MA 261 ONLINE, SUMMER 2026
Quiz 2: §13.6, 14.1, 14.2

Name: Key ______________________________ Score: /20
PUID: ______________________________ Length: 15 minutes

Directions: Follow these instructions carefully. Failure to do so may result in your quiz being invalidated and/or an academic integrity violation. All suspected violations of academic integrity will be reported to the Office of the Dean of Students.

- Complete each question below. There are 3 questions; the maximum score is 20 points.
- You have 25 minutes: 15 minutes to complete the quiz and 10 minutes to upload it to Gradescope.
- This quiz is closed book and closed notes. Calculators are not allowed.
- You are to work independently. External help (including, but not limited to, using the internet and generative AI) is prohibited.
- You may use your own paper to complete this quiz; you do not need to print this document.
- Adequate work must be shown for each problem. A question with little to no work, even with a correct answer, will result in a low score.
- Make sure your work is neat and legible, especially after it is scanned. Use proper notation, and clearly mark the question numbers and your final answer. Points may be taken off if part of your work is unreadable.

(The questions start on the next page, one problem per page)

1. Consider the quadric surface:

$$x^2 + \frac{y^2}{2} - \frac{z^2}{16} = 1$$

(a) [4 points] Identify the $x-$, $y-$, and $z-$ intercepts (if they exist).

x-ints:

$x^2 + 0 + 0 = 1$

$x^2 = 1$

$x = \pm 1$

$\Rightarrow$ x-ints are $(1,0)$ and $(-1,0)$

y-ints:

$0 + \frac{y^2}{2} - 0 = 1$

$\frac{y^2}{2} = 1$

$y^2 = 2$

$y = \pm\sqrt{2}$

$\Rightarrow$ y-ints are $(0,\sqrt{2})$ and $(0,-\sqrt{2})$

z-ints:

$0 + 0 - \frac{z^2}{16} = 1$

$z^2 = -16$

No Solution

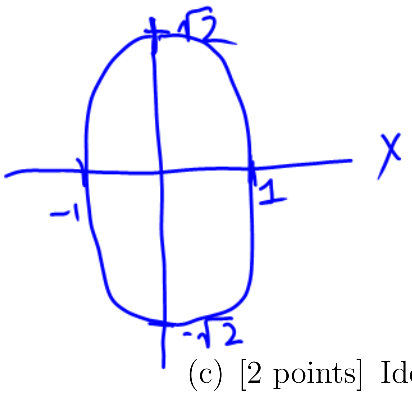
$\Rightarrow$ z-ints DNE

(b) [6 points] Find the equations for the $xy-$, $xz-$, and $yz-$traces. For each trace, state whether the equation describes a circle, ellipse, parabola, or hyperbola.

xy-trace:

$x^2 + \frac{y^2}{(\sqrt{2})^2} = 1$

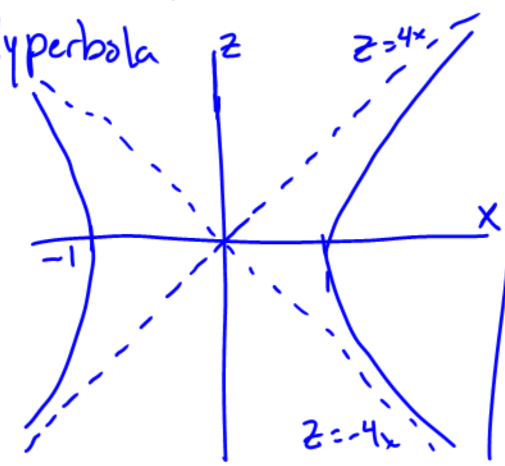
Ellipse



xz-trace:

$x^2 - \frac{z^2}{4^2} = 1$

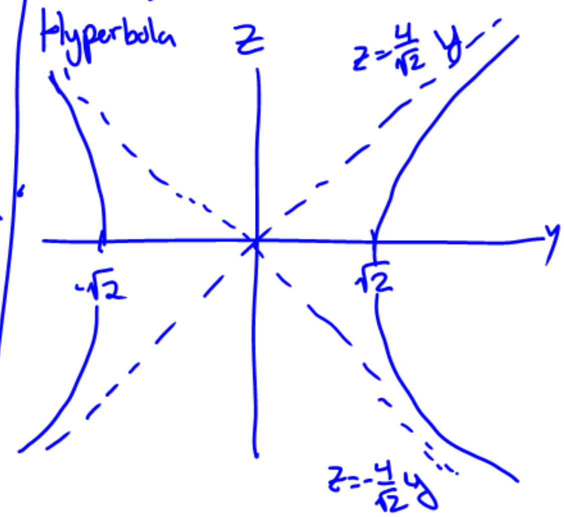
Hyperbola



yz-trace:

$\frac{y^2}{(\sqrt{2})^2} - \frac{z^2}{4^2} = 1$

Hyperbola



(c) [2 points] Identity the surface the equation describes.

Hyperboloid of one sheet

2. [4 points] What is the domain of **each component** in the vector-valued function $\vec{r}(t) = \left\langle \ln t^2, \sqrt{t(3-t)}, \frac{1}{t-3} \right\rangle$? Use these to find the domain of $\vec{r}(t)$.

Domain of x-component: $\{t^2 > 0\} = (-\infty, 0) \cup (0, \infty)$

Domain of y-component: $\{t(3-t) \geq 0\} = [0, 3]$

Domain of z-component: $\{t - 3 \neq 0\} = (-\infty, 3) \cup (3, \infty)$

Domain of $\vec{r}$: $(0, 3)$

3. [4 points] Find the unit tangent vector to $\vec{r}(t) = \left\langle te^t, t^3, 2\sqrt{t} \right\rangle$ at $t = 1$.

$$\vec{r}\,'(t) = \left\langle e^t + te^t,\ 3t^2,\ \frac{2}{2\sqrt{t}} \right\rangle$$

$$= \left\langle (t+1)e^t,\ 3t^2,\ \frac{1}{\sqrt{t}} \right\rangle$$

$$\vec{r}\,'(1) = \langle 2e,\ 3,\ 1 \rangle$$

$$|\vec{r}\,'(1)| = \sqrt{(2e)^2 + 3^2 + 1} = \sqrt{4e^2 + 10}$$

$$\Rightarrow \vec{T}(1) = \frac{\vec{r}\,'(1)}{|\vec{r}\,'(1)|} = \frac{1}{\sqrt{4e^2+10}} \langle 2e, 3, 1 \rangle$$

$$= \left\langle \frac{2e}{\sqrt{4e^2+10}}, \frac{3}{\sqrt{4e^2+10}}, \frac{1}{\sqrt{4e^2+10}} \right\rangle$$