Bekki George: bekki@math.uh.edu
James West: jdwest@math.uh.edu

University of Houston

February 24, 2017
Office Hours:
(by appointment)
Office: 639 PGH

Course webpage: www.casa.uh.edu
1. Which of the following pairs of vectors are parallel?

I. \( \mathbf{a} = (3, 2) \) and \( \mathbf{b} = (-9, -6). \)

II. \( \overrightarrow{PQ} \) and \( \overrightarrow{OR} \), where \( P = (1, 1, 0), \) \( Q = (3, 5, 2), \) \( R = (-1, -2, -1), \) and \( O \) is the origin.

III. \( \mathbf{a} = (2, 1) \) and \( \overrightarrow{PQ} \), where \( P = (0, 1) \) and \( Q = (2, 1). \)
Email me questions or have them ready in class!!!
The test is 75 minutes in CASA. Approximately 12-15 questions.
Determine if the two lines are parallel, coincident, skew or intersecting. If they intersect, give the point of intersection.

\[
\ell_1 : x_1(t) = 3 + 2t, \quad y_1(t) = -1 + 4t, \quad z_1(t) = 2 - t
\]

\[
\ell_2 : x_2(u) = 3 + 2u, \quad y_2(u) = 2 + u, \quad z_2(u) = -2 + 2u
\]
Find scalar parametric equations for the tangent line to the graph of\n\[ r(t) = (3t + 4)\, \mathbf{i} + (t^2 + 2t + 2)\, \mathbf{j} + (t^3 + 2t - 3)\, \mathbf{k} \] at the point (4, 2, −3).
Find the length of the curve traced out by \( \mathbf{r}(t) = \left( \frac{1}{3} t^3 - t \right) \mathbf{i} + t^2 \mathbf{j} \) from \( t = 0 \) to 2.
Find unit tangent, principal normal, osculating plane when $t=0$, curvature, tangential and normal components for acceleration for

$$\mathbf{r}(t) = 4e^t \cos(t) \mathbf{i} + 3e^t \mathbf{j} + 4e^t \sin(t) \mathbf{k}$$
2. Find the equation of the level curve for \( f(x, y) = (x^2 + y^2)e^{xy} \) that contains the point \( P(1, 0) \).

a. \((x^2 + y^2)e^{xy} = 0\)

b. \((x^2 + y^2)e^{xy} = 1\)

c. \(x^2 + y^2 = 1\)

d. \(xy = 1\)

e. none of these
3. Find $f_x$ for $f(x, y) = x^2 \cos(\pi y) - \ln(2xy)$. 

a. $2x \cos(\pi y)$

b. $2x \cos(\pi y) - 2y$

c. $\pi x^2 \sin(\pi y)$

d. $\pi x^2 \sin(\pi y) - 2y$

e. none of these
Find a vector $\mathbf{N}$ that is perpendicular to the plane determined by points $P, Q, R$ and find the area of triangle $PQR$ given $P = (3, 0, -2), \ Q = (2, -3, 0), \ R = (-2, -2, 0)$
4. Find the curvature at \( t=0 \) for the curve described by 
\[
x(t) = 2 - \cos(t), \quad y(t) = \sqrt{2} \sin(t), \quad z(t) = \cos(t)
\]
5. Find $f_{yx}$ for $f(x, y) = e^{\sin(x)} + x^5 y + \ln(1 + y^2)$