MA 261 Quiz 2
September 4, 2018

If you do not know how to do any one of these problems, circle **"(E) I don't know"** as your answer choice. You will receive **one point** for doing that. **Each problem** is worth **five points**. You get **two points** for writing your **full name** and **three points** for writing your **PUID and section number**.

Problem 2.1 (Problem 2 from Spring 2018). Identify the surface defined by

$$x^2 - y^2 - 4x + z^2 = 4$$

(A) hyperboloid of one sheet
(B) hyperbolic paraboloid
(C) hyperboloid of two sheets
(D) ellipsoid
(E) cone

Solution. The answer was (A). Doing a little algebra, you can arrive at the following form of the equation in the problem,

$$(x-2)^2 - y^2 + z^2 = 8.$$

This matches the equation for a hyperboloid of one sheet. ◆

Problem 2.2. Find the derivative, $\mathbf{r}'(t)$, of the vector function

$$\mathbf{r}(t) = \langle 2t-1, t^2, t^2-2\rangle \text{ at } (3, 4, 2)$$

(A) $(2, 4, 4)$.
(B) $(-1, 0, 3)$.
(C) $(2, 2, 2)$.
(D) $(2, -2, 4)$.
(E) I don't know.

Solution. The answer was (A). The first thing we need to do is find the time t at which the curve passes through the point $(3, 4, 2)$. Setting, say the first coordinate, to the point

$$2t - 1 = 3$$

we see that $t = 2$ (you can check this by plugging in 2 into the other coordinates as well). Now we just take the derivative of $\mathbf{r}$ like so

$$\mathbf{r}'(t) = \langle 2, 2t, 2t\rangle,$$

and we plug in $t = 2$, which gives us $(2, 4, 4)$. ◆

Problem 2.3 (Problem 2 from Spring 2018). If L is the tangent line to the curve

$$\mathbf{r}(t) = \langle 2t - 1, t^2, t^2 - 2 \rangle \text{ at } (3, 4, 2),$$

find the point where L intersects the xy-plane
(A) $(2, 1, 0)$
(B) $(1, 2, 0)$
(C) $(2, 2, 0)$
(D) $(0, 0, 0)$
(E) I don't know.

Solution. The answer was (C). We already did part of the problem for this one in Problem 2.2. We know that the tangent line L has slopes $(2, 4, 4)$ at the point $(3, 4, 2)$. All we need to do to find the line is add the point $(3, 4, 2)$, giving us

$$L(t) = \langle 2t + 3, 4t + 4, 4t + 2 \rangle.$$

Now, what does it mean for a line to intersect the xy-plane? It means that the line's z coordinate must be 0. When does that happen? When $t = -1/2$. Thus,

$$L(-1/2) = \langle 2, 2, 0 \rangle. \qquad \blacklozenge$$