MATH 203, SEC GH2: Calculus III

EXAMINATION 1

October 06, 2014

FILL OUT THE INFORMATION IN THE BOX AND SIGN.

Name:_____ Campus Email:_____

I pledge that the work on this exam is entirely my own.

Student signature: _____

READ THE FOLLOWING INFORMATION.

- This is a **60-minute** exam.
- Calculators, books, notes, and other aids are **not** allowed.
- You may use the backs of the pages or the extra pages for scratch work. **Do not unstaple or remove pages as they can be lost in the grading process.**
- Please do not put your name on any page besides the first page.

DO NOT BEGIN THE EXAM UNTIL SIGNALED TO DO SO.

MC (6 points). This part consists of 6 multiple choice questions. Nothing more than the answer is required, consequently no partial credit will be awarded. **Do not indicate your answer here as pages 1−4 will not be read. Fill your answer on the bubble sheet on page 5.**

1. If P, Q and R are the points $(-4, 2, 0), (2, 0, -3)$ and $(3, -1, -1)$, then the point closest from the x-axis is

   (A) P
   (B) Q
   (C) R
   (D) both P and R
   (E) both P and Q

2. If $\mathbf{a} = \mathbf{i} - \mathbf{j} + \sqrt{2}\mathbf{k}$ and $\mathbf{b} = -\mathbf{i} - 2\mathbf{j}$, then $proj_{\mathbf{a}}\mathbf{b}$ equals

   (A) $(1/4)\mathbf{a}$
   (B) $(1/4)\mathbf{b}$
   (C) $(1/2)\mathbf{a}$
   (D) $(1/2)\mathbf{b}$
   (E) None of the above

3. If $\mathbf{a} \times \mathbf{b} = 0$ for nonzero vectors $\mathbf{a}, \mathbf{b}$, then $\mathbf{a} \cdot \mathbf{b}$ is

   (A) always 0
   (B) never 0
   (C) may or may not be 0
   (D) always positive
   (E) always negative

4. If $\mathbf{o} = \mathbf{b} \times \mathbf{a}$, then $\mathbf{o}$ is

   (A) orthogonal to $\mathbf{a}$, but not orthogonal to $\mathbf{a} + 2\mathbf{b}$
   (B) orthogonal to $\mathbf{b}$, but not orthogonal to $\mathbf{a} + 2\mathbf{b}$
   (C) always orthogonal to $\mathbf{a} + 2\mathbf{b}$
   (D) never orthogonal to $\mathbf{a} + 2\mathbf{b}$
   (E) may or may not be orthogonal to $\mathbf{a} + 2\mathbf{b}$

5. The straight lines given by $x = 2 + t, y = 1 - t, z = t$ and $x = 2 + 3s, y = 2 - 3s, z = 3s$

   (A) are the same
   (B) are parallel, but not the same

(C) intersecting, but not the same

(D) intersecting, but not perpendicular

(E) None of the above

6. The surface of the equation $x^2 - y^2 + z^2 - 2x - 4y = 3$ is

(A) hyperboloid with one sheet

(B) hyperboloid with two sheet

(C) elliptic paraboloid

(D) hyperbolic paraboloid

(E) cone

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You can use it for scratch work. Please do not remove it.)

Use this page to record your answers to the Multiple Choice problems.

1. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
2. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
3. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
4. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
5. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
6. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

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Problems FR1-FR5 are free response problems. Put your answers in the boxes (where provided) and your work/explanations in the space below the problem.

- **Read and follow the instructions for every problem**.
- Show all of your work for purposes of partial credit. **Full credit may not be given for an answer alone**.
- Justify your answers. **Full sentences are not necessary** but English words help. When in doubt, do as much you think is necessary to demonstrate that you understand the problem, keeping in mind that your grader will be necessarily skeptical.

FR1 (3 points). Describe the solid body consisting of all points whose distance from the point (1,-2,1) is between 1 and 2.

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You can use it for scratch work. Please do not remove it.)

FR2 (5 points). A boatman wants to cross a canal that is 3 km wide. The current in the canal is 4 km/hr and the speed of the boat is 10 km/hr. If he goes in a direction which makes an angle $\pi/3$ with the downstream direction, then how long will it take to cross the canal? Where will he reach on the other side of the canal?

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FR3 (3 points). Find a unit vector that is orthogonal to the plane containing the points (2,1,-1), (3,2,-1) and (1,1,-2)..

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You can use it for scratch work. Please do not remove it.)

FR4 (5 points). Find the point at which the straight line at the intersection of the planes $x - y + 2z = 9$ and $2x + y - 3z + 1 = 0$ meet the xy-plane.

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You can use it for scratch work. Please do not remove it.)

FR5 (5 points). Sketch the surface consisting of all points which are equidistant from the yz-plane and the point (2,-1,-1).

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You can use it for scratch work. Please do not remove it.)