Mth 254 Midterm | Winter 2007 | (Answers are appended at the end.)

Bent Petersen 254w2007-test.tex
Date: Feb 14 2007 Time: 50 min. Section number: 050 - Form number: 1

- A scantron is provided with this test. Fill in your ID information on the scantron. Do it now! In addition enter the section number and the form number (as indicated above) on the scantron. Do not fold, staple or tear, etc., the scantron. Keep the test. Return only the scantron.
- This test consists of a number of multiple-choice problems. Fill in the answers to the multiple-choice problems in the boxes below (for your record) and on the scantron. Depending on your solution method your answer may appear in a different form from the selections provided on the test. You are expected to be able to provide the appropriate manipulations to identify the correct answer.
- 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 may use a simple scientific calculator or a modest graphics calculator on this test and you are expected to have one available. An overly elaborate calculator, laptop, handheld or notebook computer, or any device capable of extensive symbolic manipulation (other than your own brain) will not be allowed. Calculators and other equipment may not be shared.
- During the test be sure to check the board occasionally for corrections. Note $\log(x)$ means the natural logarithm of x.
- There are 6 multiple-choice problems worth 10 points each and 2 multiple-choice problems worth 15 points each. The total number of points is 90.

Section 1. Multiple-choice problems: 6 problems, 10 points each.

Problem 1. If

$$\vec{u} =< 2, -1, 2 >, \quad \vec{v} =< -3, 0, 4 >$$

find the cosine, $\cos(\theta)$, of the angle, θ, between the vectors $\vec{u}$ and $\vec{v}$.

A.) $2/3$
B.) $-2/3$
C.) $2/15$
D.) $-2/15$
E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 1).*

Problem 2. Find a vector parallel to the line of intersection of the planes

$$3x + 2y - 4z = 4 \quad \text{and} \quad 2x + 3y + 2z = 5.$$

A.) $< 16, 14, 5 >$

B.) $< 16, -14, 5 >$

C.) $< 2, 3, 2 >$

D.) $< 3, 2, -4 >$

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 2).*

Problem 3. Find the tangent plane to the graph of

$$z = 3x^3y - 2xy^3 + xy - 4x$$

at the point $(1, -2, 4)$.

A.) $8x + 20y + z - 28 = 0$

B.) $8x - 20y + z - 52 = 0$

C.) $8x + 20y - z + 36 = 0$

D.) $8x + 20y + z + 28 = 0$

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 3).*

Problem 4. Let

$$f(x, y) = x^2\, y + x\, y^2.$$

Find the directional derivative of f in the direction of $\vec{u} = \langle 3/5, -4/5 \rangle$ at the point $(-2, 3)$.

A.) $19/5$

B.) $23/5$

C.) $114/25$

D.) $27/5$

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 4).*

Problem 5. Let

$$f(x,y) = x\,y^3 + x^3\,y^4.$$

Find the maximum directional derivative of f at the point $(-1,-1)$.

A.) $\sqrt{3}$

B.) 1

C.) $\sqrt{65}$

D.) $\sqrt{5}$

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 5).*

Problem 6. Let f be a function of 2 variables and suppose $f(2,3) = 8$. Suppose in addition we know $\vec{\nabla} f(2,3) =< 4, 5 >$. Estimate $f(1.9, 3.1)$ (by using differentials).

A.) 7.1

B.) 7.9

C.) 8.1

D.) 8.9

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 6).*

Section 2. Multiple-choice problems: 2 problems, 15 points each.

Problem 7. Find the tangent plane to the surface

$$xyz^2 + 2x^2yz^2 - 3xy + yz + y + 12 = 0$$

at the point $(1,-1,2)$.

A.) $17x - 12y + 13z = 55$

B.) $17x + 12y + 13z = 55$

C.) $-17x + 12y + 13z = -55$

D.) $x - y + 2z = 6$

E.) None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 7).*

Problem 8. The point $(3, 1)$ is a critical point of the function

$$f(x, y) = 6xy - 3y^3 - x^2y.$$

Use the second derivative test to classify the critical point $(3, 1)$.

A.) saddle **B.)** local min

C.) local max **D.)** global min **E.)** None of the foregoing.

☐ ←*Mark answer here and on the scantron* *(Problem 8).*

Use the space below and the backs of the test pages for scratch work.

Answers-050: C — B D B — D C A — C

Answers-070: A — D A C — A A C — B

Answers-MLC: B — D A D — B B A — C

This test is the section 050 version but I listed the answers for all three versions above. Note there was a typographical error in problem 4 on the test (corrected above). Thus on the actual test the correct answer for problem 4 was E for all three versions of the test.
