THE UNIVERSITY OF BRITISH COLUMBIA

Sample Questions for Midterm 1 - January 26, 2012

MATH 105 All Sections

Closed book examination Time: 50 minutes

Last Name ______________________ **First** ______________________

Signature ______________

Student Number ______________

Special Instructions:

No memory aids are allowed. One basic scientific calculator, WITH COVER REMOVED, may be used. Show all your work; little or no credit will be given for a numerical answer without the correct accompanying work. If you need more space than the space provided, use the back of the previous page. Where boxes are provided for answers, put your final answers in them.

Rules governing examinations

- Each candidate must be prepared to produce, upon request, a UBCcard for identification.
- Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.
- No candidate shall be permitted to enter the examination room after the expiration of one-half hour from the scheduled starting time, or to leave during the first half hour of the examination.
- Candidates suspected of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action.

  (a) Having at the place of writing any books, papers or memoranda, calculators, computers, sound or image players/recorders/transmitters (including telephones), or other memory aid devices, other than those authorized by the examiners.

  (b) Speaking or communicating with other candidates.

  (c) Purposely exposing written papers to the view of other candidates or imaging devices. The plea of accident or forgetfulness shall not be received.
- Candidates must not destroy or mutilate any examination material; must hand in all examination papers; and must not take any examination material from the examination room without permission of the invigilator.
- Candidates must follow any additional examination rules or directions communicated by the instructor or invigilator.

1. Let $P = (1, 0, 0)$ be a point and $\overline{n} = \langle 2, 2, 1 \rangle$ a vector.

(a) Describe an equation of a plane passing through P with normal vector $\overline{n}$.

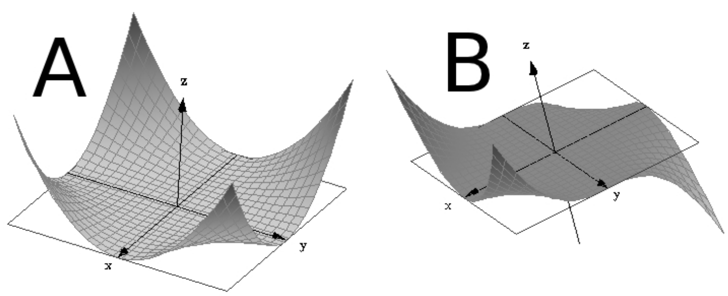
(b) Does the equation $-6x - 6y - 3z = -6$ describes the same plane? Justify your answer.

(c) Compute a unit vector that shows in the same direction as $\overline{n}$.

2. Let $f(x, y) = x^2y^2$ be a function.

(a) Sketch a diagram with at least 3 level curves of f.

(b) Which of the following two surfaces correspond to the graph of f? Decide and justify your answer!



3. Let $f(x, y) = e^{x^2 - y^2}$.

(a) In the xy-plane sketch the domain of the function f.

(b) Show or disprove that f is a differentiable function.

(c) Show or disprove that there exist a differentiable function f satisfying

$$f_x = y^{2013} \qquad \text{and} \qquad f_y = 2012xy^{2012}.$$

4. Let

$$f(x, y) = 4 + x^3 + y^3 - 3xy$$

be a function in two variables. Classify all critical points!

5. Find the point on the line passing through $(0, 0)$ with slope 3 that is closest to the point $P = (1, 1)$.

6. Let $[1,2]$ be an interval with regular partition in 4 subintervals of equal length $\Delta x = \frac{1}{4}$. Find the function whose left Riemann Sum for this regular partition is given by

$$R = \frac{1}{4} \cdot \frac{1}{1} + \frac{1}{4} \cdot \frac{1}{1+\frac{1}{4}} + \frac{1}{4} \cdot \frac{1}{1+\frac{2}{4}} + \frac{1}{4} \cdot \frac{1}{1+\frac{3}{4}} + \frac{1}{4} \cdot \frac{1}{2}$$

7. Let $f(x)$ be a differentiable function defined on some interval $[a, b]$. Assume that $f'(x) > 0$ for all x in $[a, b]$. What can you say about the left-, right- and midpoint Riemann Sum?

The End