Sample MIDTERM II, version 2.
Last year's midterm for Spring MATH 126 C, D

Scientific, but not graphing calculators are OK.

You may use one 8.5 by 11 sheet of handwritten notes.

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1. Find the slope of the tangent line to the polar curve

$$r = \frac{1}{\theta}, \theta > 0$$

at the point where it intersects the cartesian curve

$$x^2 + y^2 = \frac{1}{9}.$$

2. At what point(s) is the tangent line to the curve

$$x = t^3 - 3t, y = t^2 + 2t$$

parallel to the line with parametric equations

$$x = 3s + 5, y = s - 6 \text{ ?}$$

3. For any $m > 0$, the helix determined by the position function

$$\vec{r}(t) = \langle \cos t, \sin t, mt \rangle$$

has constant curvature that depends on m. Find the value of m such that the curvature at any point on the curve is $\frac{1}{3}$.

4. A particle is moving so that its position is given by the vector function

$$\vec{r}(t) = \langle t^2, t, 5t \rangle$$

Find the tangent and normal components of the particle's acceleration vector.

5. Reparametrize the curve

$$\vec{r}(t) = \langle 5t - 1, 2t, 3t + 2 \rangle$$

with respect to arc length measured from the point where $t = 0$ in the direction of increasing t.

6. Let $f(x,y) = x^2y + x\sin y - \ln(x - y^2)$.

(a) Find $f_y(x,y)$.

(b) Find $f_{xy}(x,y)$.