Name:

SM223 – Calculus III with Optimization Fall 2017
Assoc. Prof. Nelson Uhan

Exam 1 – 8 September 2017

Instructions

- You have until the end of the class period to complete this exam.
- You may not use a calculator.
- You may not consult any other outside materials (e.g. notes, textbooks, homework).
- **Show all your work.** Your answers should be legible and clearly labeled. It is your responsibility to make sure that I understand what you are doing. You will be awarded partial credit if your work merits it.
- Keep this booklet intact.
- **Do not discuss the contents of this exam with any midshipmen until it is returned to you.**

Problem	Weight	Score
1	1	
2	1	
3	1	
4	1	
5	1	
6	$\frac{1}{2}$	
7	1	
8	$1\frac{1}{2}$	
9	$\frac{1}{2}$	
10	$\frac{1}{2}$	
11	$\frac{1}{2}$	
12	$\frac{1}{2}$	
Total		/ 100

For Problems 1-3, let

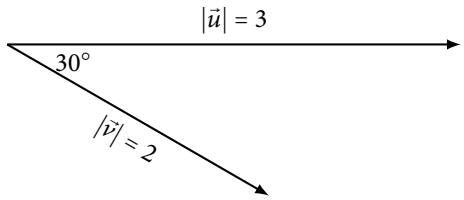
$$\vec{a} = -\vec{i} + 3\vec{j} - \vec{k} \qquad \vec{b} = -4\vec{j} + 3\vec{k}$$

Problem 1. Find a unit vector in the same direction as $\vec{b}$.

Problem 2. Find a vector orthogonal to $\vec{a}$ and $\vec{b}$.

Problem 3. Find the cosine of the angle between $\vec{a}$ and $\vec{b}$. Are $\vec{a}$ and $\vec{b}$ orthogonal? Why or why not?

For Problems 4-6, consider the vectors $\vec{u}$ and $\vec{v}$ given below.



Problem 4. Draw $\text{proj}_{\vec{v}}\vec{u}$ on the diagram above.

Problem 5. Find $|\vec{u} \times \vec{v}|$.

Problem 6. Is $\vec{u} \times \vec{v}$ directed into or out of the page?

Problem 7. Find parametric equations for the line that passes through the points $A(4,3,1)$ and $B(6,1,2)$.

Problem 8. Find an equation of the plane that passes through the points $A(2,1,-1)$, $B(0,-2,0)$, and $C(1,-1,2)$.

For Problems 9-12, the given equations describe a quadric surface.

a. Match the equation with its graph (A-F).

b. What is the name of the quadric surface?

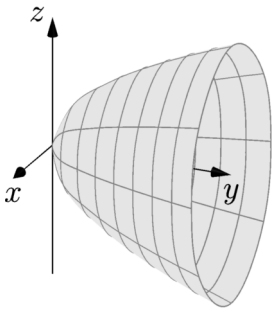
Problem 9. $x^2 = 4y^2 + 8z^2$

Problem 10. $-4x^2 - y^2 + 4z^2 = 1$

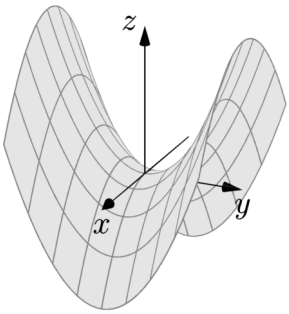
Problem 11. $2z = 3y^2 - 2x^2$

Problem 12. $y = 2x^2 + z^2$

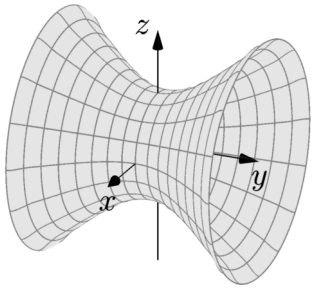
A.



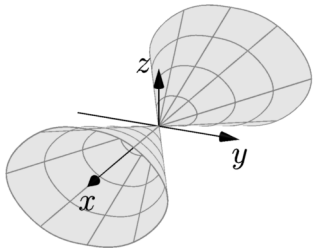
B.



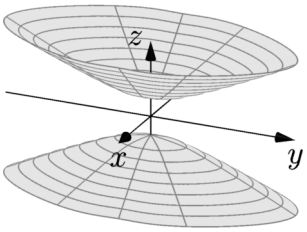
C.



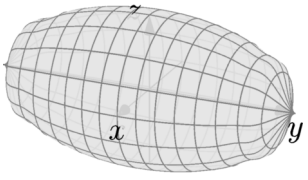
D.



E.



F.



Additional space for answers or scratchwork