University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Spring 2012

Homework 3

Name: _____ **Section:** _____

Due date: February 16, 2012 (Section 50)
February 15, 2012 (Section 51)

Problems

Taken or adapted from Section 12.3 of the book *Calculus: Early Transcendentals* 7th edition by J. Stewart. Each exercise is worth 10 points for a total of 100 points.

1. Exercise # 12.3–8. Given $\vec{a} = 3\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = 4\hat{i} + 5\hat{k}$. Find $\vec{a} \cdot \vec{b}$.

2. Exercise # 12.3–12. If $\vec{u}$ is a unit vector, find $\vec{u} \cdot \vec{v}$ and $\vec{u} \cdot \vec{w}$. See Figure 1.

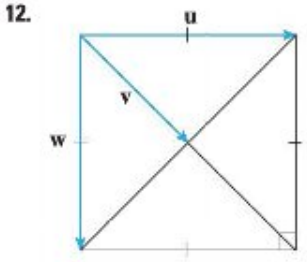

Figure 1: Problem 12

3. Exercise # 12.3–25. Use vectors to decide whether the triangle with vertices $P(1, -3, -2)$, $Q(2, 0, -4)$, and $R(6, -2, -5)$ is right-angled.

4. Exercise # 12.3–31. Find the acute angles between the curves $y = x^2$ and $y = x^3$ at their points of intersection. (The angle between two curves is the angle between their tangent lines at the point of intersection.)

5. Exercise # 12.3–47. If $\vec{a} = \langle 3, 0, -1 \rangle$, find a vector $\vec{b}$ such that $\text{comp}_{\vec{a}}\vec{b} = 2$.

6. Exercise # 12.3–49. Find the work done by a force $\vec{F} = 8\hat{i} - 6\hat{j} + 9\hat{k}$ that moves an object from the point $(0, 10, 8)$ to the point $(6, 12, 20)$ along a straight line. The distance is measured in meters and the force in newtons.

7. Exercise # 12.3–51. A sled is pulled along a level path through snow by a rope. A 30-lb. force acting at an angle of $40°$ above the horizontal moves the sled 80 ft. Find the work done by the force.

8. Exercise # 12.3–52. A boat sails south with the help of a wind blowing in the direction $S36°E$ with magnitude 400 lb. Find the work done by the wind as the boat moves 120 ft.

9. Exercise # 12.3–53. Use a scalar projection to show that the distance from a point $P_1(x_1, y_1)$ to the line $ax + by + c = 0$ is

$$\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$$

   Use this formula to find the distance from the point $(-2, 3)$ to the line $3x - 4y + 5 = 0$.

10. Exercise # 12.3–59. Prove Properties 2, 4, and 5 of the dot product. (See the text, or your notes.)