Math 1201, Fall 2016 **Name (print):** ____________________

Dr. Jo Nelson's Calculus III

Practice for 1/2 of Final,

Midterm 1 Material

Time Limit: 90 minutes

DO NOT OPEN THIS BOOKLET UNTIL INSTRUCTED TO DO SO.

This exam contains 9 pages (including this cover page) and 8 problems. It is your responsibility to ensure that, at the start of this test, this booklet has all its pages.

Put your initials on the top of every page, in case the pages become separated.

You may *not* use your books, notes, cell phone, or any calculator on this exam.

Answer all questions. Explain and justify your answers. The following rules apply:

- **Organize your work and box your answers**. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.
- **If you need more space,** use the back of the page or the blank page; clearly indicate when you have done this.
- **There is a formula sheet on page 2.**
- **Each page corresponds to a topic. Each part is graded separately** and typically has no connection to a previous part.

Do not write in the table to the right.

Problem	Points	Score
1	20	
2	10	
3	10	
4	10	
5	10	
6	20	
7	10	
8	10	
Total:	100	

Formulas:

Circle	$(x-h)^2+(y-k)^2=r^2$		center: (h,k)
	(Major) Vertical Axis	(Major) Horizontal Axis	
Parabola	$(x-h)^2=4p(y-k)$	$(y-k)^2=4p(x-h)$	vertex: (h,k)
Directrix:	$y=k-p$	$x=h-p$	
Focus:	$(h,k+p)$	$(h+p,k)$	
Ellipse $(a>b)$	$\dfrac{(x-h)^2}{b^2}+\dfrac{(y-k)^2}{a^2}=1$	$\dfrac{(x-h)^2}{a^2}+\dfrac{(y-k)^2}{b^2}=1$	center: (h,k)
Foci	c vert. units from center	c hor. units from center	$c^2=a^2-b^2$
Vertices	a vert. units from center	a hor. units from center	eccen.: $e=\frac{c}{a}$
Hyperbola	$\dfrac{(y-k)^2}{a^2}-\dfrac{(x-h)^2}{b^2}=1$	$\dfrac{(x-h)^2}{a^2}-\dfrac{(y-k)^2}{b^2}=1$	center: (h,k)
Asymptotes	$y=k\pm\frac{a}{b}(x-h)$	$y=k\pm\frac{b}{a}(x-h)$	
Foci	c vert. units from center	c hor. units from center	$c^2=a^2+b^2$
Vertices	a vert. units from center	a hor. units from center	eccen.: $e=\frac{c}{a}$

1. Consider the parametric equation,

$$\begin{aligned} x &= 2\cos\theta, \\ y &= 1+\sin\theta. \end{aligned}$$

(a) (10 points) Eliminate the parameter to find the Cartesian (e.g rectangular) equation and sketch the parametric curve. Indicate the orientation (e.g. direction) on your graph.

(b) (10 points) Find the Cartesian equation of the tangent line at $\theta = \dfrac{\pi}{3}$.

2. (10 points) Find the area of the parallelogram with vertices $A(-3,0)$, $B(-1,3)$, $C(5,2)$, $D(3,-1)$.

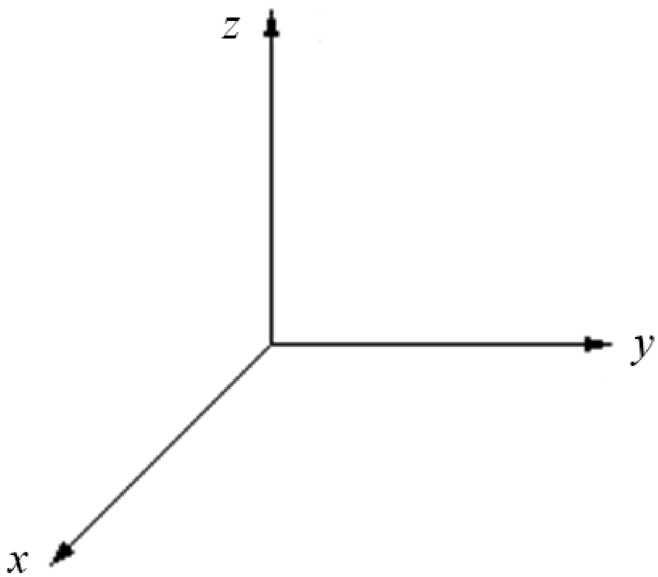
3. (10 points) If $\mathbf{a} = \langle 3, 0, -1 \rangle$, find a vector $\mathbf{b}$ such that $\text{comp}_{\mathbf{a}}\mathbf{b} = 2$.

4. (10 points) Where does the line through $(-3, 1, 0)$ and $(-1, 5, 6)$ intersect the plane $2x + y - z = -2$?

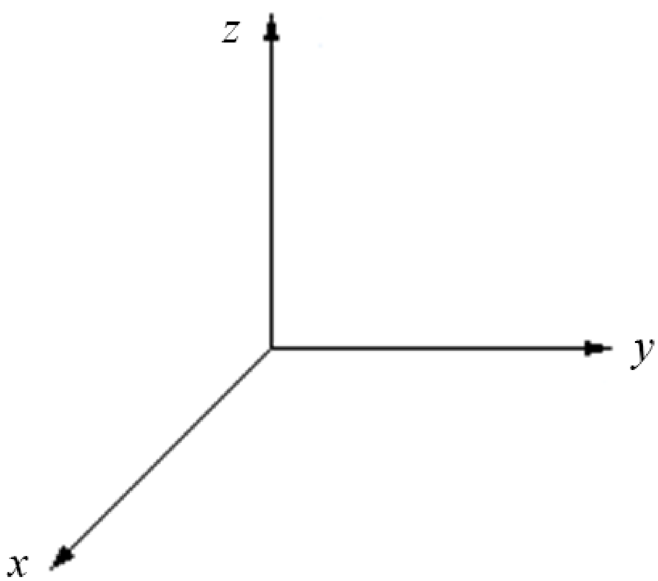
5. (10 points) Find an equation for the plane that passes through $(0, -2, 5)$ and $(-1, 3, 1)$ and is perpendicular to the plane $2z = 5x + 4y$.

6. Sketch the following surfaces. When appropriate, it is acceptable to shade it in as a region of a larger object. Should you be less than confident in your sketch, describe it. You may not have much work to show.

   (a) (10 points) Sketch the surface: $\phi = \frac{\pi}{3}$, $0 \leq \theta \leq \pi$.



   (b) (10 points) Sketch the surface: $x^2 + z^2 = 4$.

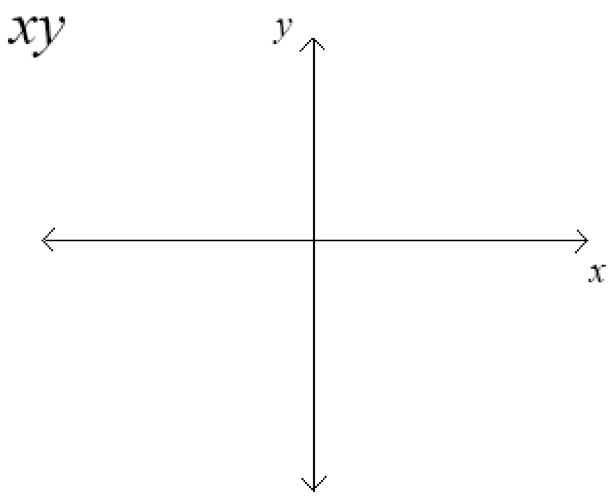


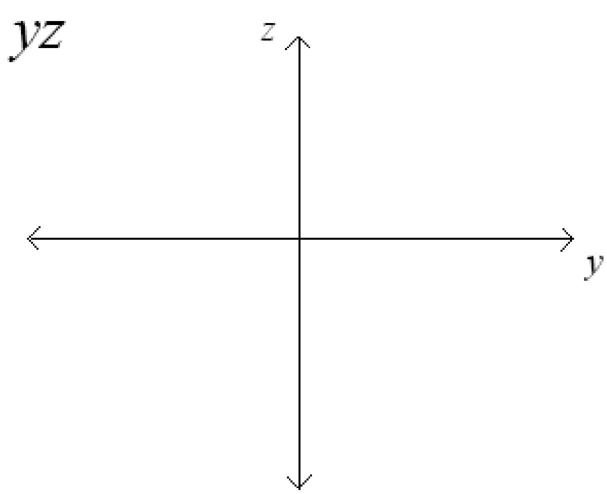
7. DO NOT SKETCH EITHER of (a) or (b).

   (a) (5 points) Convert to cylindrical coordinates and completely simplify: $x^2 - x + y^2 + z^2 = 1$

   (b) (5 points) Convert to spherical coordinates and completely simplify: $x^2 - y^2 - z^2 = 1$

8. (10 points) NOT ON MIDTERM 1: Consider the surface $3x^2 - y^2 + 3z^2 = 0$ is a cone. Sketch and label 3 distinct traces in the xy plane. Then sketch the surface on the blank page.





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