

MA 16200  
EXAM 1 Form 01  
September 12, 2019

NAME \_\_\_\_\_ YOUR TA'S NAME \_\_\_\_\_

STUDENT ID # \_\_\_\_\_ RECITATION TIME \_\_\_\_\_

Be sure the paper you are looking at right now is GREEN! Write the following in the TEST/QUIZ NUMBER boxes (and blacken in the appropriate spaces below the boxes): 

01
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You must use a #2 pencil on the mark-sense sheet (answer sheet). On the mark-sense sheet, fill in your TA's name and the COURSE number. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces. Fill in your four-digit SECTION NUMBER. If you do not know your section number, ask your TA. Sign the mark-sense sheet.

There are 12 questions, each worth 8 points (you will automatically earn 4 point for taking the exam). Blacken in your choice of the correct answer in the spaces provided for questions 1–12. Do all your work in this exam booklet. Use the back of the test pages for scrap paper. Turn in both the scantron and the exam booklet when you are finished.

If you finish the exam before 7:20, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 6:50. If you don't finish before 7:20, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.

EXAM POLICIES

1. Students may not open the exam until instructed to do so.
2. Students must obey the orders and requests by all proctors, TAs, and lecturers.
3. No student may leave in the first 20 min or in the last 10 min of the exam.
4. Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should not even be in sight in the exam room. Students may not look at anybody else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
6. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam rules stated above:

STUDENT NAME: \_\_\_\_\_

STUDENT SIGNATURE: \_\_\_\_\_

1. A sphere is described by the equation  $x^2 + y^2 + z^2 + ax + 6y - 8z = -1$ . Find  $a$  so that the sphere has a radius of 5 and its center has an  $x$ -coordinate of  $-1$ .

- A. 4
- B. 2
- C.  $-2$
- D. 1
- E.  $-1$

2. An object is acted on by the forces  $\mathbf{F}_1 = 2\mathbf{i} - \mathbf{j}$ ,  $\mathbf{F}_2 = 3\mathbf{j} + \mathbf{k}$ ,  $\mathbf{F}_3 = 4\mathbf{j} + 2\mathbf{k}$ . Find the magnitude of the force  $\mathbf{F}_4$  that must act on the object so that the net force is zero.

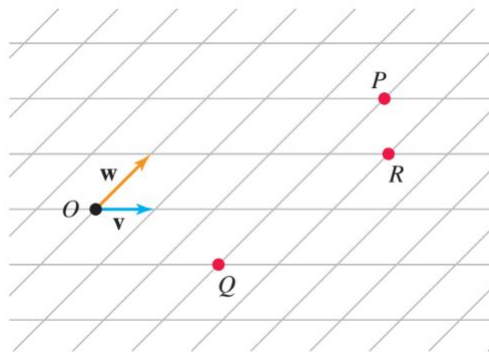
- A.  $\sqrt{7}$
- B. 7
- C. 11
- D.  $\sqrt{11}$
- E. 49

3. How many of the following expressions are mathematically meaningful?

- I.  $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$
- II.  $\mathbf{a} \times (\mathbf{b} \cdot \mathbf{c})$
- III.  $\mathbf{a} \times (\mathbf{b} \times \mathbf{c})$
- IV.  $(\mathbf{a} \cdot \mathbf{b}) \times (\mathbf{c} \cdot \mathbf{d})$
- V.  $(\mathbf{a} \times \mathbf{b}) \cdot (\mathbf{c} \times \mathbf{d})$

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

4. Use the figure below to write  $\vec{OQ} - \vec{QR}$  in terms of  $\mathbf{v}$  and  $\mathbf{w}$



- A.  $2\mathbf{v} - 3\mathbf{w}$
- B.  $4\mathbf{v} + \mathbf{w}$
- C.  $-2\mathbf{v} + 3\mathbf{w}$
- D.  $-4\mathbf{v} - \mathbf{w}$
- E.  $3\mathbf{v} + 2\mathbf{w}$

5. Let  $\mathbf{a} = \langle 1, 2, 3 \rangle$  and  $\mathbf{b} = \langle 2, -1, 2 \rangle$ . If  $\text{proj}_{\mathbf{b}}\mathbf{a} = c\mathbf{b}$ , what is  $c$ ?

- A.  $\frac{3}{2}$
- B. 2
- C. 1
- D.  $\frac{2}{3}$
- E.  $\frac{1}{3}$

6. Find the area of the triangle whose sides are the vectors  $\mathbf{u} = \langle 1, 1, 1 \rangle$ ,  $\mathbf{v} = \langle 2, 0, 2 \rangle$ , and  $\mathbf{u} - \mathbf{v}$ .

- A.  $\sqrt{2}$
- B.  $2\sqrt{2}$
- C.  $\sqrt{5}$
- D.  $2\sqrt{5}$
- E. 4

7. Find the area of the region bounded by  $y = x + 1$  and  $y = (x - 1)^2$ .

A.  $\frac{13}{2}$

B.  $\frac{5}{2}$

C.  $\frac{11}{6}$

D.  $\frac{7}{2}$

E.  $\frac{9}{2}$

8. The region bounded by  $y = e^x$ ,  $y = 1$ , and  $x = 2$  is revolved about the  $x$ -axis. If the washer method is used, the volume of the solid generated is given by the integral

A.  $\pi \int_0^2 e^{2x} dx$

B.  $2\pi \int_1^{e^2} (2 - \ln y)(y - 1) dy$

C.  $\pi \int_0^2 (e^{2x} - 1) dx$

D.  $2\pi \int_0^{e^2} y(2 - \ln y) dy$

E.  $\pi \int_0^2 (e^x - 1)^2 dx$

9. Find the volume generated by rotating the region bounded by the curves

$$y = x^2, \quad y = 0, \quad x = 1$$

about the line  $x = -1$ .

- A.  $\frac{5\pi}{6}$
- B.  $\frac{7\pi}{6}$
- C.  $\frac{11\pi}{6}$
- D.  $\frac{13\pi}{6}$
- E.  $\frac{17\pi}{6}$

10. The height of a monument is 3 meters. A horizontal cross-section at a distance  $x$  meters from the top is an equilateral triangle with each side being  $x$  meters. Find the volume (in  $\text{m}^3$ ) of the monument.

- A. 8
- B.  $\frac{9}{2}$
- C.  $\frac{3\sqrt{3}}{8}$
- D.  $\frac{\sqrt{3}}{4}$
- E.  $\frac{9\sqrt{3}}{4}$

11. A spring has a natural length of 5 m. If a 25-N force is required to keep it stretched to a length of 10 m, how much work (in joules) is required to stretch it from 5 m to 6 m?

A.  $\frac{55}{2}$

B.  $\frac{55}{4}$

C.  $\frac{5}{4}$

D.  $\frac{5}{2}$

E. 5

12. The derivative of the function  $g(x)$  is  $g'(x) = \sqrt{\sec^4 x - 1}$ . What is the length of the curve  $y = g(x)$  on the interval  $0 \leq x \leq \frac{\pi}{4}$ ?

A. 1

B. 2

C. 4

D.  $\sqrt{3}$

E.  $\sqrt{2}$