MATH 2110

Test # 1

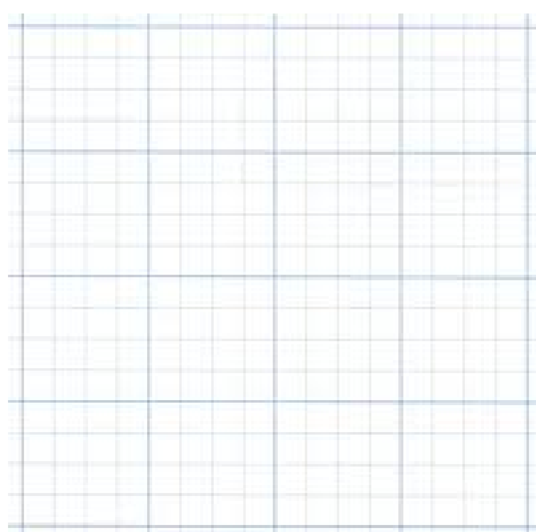
September 22, 2011

Name:____

You must **show all work** to receive full credit.

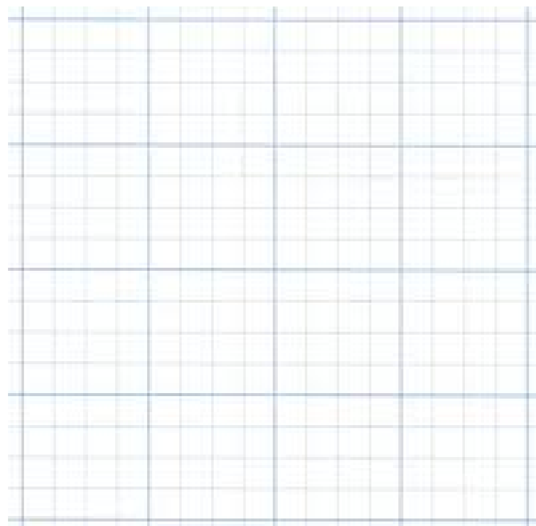
1. (5 points) Find all numbers k for which $\mathbf{u} =< -4, 5, k >$ and $\mathbf{v} =< -1, 0, -k >$ are orthogonal.

2. (5 points) Plot the vector $< 2, 3, 5 >$.



3. (8 points) The following vectors represent forces acting on a single object in space. Draw the Force Diagram (scale the axis so that 1 block = 5 units) and determine the net force acting on the object. Is the object at equilibrium?

$$\mathbf{F}_1 =< 0, -9.8 >,\ \mathbf{F}_2 =< -30, 30 >,\ \mathbf{F}_3 =< 30, 30 >$$



4. (12 points) Find the projection of the vector $\mathbf{v} =< 3, -2, -1 >$ onto the vector $\mathbf{p} =< 1, 0, 7 >$.

5. (12 points) Find the area of the triangle formed by the three points $P_1 = (2, 2, 0)$, $P_2 = (-1, 0, 2)$, and $P_3 = (0, 4, 3)$.

6. (12 points) Find the equation of the plane through the points $P_1 = (-1, 4, 3)$, $P_2 = (3, 4, 6)$ and $P_3 = (0, -3, 2)$.

7. (12 points) Find the Cartesian equation of the parameteric curve

$$\mathbf{r}(t) =< 2 - \cos t, 4 + \sin t >, \ t \text{ in } [0, 2\pi].$$

Then sketch the curve showing its orientation, if the orientation is well-defined.

8. (12 points) Find the velocity and acceleration of the vector-valued function

$$\mathbf{r}(t) =< t^2 - 2, e^{-t}, \sin 2t >$$

9. (12 points) Given the following information, find the maximum height of the projectile.

$$\mathbf{a}(t) =< 0, 0, -32 >, \ \mathbf{r}_0 =< 0, 0, 0 >, \ \mathbf{v}_0 =< 1, 2, 64 >$$

10. (12 points) Find the speed and arclength of the curve

$$\mathbf{r}(t) =< 3\cos(\pi t), 3\sin(\pi t) >$$

over the interval t in $[0, 1]$.

Bonus(5 points)

On September 9, 2009 in a game between Anaheim and Seattle, Mark Jipsen through Ken Griffey, Jr., a sweeping curveball with the following GameDay vectors:

$\mathbf{r}_0 =< -2.924, 50, 5.895 >,\ \mathbf{v}_0 =< 2.264, -121.647, -2.486 >,\ \mathbf{a} =< 10.529, 30.971, -41.439 >$

Find the parameterization of the ball's trajectory $\mathbf{r}(t)$ and determine its position as it crosses the front of the plate (i.e., when $y = 1.417$ feet)?