University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Fall 2012

Homework 1

Due date: September 4, 2012

Problems

Taken or adapted from Sections 12.1 and 12.2 of the book *Calculus: Early Transcendentals* 7th edition by J. Stewart.

1. What does the equation $y = 0$ represent in a two-dimensional space (denoted by $\mathbb{R}^2$)? What does it represent in a three-dimensional space ($\mathbb{R}^3$)? Illustrate with sketches.
2. Find the distance from $(3, 7, -5)$ to each of the following.
   (a) The xy-plane
   (b) The yz-plane
   (c) The xz-plane
   (d) The x-axis
   (e) The y-axis
   (f) The z-axis
3. Find an equation of the sphere with center $(2, -6, 4)$ and radius 5. Describe its intersection with each of the coordinate planes.
4. Write inequalities to describe the solid cylinder that lies on or below the plane $z = 8$ and on or above the disk in the xy-plane with center the origin and radius 2.
5. Find a vector $\vec{a}$ with representation given by the directed line segment $\vec{AB}$. Draw $\vec{AB}$ and the equivalent representation starting at the origin.
   (a) $A(2, 3)$, $B(-2, 1)$
   (b) $A(0, 3, 1)$, $B(2, 3, -1)$

6. Find $\vec{a} + \vec{b}$, $2\vec{a} + 3\vec{b}$, $||\vec{a}||$, and $||\vec{a} - \vec{b}||$ if $\vec{a} = \langle 2, -4, 4 \rangle$ and $\langle 0, 2, -1 \rangle$.

7. Find a vector that has the same direction as $\langle -2, 5, 1 \rangle$ but has length 100.

8. Find the unit vectors that are perpendicular to the tangent line to the curve $y = 2\sin(x)$ at the point $(\pi/6, 1)$.

9. Given $\vec{a} = \langle 3, 2 \rangle$, $\vec{b} = \langle 2, -1 \rangle$, and $\vec{c} = \langle 7, 1 \rangle$, find the value of the scalars s and t that satisfy $\vec{c} = s\vec{a} + t\vec{b}$.

10. Use vectors to prove that the line joining the midpoints of two sides of a triangle is parallel to the third side and half its length.