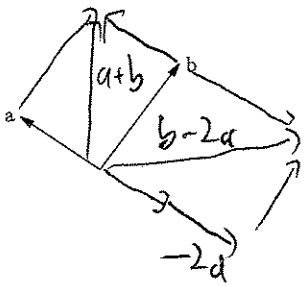
Your name: _____

Quiz no. 1 (2110 Multivariable Calculus, Fall 2009)

September 14, 2009

20 min.

1. *(3 points)* Draw the vectors $a + b$ and $b - 2a$.



2. *(4 points)* Find the angle between the two vectors $\langle 3, 1, -1\rangle$ and $\langle 1, 3, 1\rangle$.

$$\cos\theta = \frac{3+3-1}{\sqrt{11}\cdot\sqrt{11}} = \frac{5}{11}$$

$$\theta = 62.96^\circ$$

3. *(3 points)* Which of the following three expression makes sense?

(a) $a \times (b \bullet c)$
(b) $a \bullet (b \times c)$
(c) $a \times (b \times c)$

(b) and (c)

4. *(5 points)* Find a non-zero vector orthogonal to the plane containing $P(0, 2, 3)$, $Q(-3, 4, 1)$ and $R(2, 3, 5)$. Compute the area of the triangle PQR.

$$\overrightarrow{PQ} = \langle -3, 2, -2\rangle$$

$$\overrightarrow{PR} = \langle 2, 1, 2\rangle$$

5. *(5 points)* A cyclist is biking a distance of $4500m$ in the direction of NE. A strong wind blowing westwards is exerting a force of $120N$ on him. What is the work done by the cyclists against the wind?

$$W = |4500\,m \cdot 120N \cdot \cos 135^\circ|$$

$$\overrightarrow{PQ} \times \overrightarrow{PR} = \begin{vmatrix} i & j & k \\ -3 & 2 & -2 \\ 2 & 1 & 2 \end{vmatrix}$$

$$= \langle 6, +2, -7\rangle$$

$$\text{Area} = |\langle 6, +2, -7\rangle|$$

$$= \sqrt{89}$$

Your name: _____

Quiz no. 2 (2110 Multivariable Calculus, Fall 2009)

September 25, 2009

20 min.

1. *(2 points)* Give an equation for the line through $P(2,4,-1)$ orthogonal to the plane given by $3x-4y+2z=-5$.

$\vec{r}(t) = \langle 2,4,-1\rangle + t\langle 3,-4,2\rangle$

2. *(3 points)* Compute the distance of P to the plane, where P and the plane are as in the previous problem.

$$\frac{|3\cdot 2+4\cdot(-4)+2\cdot(-1)+5|}{\sqrt{3^2+4^2+2^2}} = \frac{7}{\sqrt{29}}$$

3. *(5 points)* Compute the volume of the parallelepiped with edges PQ, PR and PS for $P(2,0,-1)$, $Q(4,1,2)$, $R(2,-2,2)$ and $S(5,3,-2)$.

$$\begin{vmatrix} 2 & 1 & 3 \\ 0 & -2 & 3 \\ 3 & 3 & -1 \end{vmatrix} = 2\cdot(-7) - 1\cdot(-9) + 3(+6) = 13$$

Area $= |+13| = 13$

4. *(5 points)* Find an equation for the intersection of the two planes $2x-3y=5$ and $x+6y+4z=3$.

$\langle 2,-3,0\rangle \times \langle 1,6,4\rangle$

$= \langle -12,-8,15\rangle$

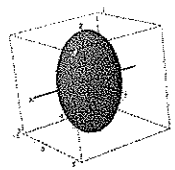
$x=0$: $y=-\frac{5}{3}$, $z=\frac{13}{4}$

$\vec{r}(t) = \langle 0,-\frac{5}{3},\frac{13}{4}\rangle + t\cdot\langle -12,-8,15\rangle$

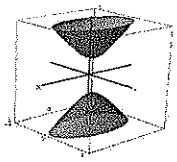
5. *(5 points)* Match the following equations with the graphs below:

$x^2+4y^2-z=0$	III 3	$x^2+4y^2-z^2=1$	IV 4
$\frac{1}{4}x^2+\frac{1}{2}y^2+\frac{1}{9}z^2=1$	I	$x^2+4y^2-z^2=-1$	II 2
$\frac{1}{4}x^2+\frac{1}{2}y^2-\frac{1}{9}z^2=0$	V 5		

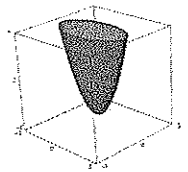
I



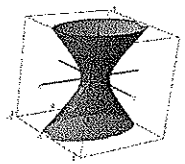
II



III



IV



V