MATH 214 (R1) Winter 2008
Intermediate Calculus I

Problem Set #8

Completion Date: Friday March 14, 2008

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Question 1. **[Sec. 13.4, # 16]** Find two unit vectors orthogonal to both $\mathbf{i}+\mathbf{j}+\mathbf{k}$ and $2\mathbf{i}+\mathbf{k}$.

Question 2. **[Sec. 13.4, # 24]** Find the area of the parallelogram with vertices $K\,(1,2,3)$, $L\,(1,3,6)$, $M\,(3,8,6)$, and $N\,(3,7,3)$.

Question 3. **[Sec. 13.4, # 28]** Given the points $P\,(2,0,-3)$, $Q\,(3,1,0)$, and $R\,(5,2,2)$,

(a) find a vector orthogonal to the plane through the points P, Q, and R, and

(b) find the area of triangle $\triangle PQR$.

Question 4. **[Sec. 13.4, # 32]** Given the points

$$P\,(0,1,2), \quad Q\,(2,4,5), \quad R\,(-1,0,1), \quad S\,(6,-1,4),$$

find the volume of the parallelopiped with adjacent edges PQ, PR, and PS.

Question 5. **[Sec. 13.5, # 10]** Find parametric equations and symmetric equations for the line through the point $(2,1,0)$ and perpendicular to both $\mathbf{i}+\mathbf{j}$ and $\mathbf{j}+\mathbf{k}$.

Question 6. **[Sec. 13.5, # 16]**

(a) Find parametric equations for the line through $(5,1,0)$ that is perpendicular to the plane $2x-y+z=1$.

(b) In what points does this line intersect the coordinate planes?

Question 7. **[Sec. 13.5, # 24]** Find an equation of the plane through the point $(4,0,-3)$ and with normal vector $\mathbf{j}+2\mathbf{k}$.

Question 8. **[Sec. 13.5, # 34]** Find an equation of the plane that passes through the point $(1,2,3)$ and contains the line

$$x=3t, \quad y=1+t, \quad z=2-t, \quad -\infty<t<\infty.$$

Question 9. **[Sec. 13.5, # 46]** Given the planes

$$2z=4y-x \qquad \text{and} \qquad 3x-12y+6x=1,$$

determine whether the planes are parallel, perpendicular, or neither. If neither, find the angle between them.

Question 10. **[Sec. 13.5, # 54]** Find parametric equations for the line of intersection of the planes

$$2x+5z+3=0 \qquad \text{and} \qquad x-3y+z+2=0.$$

Question 11. **[Sec. 14.1, # 4]** Find the limit

$$\lim_{t\to 0}\left\langle \frac{e^t-1}{t}, \frac{\sqrt{1+t}-1}{t}, \frac{3}{1+t}\right\rangle.$$

Question 12. **[Sec. 14.1, # 12]** Sketch the curve with vector equation

$$\mathbf{r}(t) = t\,\mathbf{i} + t\,\mathbf{j} + \cos t\,\mathbf{k}.$$

Indicate with an arrow the direction in which t increases.

Question 13. **[Sec. 14.1, # 14]** Sketch the curve with vector equation

$$\mathbf{r}(t) = \sin t\,\mathbf{i} + \sin t\,\mathbf{j} + \sqrt{2}\cos t\,\mathbf{k}.$$

Indicate with an arrow the direction in which t increases.

Question 14. **[Sec. 14.1, # 18]** Given the points $P\,(-2, 4, 0)$ and $Q\,(6, -1, 2)$, find a vector equation and parametric equations for the line segment that joins P to Q.

Question 15. **[Sec. 14.1, # 34]** Find a vector function that represents the intersection of the following surfaces: the cylinder $x^2 + y^2 = 4$ and the surface $z = xy$.