

Name: _____ Alpha: _____ SECTION: 1ST 2ND 3RD [CIRCLE ONE]

Instructions

1. **Do NOT turn the page or begin until instructed to do so.**
2. Print your name, alpha, and circle your section above. Write nothing else on this cover page, except your signature on the line below to indicate you've read and understood the directions.
3. There are **6** problems altogether. Relative weights are indicated in the table.
4. For fill-in-the-blank, multiple-choice, matching, and similar problems, write your answer directly on the test paper. There is plenty of space on each page (and the back) for your work. Although your work will not be graded, you might receive part-credit based on how "good" your incorrect answer is.
5. If a problem requests you to show your work, use the space provided to receive credit.
6. **Calculators are allowed for this test. However, sharing of calculators is forbidden.**
7. Unless otherwise indicated, leave answer in exact form; don't approximate $\sqrt{2}$ as 1.41, for instance.

Signature _____

DO NOT WRITE ANYTHING ON THIS PAGE BELOW THIS LINE

Problem	Points	Score
1	80	
2	50	
3	30	
4	70	
5	30	
6	30	
<i>FREE</i>	10	10
Total	300	

Test 1	300	
Test 2	300	
Test 3	300	
Test 4	300	
Quizzes	400	
Subtotal	1600	
– Low Test	–300	
TOTAL SO FAR	1300	

SM 122 Test #4 Vectors

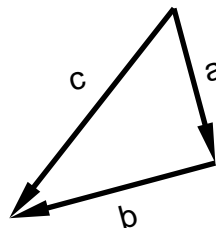
26 Apr 2006

1. The sketch shows three vectors \mathbf{a} , \mathbf{b} , and \mathbf{c} in **three** dimensions that form a $(6, 8, 10)$ -right triangle with

$$\|\mathbf{a}\| = 6$$

$$\|\mathbf{b}\| = 8$$

$$\|\mathbf{c}\| = 10$$



- (a) Draw the vector $\text{proj}_{\mathbf{c}}(\mathbf{a})$ (the vector projection of \mathbf{a} onto \mathbf{c}) in the sketch at an appropriate position. Label your vector \vec{v} .

THE REMAINING PARTS OF THIS PROBLEM ARE MULTIPLE CHOICE. CIRCLE THE BEST CAPITAL LETTER.

(b) $\mathbf{c} \cdot \mathbf{c} =$

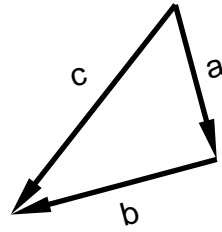
- (A) 0
- (B) 10
- (C) 20
- (D) $10\sqrt{2}$
- (E) 100

(c) $\mathbf{a} \cdot \mathbf{b} =$

- (A) 0
- (B) 24
- (C) 48
- (D) -24
- (E) -48

(d) $\|\mathbf{a} + \mathbf{b}\| =$

- (A) 0
- (B) 10
- (C) 12
- (D) 14
- (E) 50



(e) $\|\mathbf{a} + \mathbf{b} - \mathbf{c}\| =$

- (A) 0
- (B) 4
- (C) 8
- (D) 10
- (E) 24

(f) The length of $\left(\frac{1}{\|\mathbf{c}\|}\right) \mathbf{c}$ is

- (A) 0
- (B) $\frac{1}{10}$
- (C) 1
- (D) 10
- (E) $\frac{1}{100}$

(g) $\| -2\mathbf{c} \| =$

- (A) -20
- (B) -10
- (C) 0
- (D) 10
- (E) 20

(h) The vector $\mathbf{a} \times \mathbf{c}$

- (A) has length 60 and points into the page
- (B) has length 48 and points into the page
- (C) has length 30 and points into the page
- (D) has length 24 and points into the page
- (E) has length 60 and points out of the page
- (F) has length 48 and points out of the page
- (G) has length 30 and points out of the page
- (H) has length 24 and points out of the page

SM 122 Test #4 Vectors

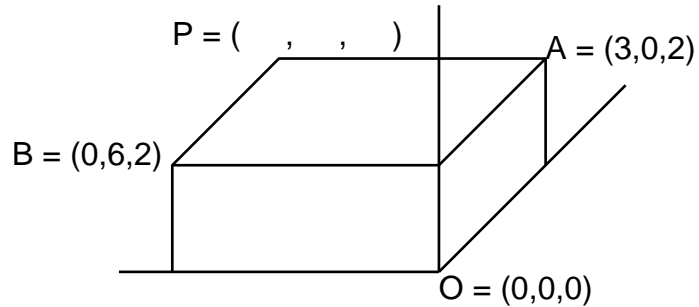
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2. Three corners of the solid brick shown are

$$O = (0, 0, 0), \quad A = (3, 0, 2), \quad B = (0, 6, 2).$$

The x -axis points into the page, and the y -axis points to the left.

The corner point P is opposite the corner of the brick at origin O .



(a) Fill in the coordinates of P in the diagram.

THE REMAINING PARTS OF THIS PROBLEM ARE MULTIPLE CHOICE. CIRCLE THE BEST CAPITAL LETTER.

(b) The dot product $\vec{OA} \cdot \vec{OB}$ equals

- (A) 0
- (B) 4
- (C) 7
- (D) 11
- (E) 13

(c) To the nearest 5 degrees $\angle BOA$ equals

- (A) 90°
- (B) 85°
- (C) 80°
- (D) 75°
- (E) 70°

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26 Apr 2006

(d) The area of $\triangle BOA$ equals

- (A) 6
- (B) 12
- (C) $6\sqrt{6}$
- (D) $6\sqrt{14}$
- (E) $3\sqrt{14}$

(e) The plane through O , A , and B also contains the point

- (A) $(-12, -6, 18)$
- (B) $(4, -1, 3)$
- (C) $(3, 0, 4)$
- (D) $(4, 0, 3)$
- (E) $(1, -2, 0)$

3. **Fill in the blanks.** For this problem we let

$$\mathbf{v} = \langle -2, 3, 1 \rangle \quad \text{and} \quad \mathbf{w} = \langle 1, 1, 2 \rangle$$

(a) The vector projection of \mathbf{w} onto \mathbf{v} is _____

(b) The scalar projection (also called the component) of \mathbf{w} onto \mathbf{v} is _____

4. **Fill in the blanks.** A particle travels with constant speed on a line L in three dimensions. At time $t = 0$ the particle is at $P_0 = (1, 3, 9)$, and at time $t = 1$ it is at $P_1 = (2, 5, 7)$.

(a) At $t = 2$ the particle is at the point $(x, y, z) = (\underline{\quad}, \underline{\quad}, \underline{\quad})$

(b) Give the symmetric equations for the line L .

(c) The line L intersects the xy -plane at the point $(x, y, z) = (\underline{\quad}, \underline{\quad}, \underline{\quad})$

(d) Find the equation of the plane through P_0 and perpendicular to L .

(e) What is the distance between the point P_1 and the plane in the previous part?

5. **Multiple Choice.** Circle the best capital letter

(a) The sphere $x^2 + y^2 + z^2 + 4x - 6y + 2z + 6 = 0$ has radius

- (A) $\sqrt{6}$
- (B) $\sqrt{8}$
- (C) $\sqrt{10}$
- (D) $\sqrt{12}$
- (E) $\sqrt{14}$

(b) A force is given by $\mathbf{F} = 3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$ and moves a particle from the point $P = (2, 1, 0)$ to the point $Q = (4, 6, 2)$. (The distances are in meters and the force is in newtons.) What is the work done?

- (A) 10 J
- (B) 36 J
- (C) 46 J
- (D) 50 J
- (E) 56 J

(c) A wagon is pulled a distance of 10 m along a horizontal path by a constant force of 50 N. The handle of the wagon is held at an angle of 60° above the horizontal. How much work is done?

- (A) 125 J
- (B) 250 J
- (C) 500 J
- (D) 550 J
- (E) 1000 J

6. Identify each expression as VECTOR, SCALAR, or NONSENSE.

Write V or S or N in each blank.

- (a) _____ $(\vec{a} \cdot \vec{b}) \times \vec{c}$
- (b) _____ $(\vec{v} \times \vec{w}) \times \vec{u}$
- (c) _____ $(\vec{a} \cdot \vec{b}) \vec{c}$
- (d) _____ $(\vec{v} \times \vec{w}) \vec{u}$
- (e) _____ $(\vec{a} \cdot \vec{b}) \cdot \vec{c}$
- (f) _____ Torque