**Simon M. Foucher** **Assignment 1** **MATH133, Fall 2005**
**due 9/27/06 at 11:00 PM.**

**You may attempt any problem an unlimited number of times.**

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**1.**(1 pt) Let $P = (5,-4,5)$ and $Q = (-9,5,9)$. Let $M$ be the midpoint of the line segment $\overline{PQ}$, and let $R$ and $S$ be the points that divide $\overline{PQ}$ into three equal parts.

Then
$M =$(____,____,____),
$R =$(____,____,____),
$S =$(____,____,____).

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**2.**(1 pt) (a) Let $P = (2,4,2)$, $Q = (0,1,-1)$, $R = (0,1,1)$ and $S = (-1,3,0)$. The point of intersection of the two lines joining the midpoints of opposite sides of the quadrilateral PQRS has coordinates (___,___, ___)
(b) (**This part is to be handed in.** ) If PQRS is a quadrilateral with no three of the points P,Q,R,S colinear, show that the lines joining the midpoints of opposite sides bisect each other.

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**3.**(1 pt) The vector projection of the vector $\mathbf{v} = \begin{bmatrix} -4 \\ 3 \\ 3 \end{bmatrix}$ onto the vector $\mathbf{u} = \begin{bmatrix} 2 \\ -4 \\ -2 \end{bmatrix}$ is the vector $\mathbf{w} = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix}$, where
$w_1 =$____
$w_2 =$____
$w_3 =$____

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**4.**(1 pt) Let $\Delta$ be the triangle with vertices at $P = (5,-4,5)$, $Q = (-2,0,2)$ and $R = (4,3,-3)$.
The area of $\Delta$is: ________
The angle $\angle QPR$ is ________ degrees
The angle $\angle PQR$ is ________ degrees
The angle $\angle PRQ$ is ________ degrees

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**5.**(1 pt) The equation of the plane passing through the 3 points $P = (1,1,-5)$, $Q = (-5,-2,0)$ and $R = (-5,-1,-2)$ is
____$x+$____$y+$ ____$z+$\_\_\_\_$= 0$

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**6.**(1 pt) Let $l$ be the line that passes through the point $P = (8,-9,9)$ and is perpendicular to the plane $-1x+3y-8z = -12$.
The parametric equations of $l$ are:
$x =$____+____$t$
$y =$____+____$t$
$z =$____+____$t$

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**7.**(1 pt) Let $l$ be the line that passes through the point $P = (6,0,0)$ and is parallel to the line with parametric equations

$$\begin{aligned} x &= -2-3t \\ y &= 2+1t \\ z &= 3+0t \end{aligned}$$

The vector equation of $l$ is $\mathbf{x} = \mathbf{p} + t\mathbf{d}$ where
$\mathbf{p} =$ (____,____, ____)$^T$
$\mathbf{d} =$ (____,____, ____)$^T$

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**8.**(1 pt) Let $P = (8,-3,8)$ and $Q = (-4,1,-8)$. The set of all points that are equidistant from $P$ and $Q$ has the equation
____$x+$____$y+$ ____$z+$\_\_\_\_$= 0$

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**9.**(1 pt) The distance between the point

$$P = (4,-4,-2)$$

and the plane with the equation

$$-4x+2y-1z = 7$$

is
$d =$_____

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**10.**(1 pt) Determine the distance between the parallel planes $-2x-1y-3z = 2$ and $2x+1y+3z = -6$: _____

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**11.**(1 pt) Find points P,Q which are closest possible with P lying on the line
$x = 0-6t, y = 1-10t, z = -2-4t$
and Q lying on the line
$x = 158+7t, y = 303-9t, z = -718-2t$.
Hint: Use the fact that the line joining P and Q is perpendicular to the two given lines.
P = (____,____,____)
Q = (____,____,____)

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**12.**(2 pts) (**A complete solution to this problem is to be handed in.**)
Let $P = (2,-1,-5)$, $Q = (4,-2,-3)$, $R = (1,-2,-3)$ and $S = (4,0,-6)$. Let $l_1$ be the line passing through $P$ and $Q$, and let $l_2$ be the line passing through $R$ and $S$.
**(i)** The distance between $R$ and $l_1$ is _____.
**(ii)** The distance between $l_1$ and $l_2$ is _____.

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**13.**(1 pt) The equation of the plane passing through the point $(-3,-5,5)$
and perpendicular to the line of intersection of the two planes
$-8x+4y-8z = -1, \quad -3x-2y-2z = 3$
is
____$x+$____$y+$ ____$z =$____