MATH 251 Spring 2017
EXAM I - VERSION A

LAST NAME: ____________________ FIRST NAME: ____________________

SECTION NUMBER: __________

UIN: ____________________

DIRECTIONS:

1. You may use a calculator on this exam.
2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
3. In Part 1 (Problems 1-10), mark the correct choice on your ScanTron using a No. 2 pencil. The ScanTron will not be returned, therefore *for your own records, also record your choices on your exam!* Each problem is worth 4 points.
4. In Part 2 (Problems 11-16), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer*. You will be graded not merely on the final answer, but also on the **quality** and **correctness** of the work leading up to it.
5. Be sure to *write your name, section number and version letter of the exam on the ScanTron form.*

THE AGGIE CODE OF HONOR

"An Aggie does not lie, cheat or steal, or tolerate those who do."

Signature: ____________________

DO NOT WRITE BELOW!

Question Type	Points Awarded	Points
Multiple Choice		40
Free Resepose		60
Total		100

PART I: Multiple Choice. 4 points each.

Part I Multiple choice. (4 points each).

1. The equations $x^2 + z^2 = 4$ and $y = -1$ represent what in $\mathbb{R}^3$?

   (a) A cylinder centered along the z axis

   (b) A circle centered along the z axis

   (c) A cylinder centered along the y axis

   (d) A circle centered along the y axis

   (e) A sphere

2. Which of the following is the domain of the vector function $\mathbf{r}(t) = \left\langle \frac{t}{\ln(t-1)}, \sqrt{9-t^2}, e^t \right\rangle$?

   (a) $(1,2) \cup (2,3]$

   (b) $(1,2) \cup (2,3)$

   (c) $(1,3]$

   (d) $[-3,3]$

   (e) $(-3,3)$

3. Find $\lim_{t \to 0} \left\langle \frac{t}{t^2+3t}, \frac{\sin(\pi t)}{\ln(t+1)}, \frac{1}{2^t} \right\rangle$

   (a) $\langle 0, -1, 1 \rangle$

   (b) $\left\langle \frac{1}{3}, \pi, 1 \right\rangle$

   (c) $\langle 0, \pi, 1 \rangle$

   (d) $\left\langle \frac{1}{3}, 1, 1 \right\rangle$

   (e) $\left\langle \frac{1}{3}, -\pi, 1 \right\rangle$

4. Find the scalar projection of $\langle -5, 3, 2 \rangle$ onto $\mathbf{i} - \mathbf{k}$.

(a) $-\dfrac{8}{\sqrt{2}}$

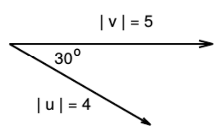
(b) $-\dfrac{5}{\sqrt{2}}$

(c) $-\dfrac{7}{\sqrt{38}}$

(d) $-\dfrac{8}{\sqrt{38}}$

(e) $-\dfrac{7}{\sqrt{2}}$

5. Find $|\mathbf{v} \times \mathbf{u}|$ and whether $\mathbf{v} \times \mathbf{u}$ points in or out of the page.



(a) $|\mathbf{v} \times \mathbf{u}| = 10\sqrt{3}$ and points out of the page

(b) $|\mathbf{v} \times \mathbf{u}| = 10$ and points into the page

(c) $|\mathbf{v} \times \mathbf{u}| = 10\sqrt{3}$ and points into the page

(d) $|\mathbf{v} \times \mathbf{u}| = 10$ and points out of the page

(e) None of these

6. Find the equation of the plane that contains the line $x = 1 + t$, $y = 2 - t$ and $z = 4 - 3t$ and is parallel to the plane $5x + 2y + z = 1$.

(a) $-x + 2y + z - 7 = 0$

(b) $5x + 2y + z - 13 = 0$

(c) $-x + 2y + z + 6 = 0$

(d) $5x + 2y + z - 9 = 0$

(e) $5x + 2y + z - 7 = 0$

7. Find the angle at vertex B for ΔABC. $A(1,0,-1)$, $B(3,-2,0)$ and $C(1,3,3)$.

(a) $\arccos\left(\dfrac{11}{3\sqrt{38}}\right)$

(b) $\arccos\left(\dfrac{2}{15}\right)$

(c) $\arccos\left(\dfrac{-11}{3\sqrt{38}}\right)$

(d) $\arccos\left(\dfrac{-2}{15}\right)$

(e) None of the above

8. The space curve shown here has which equation? Assume $t \geq 0$.

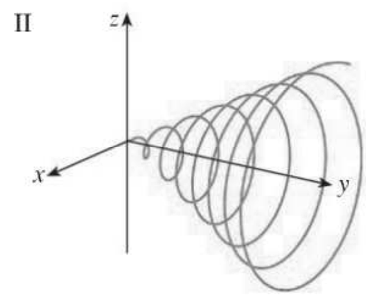
(a) $\mathbf{r}(t) = \langle t\cos t, t, t\sin t\rangle$

(b) $\mathbf{r}(t) = \left\langle \cos t, \sin t, \dfrac{1}{1+t^2}\right\rangle$

(c) $\mathbf{r}(t) = \left\langle t, \dfrac{1}{1+t^2}, t^2\right\rangle$

(d) $\mathbf{r}(t) = \langle \cos 8t, \sin 8t, e^t\rangle$

(e) $\mathbf{r}(t) = \langle \cos t, \cos 3t, \cos 4t\rangle$



9. Find the equation of the line passing through the point $P(1,2,3)$ that is perpendicular to both $\langle 3,-1,2\rangle$ and $\langle 1,0,-2\rangle$.

(a) $x = 2+t,\ y = 8+2t,\ z = 1+3t$

(b) $x = 2+t,\ y = -8+2t,\ z = 1+3t$

(c) $x = 1+2t,\ y = 2+8t,\ z = 3+t$

(d) $x = 1+2t,\ y = 2-8t,\ z = 3+t$

(e) $x = 2-t,\ y = -8-2t,\ z = 1-3t$

10. What is the intersection of the sphere $x^2+y^2+z^2+6x-4y-10z-26=0$ with the yz plane?

(a) The yz plane intersects the sphere in the circle $(y-2)^2+(z-5)^2 = 55$

(b) The yz plane intersects the sphere at the point $(-3,2,5)$

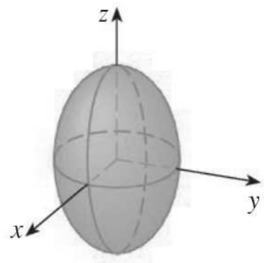
(c) The yz plane intersects the sphere in the circle $(y-2)^2+(z-5)^2 = 73$

(d) The yz plane does not intersect the sphere.

(e) The yz plane intersects the sphere in the circle $(y-2)^2+(z-5)^2 = 26$

Part II: Work out. Show all intermediate steps.

11. (10 pts) Match the graph with its equation by putting the corresponding letter in the blank provided.



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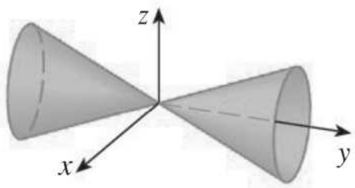

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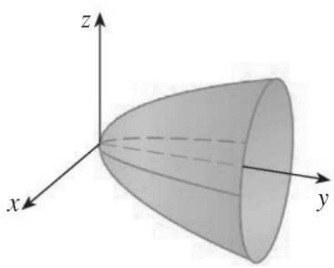

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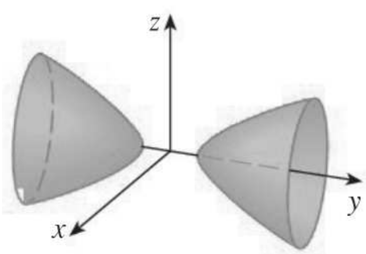

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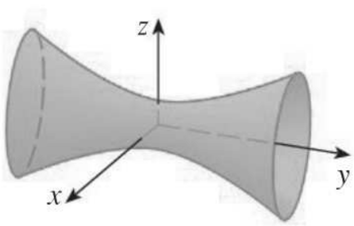

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A. $\frac{x^2}{4} - \frac{y^2}{9} + \frac{z^2}{9} = 1$

B. $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{9} = 1$

C. $y = \frac{x^2}{4} + \frac{z^2}{9}$

D. $-\frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{9} = 1$

E. $\frac{y^2}{4} = \frac{x^2}{9} + \frac{z^2}{9}$

12. (10 pts) Given that the vector functions $\mathbf{r_1}(t) = \left\langle -2t, t^5, -5t^3 \right\rangle$ and $\mathbf{r_2}(u) = \langle \sin(-2u), \sin(u), u - \pi \rangle$ intersect at the origin, find the angle of intersection, rounded to the nearest degree.

13. Consider the planes $x - 3y + z = 11$ and $x - 2y - z = 4$.

a.) (4 pts) Find the point where the line of intersection of these two planes passes through the xy-plane.

b.) (4 pts) Find a vector, $\mathbf{v}$, that is parallel to the line of intersection of these two planes.

c.) (6 pts) Using the information in parts a.) and b.), find a **parametric equation** for the line of intersection of these planes.

14. (8 pts) Find parametric equations for the tangent line to the curve $x = t^2 + t$, $y = 4\sqrt{t}$, $z = e^{t^3 - t}$ at $(2, 4, 1)$.

15. (8 pts) Find the length of the curve $\mathbf{r}(t) = \left\langle t\sqrt{2}, e^t, e^{-t} \right\rangle$ for $0 \leq t \leq 3$.

16. (10 pts) Find $\mathbf{r}(t)$ if $\mathbf{r}'(t) = \langle t, e^t, 2t \ln t \rangle$ and $\mathbf{r}(1) = \langle 2, -3, 1 \rangle$. In order to get full credit, steps must be shown if a technique of integration is needed to find the antiderivative.