Mth 254 Midterm | Name: ID:

Bent Petersen `254w2005-test.tex` Feb 9, 2005 Time: 50 minutes.

Instructions: $\Longrightarrow$
If you do not read the instructions, then how will you know what to do? Read them now.

Be sure to enter all required information on the scantron and on this test.

Section Number: 001
Form Number: 001

- *This test is multiple-choice and workout. You must turn in both the test and the scantron.*
- *For the multiple-choice problems you must mark your answer on the provided scantron. Fill in the appropriate bubbles on the scantron very carefully.*
- *For the workout problems you must show your work in reasonable detail on the test. Partial credit is allocated only for clear and relevant work.*
- *You may use one 8.5×11 inch note sheet prepared in advance. You may write on both sides of your note sheet.*
- *Note sheets may not be shared. If you do not bring a note sheet you will have to do without any help notes.*
- *You may not use any books, notebooks, additional note sheets nor note cards.*
- *You are expected to have a simple scientific calculator available for use on this test. Calculators and other equipment may not be shared.*
- *You may use a simple graphics calculator but not a laptop computer nor any device capable of extensive symbolic manipulation (other than your own brain).*
- *There are 9 multiple-choice (8 points each) and 1 work-out (20 points each) problems.*
- *Note that $\log(x)$ means the* natural logarithm *of x.*

Important Note: If you are taking this test in the Mathematics Learning Center you will not need a scantron. Just be sure to write the letters corresponding to your answers in the boxes provided below.

Problem 1. Find the cosine of the angle between the vectors $\vec{\mathrm{i}} + 2\vec{\mathrm{j}} + 2\vec{\mathrm{k}}$ and $12\vec{\mathrm{i}} - 4\vec{\mathrm{j}} + 3\vec{\mathrm{k}}$.

A.) $\frac{26}{39}$ **B.)** $\frac{10}{39}$
C.) $\frac{5}{8}$ **D.)** $\frac{15}{13}$ **E.)** None of the above.

[ ] ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 1).*

Problem 2. Find the distance from the origin to the plane through the points $(1, 2, 3)$, $(1, 1, 2)$ and $(3, 2, 2)$.

A.) 1 **B.)** 2
C.) 3 **D.)** 4 **E.)** None of the above.

[ ] ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 2).*

Problem 3. Consider two planes with normals $\vec{n}_1 =< 1, 1, 2 >$ and $\vec{n}_2 =< 2, 1, 1 >$. Find a vector parallel to the line of intersection of the planes.

A.) $< 1, 3, 1 >$ **B.)** $< -1, 3, 2 >$
C.) $< 2, 3, -1 >$ **D.)** $< 1, -3, 1 >$ **E.)** None of the above.

[ ] ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 3).*

Problem 4. The line with direction vector $\vec{v} =< 2, 3, 4 >$ and through the point $(3, -3, 2)$ passes through the point:

A.) $(5, 0, 5)$ **B.)** $(7, 3, 10)$
C.) $(1, -6, 6)$ **D.)** $(1, -6, -2)$ **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 4).*

Problem 5. The equation of the line through the point $(1, 0, 2)$ and perpendicular to the plane $6x + 4y - 6z = 3$ is $\vec{r}(t) =< 1 - 3t, -2t, A >$ where

A.) $A = 2 + 3t$ **B.)** $A = 2 - 3t$
C.) $A = 3t$ **D.)** $A = 2 + 6t$ **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 5).*

Problem 6. If $f(x, y) = 3x \log(y - x)$ compute $f_x(1, 2)$ (also denoted by $\dfrac{\partial f}{\partial x}(1, 2)$).

A.) 2 **B.)** 3
C.) 6 **D.)** 8 **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 6).*

Problem 7. Suppose we solve $z = 1 + \log(2x^2 + y - 2z^2)$ for z as a function of x and y. Compute the partial derivative $\dfrac{\partial z}{\partial x}$ when $x = 1$, $y = 1$ and $z = 1$.

A.) -1 **B.)** 1
C.) $-4/5$ **D.)** $4/5$ **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 7).*

Problem 8. Find an equation of the tangent plane to the surface $z = x^2y + xy^2$ at the point (1,2,6).

A.) $4x + y - z = 0$ **B.)** $8x + 5y - z = 12$
C.) $5x + 8y - z = 15$ **D.)** $6x + 3y - z = 0$ **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 8).*

Problem 9. If $f(x, y, z) = x^2 + yz$ find the maximum value of all the directional derivatives of f at the point $(1, 2, 1)$.

A.) 1 **B.)** 2
C.) 3 **D.)** 4 **E.)** None of the above.

☐ ←*Write letter corresponding to your answer here and mark it on the scantron (Problem 9).*

Problem 10. Use the method of Langrange multipliers to find the extreme points (maxima and minima) of $f(x, y, z) = 4x^2 - 4xy + y^2$ subject to the constraint $x^2 + y^2 = 5$. *Note you must use the method of Langrange multipliers and you must show clear work.*

Use this page and the backs of all the pages for scratch work.