Math 205 Test 1 Preparation

1. The test covers chapters 12 and 13
2. The open ended test questions will be based on the homework. There will be some multiple choice questions on the test. These questions will focus on concepts and shortened homework-type problems.
3. Memorize the following formulas:
   a) Distance formula in space.
   b) The following formulas involving vectors.
      i) magnitude
      ii) angle between two vectors
      iii) vector projection, work, and torque formulas
      iv) dot and cross products
      v) unit vector

Let $\mathbf{r}(t)$ be a position vector of an object traveling along a smooth curve in space.

c) $\mathbf{v}(t) = \mathbf{r}'(t)$ is the object's **velocity vector**.

d) $\|\mathbf{v}(t)\| = \dfrac{ds}{dt}$ is called the object's **speed**.

e) $\mathbf{a}(t) = \mathbf{r}''(t)$ is called the object's **acceleration vector**.

f) The **unit tangent vector**: $\mathbf{T}(t) = \dfrac{\mathbf{r}'(t)}{\|\mathbf{r}'(t)\|} = \dfrac{\mathbf{v}(t)}{\|\mathbf{v}(t)\|}$.

g) The **principal unit normal vector**: $\mathbf{N}(t) = \dfrac{\mathbf{T}'(t)}{\|\mathbf{T}'(t)\|}$

h) $\mathbf{a}(t) = a_{\mathbf{T}}\,\mathbf{T}(t) + a_{\mathbf{N}}\,\mathbf{N}(t)$, where $a_{\mathbf{T}} = \dfrac{d}{dt}\|\mathbf{v}(t)\|$ and $a_{\mathbf{N}} = \|\mathbf{v}\|\,\|\mathbf{T}'(t)\|$

i) $a_{\mathbf{T}} = \mathbf{a} \bullet \mathbf{T}$

j) $a_{\mathbf{N}} = \mathbf{a} \bullet \mathbf{N} = \sqrt{\|\mathbf{a}\|^2 - a_{\mathbf{T}}{}^2}$

k) Arc length formula: $s = \displaystyle\int_a^b \|\mathbf{r}'(t)\|dt$

l) Arc length function: $s(t) = \displaystyle\int_a^t \|\mathbf{r}'(u)\|du$

m) **Curvature**: $K = \|\mathbf{T}'(s)\| = \dfrac{\|\mathbf{T}'(t)\|}{\|\mathbf{r}'(t)\|} = \dfrac{\|\mathbf{r}'(t) \times \mathbf{r}''(t)\|}{\|r'(t)\|^3}$

n) Parametric equations of a line in space: $x = x_1 + at$, $y = y_1 + bt$, $z = z_1 + ct$

o) Equation of a plane: $a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$.

p) names of cylinders and quadric surfaces in relation to their equations.

Note: Also know what the letters stand for in each formula.

4. A well-prepared student should be able to…

a) write the component form of a vector.
b) add, subtract, and scalar multiply vectors in component form and interpret the results geometrically.
c) write any vector as a linear combination of standard unit vectors.
d) solve applications.
e) plot points, vectors, and surfaces in a three-dimensional coordinate system.
f) find the distance and midpoint between two points in space.
g) find the equation of a sphere.
h) find the dot product of two vectors.
i) find the angle between two vectors.
j) find the projection of a vector onto another vector.
k) find the work done by a constant force.
l) find the cross product of two vectors.
m) interpret the cross product geometrically.
n) compute and apply the triple scalar product of three vectors.
o) find parametric equations of a line in space.
p find the equation of a plane in space.
q) sketch a plane given by a linear equation.
r) find the distance between points and planes in space.
s) write the parametric equations (or vector-valued function) of a curve.
t) analyze and sketch a space curve given by a vector-valued function.
u) evaluate a limit of a vector-valued function.
v) determine the interval(s) on which a vector-valued function is continuous or/and smooth.
w) differentiate vector-valued functions.
x) integrate vector-valued functions.
y) calculate the velocity and acceleration vectors associated with the position function of an object.
z) analyze projectile motion using vector-valued functions.
aa) find the unit tangent vector **T** at a point on a curve.
bb) find the principal unit normal vector **N** at a point on a curve.
cc) find the tangential and normal components of acceleration.
dd) find the arc length of a space curve.
ee) describe a curve using the arc length parameter.
ff) calculate curvature.
gg) HOMEWORK-LIKE PROBLEMS!!!