MATH 2415	Calculus III SI Session	09/14/11
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Wednesdays Rm 1245		03:00 PM - 05:00 PM and 05:00 PM - 07:00 PM

1. Find $\mathbf{u} \times \mathbf{v}$ and show that is is orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.
   (a) $\mathbf{u} = (-10, 0, 6)$, $\mathbf{v} = (7, 0, 0)$
   (b) $\mathbf{u} = \hat{\imath} + 6\hat{\jmath}$, $\mathbf{v} = -2\hat{\imath} + \hat{\jmath} + \hat{k}$

2. Verify that the points are the vertices of a parallelogram, and find its area.
   $(2, -3, 1), (6, 5, -1), (3, -6, 4), (7, 2, 2)$

3. Find the area of the triangle with the given vertices:$(1, 2, 0), (-2, 1, 0), (0, 0, 0)$

4. Let $\mathbf{u} = 2\hat{\imath} + 5\hat{\jmath} + \hat{k}$ and $\mathbf{v} = 3\hat{\imath} - \hat{\jmath} + 7\hat{k}$
   (a) Find the vector which has the same length as $\mathbf{u}$ and the opposite direction as $\mathbf{v}$.
   (b) Determine if the vector $\mathbf{w} = \hat{\imath} + 3\hat{k}$ lies in the plane of $\mathbf{u}$ and $\mathbf{v}$.
   (c) Find all unit vectors which are orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.
   (d) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.

5. Find the vector that has length 3 and has the opposite direction as $\langle -1, 2, 4 \rangle$.

6. Let $\mathbf{u} = \langle -1, 4, -2 \rangle$. Find a vector $\mathbf{v}$ such that the area of the parallelogram spanned by $\mathbf{u}$ and $\mathbf{v}$ is 10.

7. Find a set of parametric equations of the described line.
   (a) The line that passes through the point $(-4, 5, 2)$ and is parallel to both the xy-plane and the yz-plane.
   (b) The line that passes through the point $(-4, 5, 2)$ and is perpendicular to the plane given by $-x + 2y + z = 5$.
   (c)The line that passes through the point $(1, 4, -3)$ and is parallel to $\mathbf{v} = 5\hat{\imath} - \hat{\jmath}$.
   (d) The line that passes through the point $(6, 0, 8)$ and is parallel to the line $x = 5 - 2t$, $y = 2t - 4$, $z = 0$.

8. Find an equation of the described plane.
   (a) The plane that passes through $(2, 3, -2)$, $(3, 4, 2)$, and $(1, -1, 0)$.
   (b) The plane that passes through the point $(1, 2, 3)$ and parallel to the yz-plane.
   (c) The plane that passes through the points $(3, 2, 1)$ and $(3, 1, -5)$ and is perpendicular to the plane $6x + 7y + 2z = 10$
   (d) The plane that passes through the points $(4, 2, 1)$ and $(-3, 5, 7)$ and is parallel to the z-axis.

9. Determine all values of c such that the angle between the vectors $\mathbf{u} = (-1, 01)$ and $\mathbf{v} = (c, 3, 1)$ is $45°$.

10. Find parametric equations for the line through $(3, 1, -2)$ that intersects and is perpendicular to the line given by: $x = -1 + t$, $y = -2 + t$, $z = -1 + t$.

11. Find an equation of the plane that contains the following lines:
    $l_1 : x = t, y = 2 - t, z = 2 + 3t$ and $l_2 : x = 1 + 4t, y = 1, z = 5 + 2t$

12. Find the distance from the point $(1, 2, 3)$ to the plane $x + y - 2z = 1$.

13. (a) If two nonzero vectors are parallel, what can be said about the angle between them?
    (b) Suppose that $\mathbf{u}$ and $\mathbf{v}$ are nonzero vectors in space satisfying $\|\mathbf{u} \times \mathbf{v}\| = 0$ Show that $\mathbf{u}$ and $\mathbf{v}$ must be parallel.

14. Determine if the vectors $\langle -1, 1, 2 \rangle$, $\langle 2, 1, -1 \rangle$ and $\langle 4, -1, -5 \rangle$ lie in a common plane.