Name :

## Quiz 3 for Math114, Summer 2009

Write clearly, justify your answers, do not forget your name.
You will get no credit for guessing, but you will get partial credit for relevant work.

**1.** Evaluate $\int_0^2 \int_{\frac{x}{2}}^1 e^{y^2}\,dy dx$.
A. 0 B. $e$ C. $e-1$ D. $e+1$ E. None of the above.

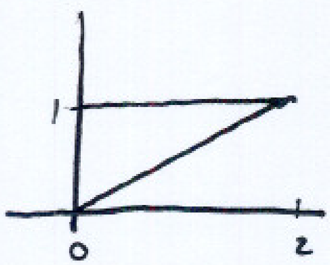
**2.** Find the absolute maximum value of $f(x,y) = x^2y^2$ on the set

$$D = \{(x,y) | x \geq 0, y \geq 0, x^2 + y^2 = 1\}$$

A. 0 B. $\frac{1}{2}$ C. 1 D. 2 E. None of the above.

**3.** For which of the following points, the direction of fastest change of the function $f(x,y) = x^2 - y^2$ is $i + j$:
A. $(1,0)$ B. $(0,1)$ C. $(1,-1)$ D. $(1,1)$ E. None of the above.

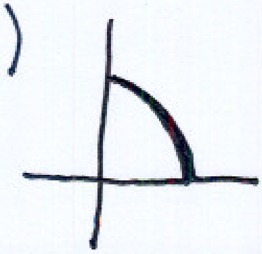
1)



$$\int_0^2 \int_{x/2}^1 e^{y^2}\,dy\,dx = \int_0^1 \int_0^{2y} e^{y^2}\,dx\,dy$$

$$= \int_0^1 2y e^{y^2}\,dy = e^{y^2}\Big|_0^1 = \boxed{e-1}$$

2.)



$g = x^2 + y^2$
$f = x^2y^2$ $\Rightarrow \nabla g = (2x, 2y)$, $\nabla f = (2xy^2, 2x^2y)$

$\Rightarrow \lambda 2x = 2xy^2 \Rightarrow x = 0$ or $\lambda = y^2$

$\lambda 2y = 2yx^2 \Rightarrow y = 0$ or $\lambda = x^2$

$\Rightarrow$ get pts $(1,0)$, $(0,1)$, $(1/\sqrt{2}, 1/\sqrt{2}) \Rightarrow \boxed{\max = 1/4}$

$y=0$, $f=0$; $x=0$, $f=0$; $x^2=y^2$, $f=1/4$

3) $f = x^2 - y^2$

$\nabla f = (2x, -2y)$

• Want $\nabla f = k \cdot (1,1) \Rightarrow$ want $x > 0$, $y = -x$.

so $\boxed{(1,-1) \text{ works}}$.