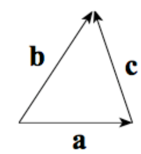
Math 213 Calculus III

Spring 2013
Thursday, May 2
Sections 9.2-9.4
Topics:

1. Definition and length of vectors, vector addition, scalar multiplication.
2. In the diagram to the right, describe **c** in terms of **a** and **b**.
3. Unit Vectors
4. Relationship between vector representation, $\mathbf{a} = \langle a_1, a_2 \rangle$, then point $P(a_1, a_2)$ and the position representation $\overrightarrow{OP}$.
5. Algebraic and geometric formulations of the dot product
6. The interpretation of the sign of $\mathbf{a} \cdot \mathbf{b}$ in terms of the angle between **a** and **b**.
7. Orthogonal vectors
8. Vector and scalar projections
9. Cross product defined algebraically and defined as a vector perpendicular to two given vectors, whose length is the area of the parallelogram determined by the vectors
10. Right hand rule and properties of the cross product.



Homework for Friday
Homework Problems:

- Complete All Class 02 Worksheets
- WebAssign Assignment 2 HW
- Mathematica Class 02 Vector Operations Assignment
- Reading Questions on 9.5–9.5

Reading the Text

Read Sections 9.5-9.6 and answer the following questions

1. When specifying the equation of a line in space, the text says that you need a point on the line and a vector parallel to the line. Why can't you determine a line in space simply by using one vector?

2. Find symmetric equations of the line going through the points (1,2,1) and (-1,3,5).

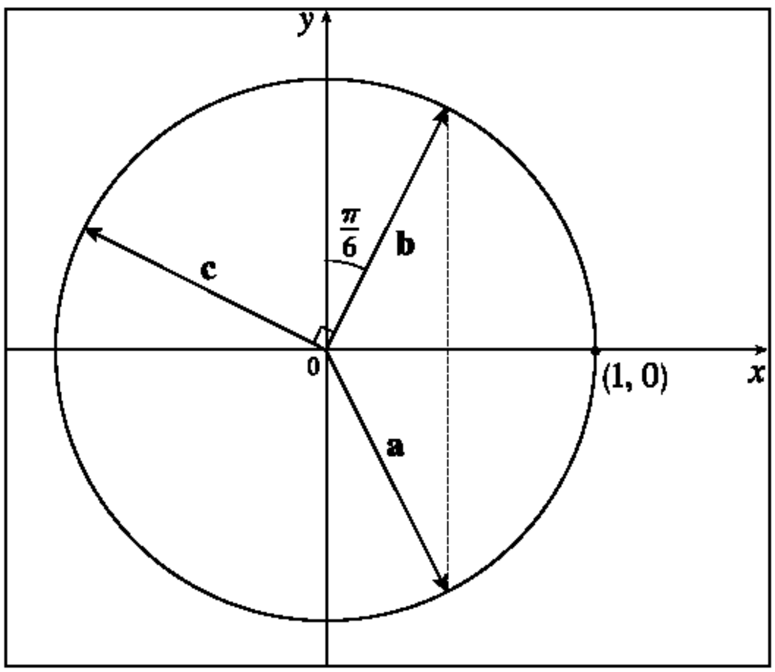
3. If *f* is a function of two variables and $f(3,4) = -1$, give the coordinates of a point on the graph of *f*.

4. What are the vertical traces of the surface $z = 4x^2 + y^2$? What are the horizontal traces for $z > 0$? For $z < 0$?

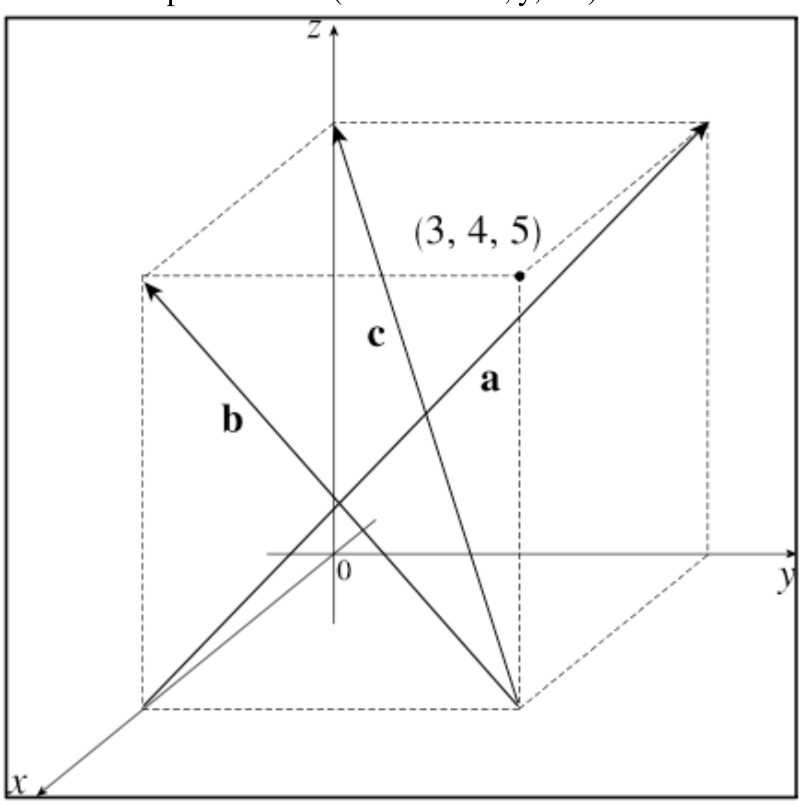
5. Why is the quadric surface $x^2 + \frac{1}{9}y^2 + \frac{1}{4}z^2 = 1$ not the graph of a function $f(x,y)$?

Math 213 Class 02: Component Vectors

Find the component form (the form <x,y>) of the vectors **a**, **b**, **c** shown in the diagram below

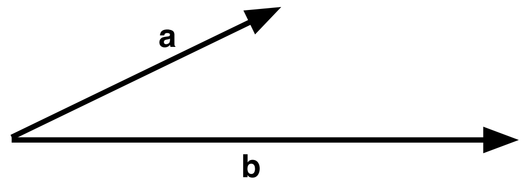


Now for a 3D problem.
Find the component form (the form < x, y, z >) of the vectors **a**, **b**, **c** shown in the diagram below



Math 213 Class 02: Dot and Cross Product

1. Consider the following two vectors. Draw the vector projection of **b** onto **a** and the vector projection of **a** onto **b**.



2. If $\mathbf{a} \neq \mathbf{0}$ and $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \cdot \mathbf{c}$ then is $\mathbf{b} = \mathbf{c}$? Explain or give a counterexample.

3. If $\mathbf{a} \neq \mathbf{0}$ and $\mathbf{a} \times \mathbf{b} = \mathbf{a} \times \mathbf{c}$ then is $\mathbf{b} = \mathbf{c}$?

4. If $\mathbf{a} \perp \mathbf{b}$ then what is the length of $\mathbf{a} \times \mathbf{b}$?

Math 213 Class 02: Triangles: The Right Stuff

For each problem below, the set of points given form a triangle. Is the triangle a right triangle? Justify your answer.

1. (-2,-1),(-2,8),(8,-1)

2. (0,0),(10,7), (-14,20)

3. (3,4),(3,12),(6,5)

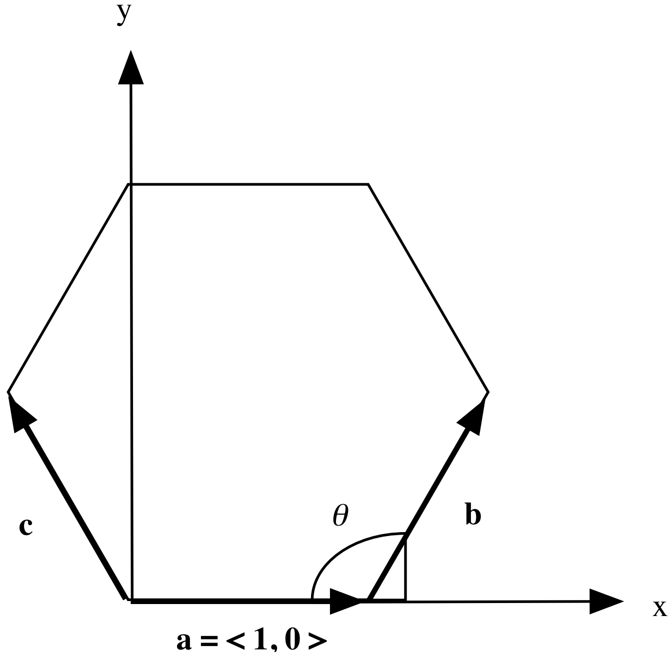
4. (2,1,2),(3,3,1),(2,2,4)

5. (-1,-2,-3),(0,0,-4),(-1,-1,-1)

6. (2,3,6),(3,4,7),(3,3,6)

Math 213 Class 02: The Regular Hexagon

Consider the following regular hexagon



1.Compute $|\mathbf{a}|, |\mathbf{b}|, |\mathbf{c}|$.

2.What is the angle θ?

3.What is $\mathbf{a} \bullet \mathbf{b}$?

4.What is $\mathbf{a} \bullet \mathbf{c}$?

5.What are $\text{proj}_{\mathbf{a}}\mathbf{b}$ and $\text{proj}_{\mathbf{b}}\mathbf{c}$?

6.What is the *x* component of $\mathbf{a} + \mathbf{b} + \mathbf{c}$?

Math 213 Class 02: Lines in the Plane

Let t be a scalar.

Let the vector $\mathbf{r}(t) = \langle 4,3 \rangle + t\langle 2,-1 \rangle$ be a function of t. Suppose the initial point of $\mathbf{r}(t)$ is always the origin.

Compute and give the vectors $\mathbf{r}(t)$ for $t = 0,1,2,3,-1,$and -1.5.

Into the coordinate system draw the vector $\mathbf{r}(t)$ for $t = 0,1,2,3,-1,$and -1.5.