MA 16600 Exam I, September 2019

Name ______________________________

10–digit PUID number ______________________________

Recitation Instructor ______________________________

Recitation Section Number and Time ______________________________

Instructions: **MARK TEST NUMBER 26 ON YOUR SCANTRON**

1. Do not open this booklet until you are instructed to.
2. Fill in all the information requested above and on the scantron sheet. On the scantron sheet fill in the little circles for your name, section number and PUID.
3. This booklet contains 12 problems, each worth 8 points. You will get 4 points for correctly supplying information above and on the scantron.
4. For each problem mark your answer on the scantron sheet and also **circle it in this booklet**.
5. Work only on the pages of this booklet.
6. Books, notes, calculators or any electronic device are not allowed during this test and they should not even be in sight in the exam room. You may not look at anybody else's test, and you may not communicate with anybody else, except, if you have a question, with your instructor.
7. You are not allowed to leave during the first 20 and the last 10 minutes of the exam.
8. When time is called at the end of the exam, put down your writing instruments and remain seated. The TAs will collect the scantrons and the booklets.

1. The base of a solid is a 3 by 3 square. Its cross sections perpendicular to a fixed diagonal of the square are equilateral triangles with one side on the base. Find the volume of the solid.

   A. $2\sqrt{3}/3$
   B. $9\sqrt{3}/\sqrt{2}$
   C. $3\sqrt{3}/4$
   D. $6\sqrt{3}$
   E. $8/\sqrt{3}$

2. The angle between the vectors $\langle 2, 1, 2\rangle$ and $\langle 1, -2, 2\rangle$ is

   A. $\cos^{-1} 4/9$
   B. $\pi/6$
   C. $\pi/4$
   D. $\cos^{-1} 3/5$
   E. None of the above.

3. Forces represented by the vectors $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $2\mathbf{i} + \mathbf{j} - \mathbf{k}$ act on an object. What third force should be applied to keep the object in equilibrium?

   A. $3\mathbf{i} + \mathbf{j} + 2\mathbf{k}$

   B. $-3\mathbf{i} + \mathbf{j}$

   C. $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$

   D. $3\mathbf{i} - \mathbf{j}$

   E. $-\mathbf{i} - 2\mathbf{j} - \mathbf{k}$

4. Given that $\sin x \geq \dfrac{\sin 3x}{3}$ for $0 \leq x \leq \pi$, find the area between the the graphs of $\sin x$ and $\dfrac{\sin 3x}{3}$, $0 \leq x \leq \pi$.

   A. 5/8

   B. 12/5

   C. 15/8

   D. 7/5

   E. 16/9

5. A sled is pulled 100 m along a horizontal path by a force of 30 N acting at an angle of 30 degrees above the horizontal. The work done by the force is (recall that J=Nm):

   A. 1500 J
   B. 150 J
   C. $1500\sqrt{2}$ J
   D. $150\sqrt{3}$ J
   E. $1500\sqrt{3}$ J

6. The area of the triangle with vertices $(1, 2, 3)$, $(2, 2, 4)$, $(1, 2, 0)$ is

   A. 2
   B. 1
   C. 3/2
   D. 2/3
   E. 1/2

7. A region in the xy plane is bounded by the curves $y = 1/x$, $y = \sqrt{x}$, and $x = 4$. Find the volume generated if this region is rotated about the x axis.

   A. 9π

   B. $16\pi/3$

   C. $64\pi/15$

   D. $27\pi/4$

   E. 4π

8. Which is true? The vectors $\mathbf{a}$ and $\mathbf{b}$ are parallel if and only if

   I. $\mathbf{a} \cdot \mathbf{b} = 0$; II. $\mathbf{a} \times \mathbf{b} = \mathbf{0}$; III. $\mathbf{a} \times \mathbf{b} = \pi/2$.

   A. Only I.

   B. Only II.

   C. Only III.

   D. Only I. and II.

   E. Only I. and III.

9. If it takes 4 J work to stretch a spring by 0.02 m beyond its natural length, how much work is required to stretch it an additional 0.02 m?

   A. 4 J

   B. 6 J

   C. 9 J

   D. 12 J

   E. 15 J

10. In the xy plane the line through $(0, 5)$ and $(4, -3)$ cuts the circle $x^2 + y^2 \leq 25$ in two regions. If we rotate the smaller of the two about the y axis, the volume generated is represented by which of the following expressions?

    A. $\pi \displaystyle\int_{-3}^{5} \left(\frac{75}{4} + \frac{5y}{2} - \frac{5y^2}{4} \right) dy$

    B. $\pi \displaystyle\int_{-3}^{5} \left(\frac{25}{4} + 5x - \frac{x^2}{2} \right) dx$

    C. $\pi \displaystyle\int_{0}^{4} \left(\frac{25}{4} + 5x + \frac{x^2}{2} \right) dx$

    D. $\pi \displaystyle\int_{0}^{4} (75 - 6x + 5x^2)\, dx$

    E. $\pi \displaystyle\int_{0}^{4} \left(48 - \frac{7y}{4} + \frac{y^2}{2} \right) dy$

11. The radius of the sphere represented by

$$x^2 + y^2 + z^2 + 4x - 6z - 3 = 0$$

is

A. 1

B. 2

C. 3

D. 4

E. 5

12. If the arc length of the graph of a differentiable function $f(x)$ over any interval $[a, b]$ is given by $\int_a^b \sqrt{1 + 4e^{4x}}\, dx$, the function can be $f(x) =$

A. e^{2x}

B. $e^{4x}/2$

C. $2e^{2x}$

D. $2e^{4x}$

E. e^{4x}