

Math 210 (Lesieutre)
Exam 1 review
February 15, 2017

Problem 1. Find the parametrization for a line which...

- a) ... has $\mathbf{r}(0) = (1, 2, 3)$ and $\mathbf{r}(1) = (1, -2, 1)$.

- b) ... is normal to the plane $3x - 2y + z = 0$ and passes through the origin.

- c) ... is the intersection of the planes $x + y + z = 3$ and $x - y + 2z = 1$.

- d) ... is tangent to the curve $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$ at $t = 2$.

Problem 2. Consider the two vectors $\mathbf{u} = \langle 1, 2, 3 \rangle$ and $\mathbf{v} = \langle -1, -1, -1 \rangle$.

- a) What is the angle between \mathbf{u} and \mathbf{v} ?

- b) If a triangle has $(0, 0, 0)$ as a vertex, with \mathbf{u} and \mathbf{v} the two edges from this vertex, what is the vector for the third edge?

- c) What is the area of this triangle?

Problem 3. Let $\mathbf{u} = \langle -13, 2, 1 \rangle$ and $\mathbf{v} = \langle 0, 21, -2 \rangle$. In what general direction does $\mathbf{u} \times \mathbf{v}$ point? (Use the right-hand rule.)

Problem 4. Use the two-path test to explain why the limit

$$\lim_{(x,y) \rightarrow (0,0)} \frac{y^2 - 3x}{y^2 - x}$$

does not exist.

Problem 5. A moving particle has $\mathbf{v}(t) = \langle -\sin t, \cos t, 1 \rangle$.

- a) What is the tangent vector to its path at $t = 0$?
- b) Find the length of the curve from $t = 0$ to $t = 2\pi$. What is the tangent vector at $t = 0$?
- c) Suppose that $\mathbf{r}(0) = \langle 0, 0, 0 \rangle$. Find a formula for $\mathbf{r}(t)$.

Problem 6. An object sits at $(1, 1)$ on a surface sloped 45° . The gravitational force is $\mathbf{g} = \langle 0, -10 \rangle$.

- a) What is the component of the gravitational force parallel to the surface?
- b) The object slides down the slope to the point $(0, 0)$. Find the work done by gravity.

Problem 7. Let $f(x, y) = x^2y + 3x - 2$.

- a) Find the gradient ∇f .
- b) Find the direction of fastest increase at the point $(x, y) = (0, 1)$. What is the rate of increase?

Problem 8. What is the domain of the function $f(x, y) = \ln(x^2 + y^2 - 4)$? Sketch some level curves.