MA 162   Exam 1   Fall 2002

NAME _____

STUDENT ID _____

REC. INSTR. _____ REC. TIME. _____

INSTRUCTOR _____

INSTRUCTIONS:

1. Make sure that you have all 5 test pages.

2. Fill in your name, your student ID number, and your instructor's name above.

3. There are 12 problems.

4. No books or notes or calculators may be used.

(4 pts)   1. The expression $((\mathbf{a} \times \mathbf{b}) \cdot (\mathbf{c} \times \mathbf{d}))(\mathbf{e} \times \mathbf{d})$ is a vector.
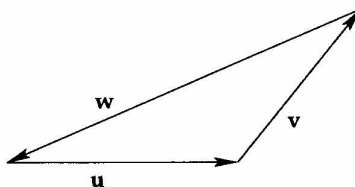
(A) True

(B) False

(6 pts)   2. The equation $x^2 + y^2 + z^2 = 4x + 2y - 4z$ represents a sphere of radius 3 centered at $(-2, -1, 2)$.

(A) True

(B) False

(8 pts)   3. For the vectors represented in the figure, write $\mathbf{w}$ in terms of $\mathbf{u}$ and $\mathbf{v}$.

(A) $\mathbf{w} = \mathbf{u} + \mathbf{v}$

(B) $\mathbf{w} = \mathbf{u} - \mathbf{v}$

(C) $\mathbf{w} = -\mathbf{u} - \mathbf{v}$

(D) $\mathbf{w} = \mathbf{v} - \mathbf{u}$

(E) $\mathbf{w} = \mathbf{u} - 2\mathbf{v}$

(10 pts)   4. The angle between $\mathbf{j} - \mathbf{k}$ and $2\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ is

(A) $\cos^{-1}\left(\dfrac{2\sqrt{7}}{7}\right)$

(B) $\cos^{-1}\left(\dfrac{2}{7}\right)$

(C) $\cos^{-1}\left(\dfrac{-2\sqrt{7}}{7}\right)$

(D) $\cos^{-1}\left(\dfrac{\sqrt{7}}{7}\right)$

(E) $\cos^{-1}\left(\dfrac{-1}{7}\right)$

(10 pts)   5. Let $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$, and $\mathbf{b} = \mathbf{i} - \mathbf{j} + \mathbf{k}$. Compute $\mathbf{a} \times \mathbf{b}$.

(A) $4\mathbf{i} - 5\mathbf{j} + \mathbf{k}$

(B) $4\mathbf{i} - \mathbf{j} - 5\mathbf{k}$

(C) $4\mathbf{i} - \mathbf{j} + 5\mathbf{k}$

(D) $4\mathbf{i} + \mathbf{j} + 5\mathbf{k}$

(E) $2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$

(12 pts)   6. Find the area of the region enclosed by the curves $y = x^2$ and $y = 2x + 3$.

(A) $32/3$

(B) $59/3$

(C) $26/3$

(D) $38/3$

(E) $34/3$

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(10 pts) 7. Find the volume of the solid obtained by rotating the region bounded by $y = e^{-x}$, $y = x + 1$, $x = 1$ about the x-axis.

(A) $\pi \left(\dfrac{4}{3} + e^{-2} \right)$

(B) $\pi \left(\dfrac{1}{2}e^{-2} - \dfrac{11}{6} \right)$

(C) $\pi \left(\dfrac{14}{6} - \dfrac{1}{2}e^{-2} \right)$

(D) $\pi \left(\dfrac{11}{6} + \dfrac{1}{2}e^{-2} \right)$

(E) $\pi \left(e^{-2} - \dfrac{4}{3} \right)$

(10 pts) 8. The region enclosed by $y = x^2 + x + 1$ and $y = 4x - 1$ is rotated about the y-axis. Find the volume of the solid.

(A) $\dfrac{5}{2}\pi$

(B) 4π

(C) 3π

(D) 2π

(E) $\dfrac{1}{2}\pi$

(10 pts) 9. A 50 ft. cable that weighs 1 lb/ft is used to lift a 100 lb box up 50 ft. How much work is done?

(A) 7500 ft-lb

(B) 5000 ft-lb

(C) 2500 ft-lb

(D) 6250 ft-lb

(E) 6000 ft-lb

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(5 pts)   10. Suppose we stretch a spring twice from its neutral position. The first time we stretch it to a distance a and the second time to a distance $2a$. Then the amount of work done in the second stretch is twice as much as work done in the first one.

(A) True

(B) False

(5 pts)   11. Suppose two tanks have the same depth and the same volume but not the same shape. If the tanks are filled with water then the work done in pumping out the water from the top of the tanks will always be the same.

(A) True

(B) False

(10 pts)   12. Evaluate $\displaystyle\int_0^{\frac{\pi}{4}} x \sin(2x)\,dx$.

(A) $\dfrac{1}{4}$

(B) $\dfrac{1}{4} - \dfrac{\pi}{8}$

(C) $\dfrac{1}{2}$

(D) $\dfrac{1}{2} - \dfrac{\pi}{4}$

(E) 1