Ch 10 Study Guide / Your Name: _____ / Your Class: _____

Calculus III - Math 2630 - Spring 2013 Instructor: Steven Clontz

Draw a box around your answer. Show your work. Calculators not allowed.

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1. Find the cosine of the angle between the vectors $\mathbf{u} = \langle 4, -3, 0 \rangle$ and $\mathbf{v} = \langle 2, 6, -3 \rangle$.

   (a) Invoke correct formula $\mathbf{u} \cdot \mathbf{v} = |\mathbf{u}||\mathbf{v}| \cos\theta$ (3 points)

   (b) Compute each of $|\mathbf{u}|$, $|\mathbf{v}|$, $\mathbf{u} \cdot \mathbf{v}$ correctly (1 point each, 3 total)

   (c) Compute $\cos\theta$ correctly (4 points)

2. Find the vector which is the projection of the vector $\mathbf{u} = \mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$ onto the vector $\mathbf{v} = -3\mathbf{i} + 4\mathbf{k}$.

   (a) Apply correct formula $\text{proj}_{\mathbf{v}}(\mathbf{u}) = \left(\dfrac{\mathbf{u} \cdot \mathbf{v}}{|\mathbf{v}|^2}\right) \mathbf{v}$ (3 points)

   (b) Compute each of $\mathbf{u} \cdot \mathbf{v}$, $|\mathbf{v}|$ correctly (2 points each, 4 total)

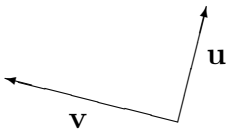
   (c) Compute $\text{proj}_{\mathbf{v}}(\mathbf{u})$ correctly (3 points)

3. Circle one for each: Given the below images, does the vector $\mathbf{u} \times \mathbf{v}$ extend OUT of the paper or INTO the paper for each?

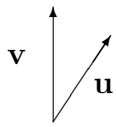
   (a) Get all correct (10 points)

   (b) Get all incorrect (5 points)

   (c) Mix of correct and incorrect (0 points)



OUT / INTO



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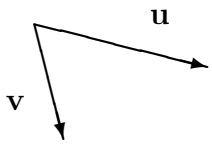

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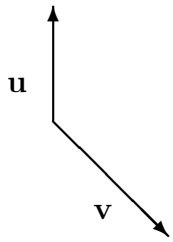

OUT / INTO

4. Find a nonzero vector which is normal to both of the vectors $\langle 1, 3, -4 \rangle$ and $\langle 2, 0, 1 \rangle$.

   (a) Claim cross-product is normal (2 points)

   (b) Set up the cross-product correctly (2 points)

   (c) Compute cross-product correctly (6 points)

5. Find the vector equation and parametric equations for the line passing through $(1, 2, 3)$ and parallel to the line given by $\mathbf{r}(t) = \langle 4 - t, 3 - 2t, 2 + t \rangle$.

   (a) Identify a point on the line (1 point)

   (b) Identify a vector parallel to the line (2 points)

   (c) Write a correct vector equation (4 points)

   (d) Write correct parametric equations (3 points)

6. Find the equation for the plane passing through $(1, 4, -1)$ and normal to the line

$$x = -3t, y = t + 2, z = 2t - 1$$

(a) Identify a point on the plane (2 point)

(b) Identify a vector normal to the plane (3 points)

(c) Write a correct plane equation (5 points)

7. Find the distance from the point $(2, 7, -3)$ to the plane given by the equation $2x+6y-3z = 6$.

   (a) Use the correct formula for distance from a point to a plane $d = \frac{|\mathbf{PS} \cdot \mathbf{n}|}{|\mathbf{n}|}$ (3 points)

   (b) Identify a correct **PS** (2 points)

   (c) Identify a correct **n** (2 points)

   (d) Compute the correct distance (3 points)

8. Find the distance from the point $(2, 7, -3)$ to the line given by the equation $\mathbf{r}(t) = \langle 2t, 6t, -3t \rangle$.

   (a) Use the correct formula for distance from a point to a line $d = \frac{|\mathbf{PS} \times \mathbf{v}|}{|\mathbf{v}|}$ (3 points)

   (b) Identify a correct $\mathbf{PS}$ (2 points)

   (c) Identify a correct $\mathbf{v}$ (2 points)

   (d) Compute the correct distance (3 points)

9. Give the name of the surface in 3D space given by the equation $x = \sin z$. Sketch any relevant planar cross-sections and sketch the graph in 3D space.

   (a) Identify the surface as a cylinder (2 points)

   (b) Sketch a cross-section of the surface in a coordinate plane (3 points)

   (c) Sketch the surface in xyz space (5 points)

10. Give the name of the surface in 3D space given by the equation $x^2 - z^2 = 4y^2 + 16$. Sketch any relevant planar cross-sections and sketch the graph in 3D space.

    (a) Sketch cross-sections of the surface in each coordinate plane (2 point each, 6 total)

    (b) Sketch the surface in xyz space (2 points)

    (c) Identify the quadric surface as a [hyperboloid of two sheets] (2 points)

Include extra scratch work below:

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