HW 2: Due: 21.01.2020

1. Consider the curve with parametric equations
   $x(t) = \cos(t), y(t) = \sin(t), z(t) = t^2$ for $0 \le t \le 6\pi$.
   (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.

2. Consider the curve with parametric equation $x(t) = \cos(t), y(t) = \cos^2(t)$ for $-\infty < t < \infty$.
   (a) Sketch the curve and carefully describe the motion. *Hint: think carefully about the range of $x(t)$ and $y(t)$.*
   (b) Find the tangent vectors at the point $(1/2, 1/4)$. Makes 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.

3. Consider the function $z = f(x, y) = x^2 + 2y^2$.
   (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 $f = 10$.

4. Do exercise 14.1.7 in Guichard's Calculus text. `https://www.whitman.edu/mathematics/calculus_online/section14.01.html`

5. Let $f(x)$ be a function defined for all real numbers x. Is it possible for two different level curves to intersect? That is, if $a \neq b$, is it possible that the level curves $f = a$ and $f = b$ intersect?

6. **BONUS POINT** Any or all of the problems 10.4.7, 10.4.8, 10.4.9 from Guichard's Calculus. The answers are already there so you need to provide a careful and well-written derivation. `https://www.whitman.edu/mathematics/calculus_online/section10.04.html`

You don't have to turn in "BONUS POINTS" to get a full grade.

Extra suggested problems not to be submitted. These are good routine question to practice. The answers are all given in the text.

From Guichard's Calculus text:

- Exercises 1 to 6 from section 10.4.
- Exercises 1 to 6 from section 13.1
- Exercises 1 to 6 from section 13.3
- Exercises 1 to 6 from section 14.1