MA 16200
EXAM 1 Form 01
September 21, 2023

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 on the scantron: | 01 |

You must use a #2 pencil on the scantron answer sheet. Fill in the following on your scantron and blacken the bubbles

1. Your name. If there aren't enough space for your name, fill in as much as you can.

2. Section number. If you don't know your section number, ask your TA.

3. Test/Quiz number: | 01 |

4. Student Identification Number: | **This is your Purdue ID number with two leading zeros.** |

There are **12** questions, each worth 8 points (you will automatically earn 4 points for filling out your student ID number correctly). 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 SIGNATURE: ————————————————————————————

1. If $|\mathbf{u}| \neq \mathbf{0}$ and $|\mathbf{v}| \neq \mathbf{0}$ and $|\mathbf{u}+\mathbf{v}| = |\mathbf{u}|+|\mathbf{v}|$, which of the following statements is correct?

     A. $\mathbf{u}$ and $\mathbf{v}$ are parallel and in the same direction.

     B. $\mathbf{u}$ and $\mathbf{v}$ are parallel and in the opposite directions.

     C. $\mathbf{u}$ and $\mathbf{v}$ are perpendicular.

     D. Always true for all $\mathbf{u}$ and $\mathbf{v}$

     E. Never true for any $\mathbf{u}$ and $\mathbf{v}$

2. What are the center and radius of the sphere given by

$$x^2 + y^2 + z^2 + 6x + 8y - 4z + 4 = 0$$

     A. Center $(3, 4, -2)$ and radius 25

     B. Center $(3, 4, -2)$ and radius 5

     C. Center $(-3, -4, 2)$ and radius $\sqrt{33}$

     D. Center $(-3, -4, 2)$ and radius 5

     E. Center $(3, 4, -2)$ and radius $\sqrt{33}$

3. If $u = <-4, 0, 1>$ and $v = <1, 3, -3>$ and $\text{proj}_v u = <a, b, c>$, what is b?

A. $-\frac{21}{19}$

B. $-\frac{7}{19}$

C. -21

D. 0

E. 21

4. The angle between $a = <1, 1>$ and $b = <\sqrt{3}-1, \sqrt{3}+1>$ is:

A. $\frac{\pi}{6}$

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

C. 0

D. $\frac{\pi}{3}$

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

5. Find $x > 0$ so that the area of the area of the **triangle** with vertices $(0, 0, 0)$, $(1, 1, 1)$, $(x, 2x, 3x)$ is 1.

A. $\frac{1}{\sqrt{3}}$

B. $\frac{1}{\sqrt{2}}$

C. $\frac{2}{\sqrt{6}}$

D. $\frac{1}{\sqrt{6}}$

E. $\frac{2}{\sqrt{3}}$

6. The area of the region bounded by $y = \cos x$, $y = \sin x$, and the x−axis, $0 \le x \le \frac{\pi}{2}$ is given by

A. $\displaystyle\int_0^{\frac{\pi}{4}} \cos x \; dx - \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \sin x \; dx$

B. $\displaystyle\int_0^{\frac{\pi}{4}} (\cos x - \sin x) \; dx$

C. $\displaystyle\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} (\sin x - \cos x) \; dx$

D. $\displaystyle\int_0^{\frac{\pi}{4}} \sin x \; dx + \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cos x \; dx$

E. $\displaystyle\int_0^{\frac{\pi}{4}} (\cos x - \sin x) \; dx + \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} (\sin x - \cos x) \; dx$

7. Find the volume of a solid obtained by revolving about the x-axis the region bounded by $x = y^2$, $x = y + 2$, and the x-axis in the first quadrant.

    A. $\frac{8\pi}{3}$

    B. $\frac{10\pi}{3}$

    C. 4π

    D. $\frac{14\pi}{3}$

    E. $\frac{16\pi}{3}$

8. Find the volume of a solid whose base is the region bounded by $y = \sqrt{1 - x^2}$ and the x-axis on the xy-plane. Slices of this solid perpendicular to the x-axis and the xy-plane are squares with sides $\sqrt{1 - x^2}$.

    A. $\frac{1}{3}$

    B. $\frac{5}{3}$

    C. $\frac{2}{3}$

    D. 1

    E. $\frac{4}{3}$

9. Find the length of the curve $y = \dfrac{x^3}{6} + \dfrac{1}{2x}$, $1 \le x \le 2$.

A. $\frac{19}{12}$

B. $\frac{17}{12}$

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

D. $\frac{13}{12}$

E. $\frac{11}{12}$

10. Find the area of the surface obtained by revolving the curve $y = \sqrt{1 - x^2}$ from $x = 0$ to $x = \dfrac{\sqrt{3}}{2}$ about the x-axis.

A. $\sqrt{2}\pi$

B. $\sqrt{3}\pi$

C. $\frac{3\pi}{4}$

D. $\frac{\sqrt{3}\pi}{2}$

E. $\frac{\sqrt{2}\pi}{3}$

11. A full water basin has the shape of a box 2m wide, 10m long, and 1m deep. How much work (in J) is required to pump the water out? Please use $1000 \ \frac{\text{kg}}{\text{m}^3}$ as the density of water and $g = 9.8 \ \frac{\text{m}}{\text{s}^2}$ as the acceleration due to gravity in your calculation.

    A. 49000

    B. 98000

    C. 147000

    D. 196000

    E. 245000

12. It takes 20 J of work to stretch a spring 0.2 m from its equilibrium position. How much work (in J) does it take to stretch it by an additional 0.3 m?

    A. 95

    B. 55

    C. 105

    D. 75

    E. 115