COACH TOPIC GRADIENT   Math 21a, Fall 2006

- the gradient

- computing tangent lines

- computing tangent planes

- the chain rule

- finding critical points

1. Problem: Gradient

Find the angle between the plane $3x + 5y + 3z = 19$ and the sphere $x^2 + y^2 + z^2 = 9$ at the point $(2, 2, 1)$.

Space for work:

2. Problem: Computing tangent lines

Find the tangent line to the curve $x^2 + 4y^2 = 6$ at the point $(2, 1)$.

Space for work:

3. Problem: Computing tangent planes

Find the tangent plane at the hyperbolic paraboloid $z - x^2 + y^2 = 11$ at the point $(1, 3, 3)$.

Space for work:

4. Problem: Estimation

Estimate $10.001 * 9.99991 * 13.001$.

Space for work:

5. Problem: The chain rule.

Let $f(x, y, z) = x^2 + y^2 + z^2$. What is

$$\frac{d}{dt} f(\vec{r}(t)) \,,$$

where $\vec{r}(t) = \langle \cos(t), \sin(t), t \rangle$ at the time $t = \pi$?

Space for work:

6. Problem: Finding critical points

Find all the critical points of the function

$$f(x, y) = xy + y^3 + x^3 \ .$$

Are they local maxima, local minima or saddle points?

Space for work:

7. Problem: implicit differentiation

The implicit equation $x^4 y + y^4 x = 0$ defines a function $y = y(x)$ near $(x, y) = (1, -1)$. Find $y'(x)$ at $x = 1$.

Space for work: