, 1)$. Sketch the line.
2. Sketch the curves
   (a) $x(t) = 3\cos(t), y(t) = 5\sin(t)$ for $0 \leq t < 2\pi$. What is this curve called?
   (b) $x(t) = t\cos(t), y(t) = t\sin(t), z(t) = t$ for $0 \leq t \leq 7\pi$
3. Consider the parametric curve $x(t) = \cos(t)$, $y(t) = \cos^2(t)$ for $-\infty < t < \infty$.
   (a) Sketch the curve and carefully describe the motion. Think carefully about the range of $x(t)$ and $y(t)$.
   (b) Find the tangent vectors at the point $(1/2, 1/4)$. Make a sketch and relate your answers to the direction of motion.
   (c) Find the "tangent vector" at the point $(1, 1)$. Does your answer make sense? Is the curve smooth at this point?
   (d) Find the length of the curve.
4. Consider the curve of intersection of the plane $z = y$ and the parabolic cylinder $y = 4 - x^2$.
   (a) Find a parametric equation $r(t) = (x(t), y(t), z(t))$ of the curve.
   (b) Find the arc length of the part of the curve that lies above the xy-plane.
5. Consider the curve with parametric equations $r(t) = (cos(t), sin(t), t^2)$ for $0 \leq t \leq 6\pi$.
   (a) Sketch the curve and the tangent vector to the curve when $t = \pi/4$.
   (b) Compute the tangent vector at $t = \pi/4$. Does your sketch match the computation?
   (c) Compute the arc length of the curve.
6. Consider the function $f(x, y) = x^2 + 2y^2$.
   (a) Sketch the graph of $f(x, y)$. That is, the surface determined by $z = f(x, y)$.
   (b) Find and sketch the level surfaces $f = -1$, $f = 0$, $f = 1$, $f = 2$ and $f = 10$.
7. Consider the function $f(x, y) = x^2 - 2y^2$.
   (a) Sketch the graph of $f(x, y)$. That is, the surface determined by $z = f(x, y)$.
   (b) Find and sketch the level curves $f = -2, f = 0, f = 2$ and $f = 10$.
8. Below are two sets of level curves. One is for a cone, one is for a paraboloid. Which is which? Explain.

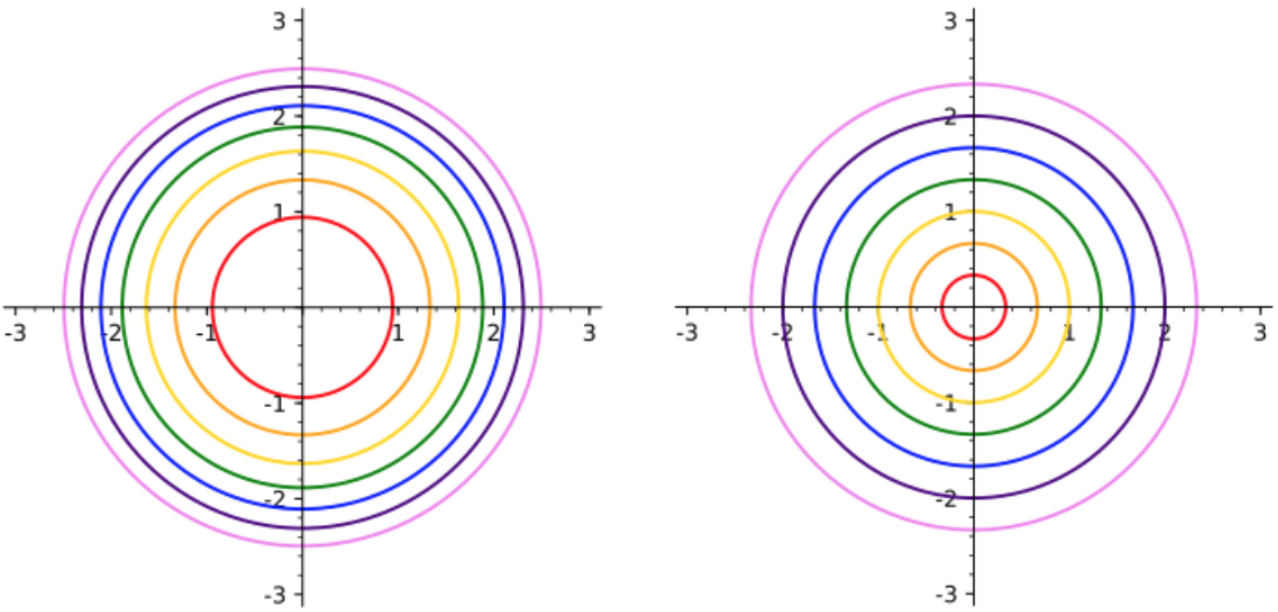

Figure 1: exercise 14.1.7 in Guichard's Calculus text.