Math 2400, Midterm 1

February 12, 2018

PRINT YOUR NAME: ______________________________

PRINT INSTRUCTOR'S NAME: ______________________________

Mark your section/instructor:

☐	Section 001	Kevin Berg	8:00–8:50
☐	Section 002	Xingzhou Yang	8:00–8:50
☐	Section 003	Albert Bronstein	9:00–9:50
☐	Section 004	Cliff Blakestad	10:00–10:50
☐	Section 005	Albert Bronstein	10:00–10:50
☐	Section 006	Mark Pullins	11:00–11:50
☐	Section 009	Taylor Klotz	11:00–11:50
☐	Section 007	Albert Bronstein	12:00–12:50
☐	Section 008	Martin Walter	1:00–1:50
☐	Section 010	Braden Balentine	2:00–2:50
☐	Section 011	Pedro Berrizbeitia	3:00–3:50
☐	Section 012	Pedro Berrizbeitia	4:00–4:50

Question	Points	Score
1	14	
2	14	
3	15	
4	15	
5	15	
6	15	
7	12	
Total:	100	

- No calculators or cell phones or other electronic devices allowed at any time.
- Show all your reasoning and work for full credit, except where otherwise indicated. Use full mathematical or English sentences.
- You have 90 minutes and the exam is 100 points.
- You do not need to simplify numerical expressions. For example leave fractions like **100/7** or expressions like **ln(3)/2** as is.
- When done, give your exam to your instructor, who will mark your name off on a photo roster.
- We hope you show us your best work!

1. (14 points) Find an equation of the plane that contains the points $\mathbf{(-2, 3, 1)}$, $\mathbf{(1, 0, 2)}$, and $\mathbf{(1, 2, -1)}$.

2. (14 points) Find the volume of the parallelipiped determined by the following three vectors: $\vec{\boldsymbol{a}} = \langle \mathbf{3}, \mathbf{3}, \mathbf{3} \rangle$, $\vec{\boldsymbol{b}} = \langle \mathbf{2}, \mathbf{3}, \mathbf{0} \rangle$, and $\vec{\boldsymbol{c}} = \langle \mathbf{0}, \mathbf{1}, \mathbf{1} \rangle$.

3. Consider the curve in space described by $\vec{r}(t) = \langle t, 2\ \sin(t), 2\ \cos(t) \rangle$.

   (a) (8 points) Find the equation of the line tangent to this curve when $t = \pi$.

   (b) (7 points) Find the length of the arc of this curve between the points $(0, 0, 2)$ and $(\pi, 0, -2)$

4. Assume that the lines

$$\boldsymbol{L_1}: \qquad \boldsymbol{x = 1 + t, \;\; y = 1 + 6t, \;\; z = 2t}$$

$$\boldsymbol{L_2}: \qquad \boldsymbol{x = 1 + 2s, \;\; y = 5 + 15s, \;\; z = -2 + 6s}$$

are skew.

(a) (5 points) Find a vector $\boldsymbol{\vec{n}}$ normal to both $\boldsymbol{L_1}$ and $\boldsymbol{L_2}$.

(b) (5 points) Find an equation of the plane that contains $\boldsymbol{L_2}$ and normal to $\boldsymbol{\vec{n}}$.

(c) (5 points) Find the distance between $\boldsymbol{L_1}$ and $\boldsymbol{L_2}$.

5. (15 points) Find a parametric representation for the cone $\boldsymbol{y^2 = 2x^2 + 2z^2}$ between the planes $\boldsymbol{y = 0}$ and $\boldsymbol{y = 3}$.

6. (15 points) Find a rectangular equation for the surface whose spherical equation is

$$\boldsymbol{\rho = 2 \sin \phi \cos \theta}$$

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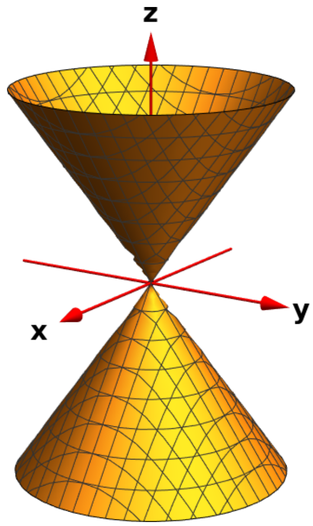
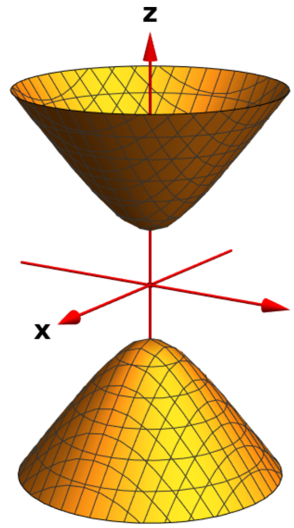
7. (12 points) Match each 3D surface with one of the equations on the right side. Not all equations will be matched.

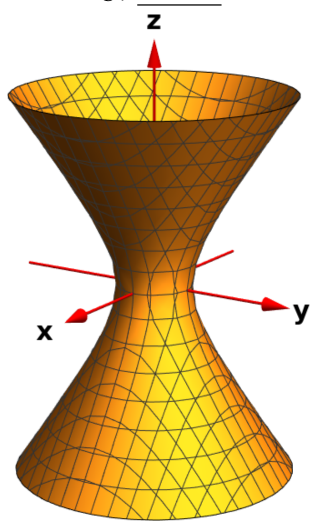
A. ______



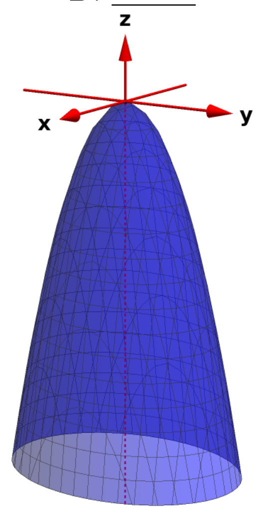
B. ______



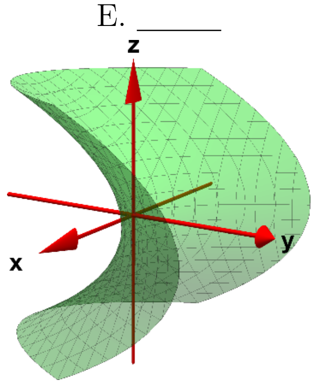
C. ______



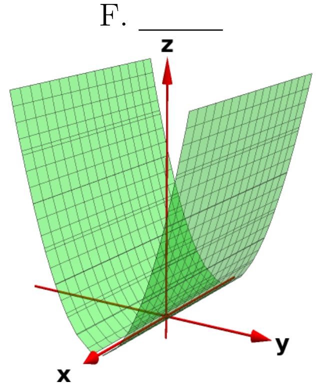
D. ______



E. ______



F. ______



(1) $\boldsymbol{x^2 + y^2 - z^2 = 1}$

(2) $\boldsymbol{x^2 - y^2 + z^2 = 1}$

(3) $\boldsymbol{x^2 + y^2 - z^2 = -1}$

(4) $\boldsymbol{x^2 - y^2 + z^2 = -1}$

(5) $\boldsymbol{x^2 + y^2 - z^2 = 0}$

(6) $\boldsymbol{x^2 - y^2 + z^2 = 0}$

(7) $\boldsymbol{z = x^2}$

(8) $\boldsymbol{z = y^2}$

(9) $\boldsymbol{z = -x^2 - y^2}$

(10) $\boldsymbol{z = x^2 - y^2}$

(11) $\boldsymbol{y = x^2 - z^2}$

(12) $\boldsymbol{y = z^2 - x^2}$