

Math 32A. Quiz 7b March 9, 2006

Name:

Write your solution on the exam sheet. Show some work and justify your answer. Do not just give the correct answer. You have 15 minutes. Good luck!

1. Let

$$F(x, y, z) = x^4 + 2y^4 + 3z^4.$$

At the point $(2, 1, 1)$ find the direction $\vec{u} = \langle u_1, u_2, u_3 \rangle$ (with $u_1^2 + u_2^2 + u_3^2 = 1$) in which F has the greatest increase.

Solution: Since the the directional derivative $D_u F = \vec{\nabla} F \cdot \vec{u}$, the direction of greatest increase for F is always

$$\vec{u} = \frac{\vec{\nabla} F}{|\vec{\nabla} F|}.$$

In our case we have

$$\vec{\nabla} F = \langle 4x^3, 8y^3, 12z^3 \rangle = \langle 32, 8, 12 \rangle$$

and

$$\vec{u} = \frac{1}{\sqrt{26}} \langle 4, 1, 3 \rangle .$$