Vectors Half (Chapters 6 – 9) – ***Exam Overview***

Congratulations! You have made it through Calculus and Vectors (final exam still to come!) Below is a rough overview of what you are expected to know. Study well! **Read your notes**, and paying attention to **examples**. You have two (and a half) classes to review. Ask questions of me, and your classmates. I want to encourage you to not waste this time.

Geometry of Vectors

1. Know the basic characteristics of a vector.
2. Be able to add/subtract vectors "geometrically" using the cosine law.

Algebra of Vectors (Note: There are close ties to Geometry with much of these topics)

1. Given 4 (algebraic – i.e. in component form) vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ in $\mathbb{R}^2$ or $\mathbb{R}^3$, determine:
    1. Linear combinations through add/subt/scalar multiplication (be able to use all).
    2. Magnitude of $\vec{a}$
    3. Unit vector in the direction of $\vec{b}$
    4. Angle between $\vec{c}$ and $\vec{d}$.
    5. Dot Product of two vectors.
    6. Cross Product of two vectors in $\mathbb{R}^3$. Why does cross product not work in $\mathbb{R}^2$?
    7. Scalar Projections $\left(comp_{\vec{a}}\vec{b}\right)$ and Vector Projections $\left(proj_{\vec{a}}\vec{b}\right)$
2. Be able to write vectors as Linear combinations of the Standard Unit Vectors $\hat{i}$, $\hat{j}$, and $\hat{k}$.
3. Force is a valid option for an application question.
4. Work is a valid option for an applications question.
5. Torque is a valid option for an application question.
6. Know your Direction Angles and Direction Cosines.
7. Vector or scalar?
    1. What is the difference?
    2. One is nonsense, one is a vector, one is a scalar. Determine which is which…
        1. $\left(\vec{a}\cdot\vec{b}\right)\times\vec{c}$
        2. $\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$
        3. $\left(\vec{a}\cdot\vec{b}\right)\left(\vec{b}\times\vec{c}\right)$
8. Span of a Set of Vectors. (And know what a Basis is.)

Lines

1. Given the correct info in $\mathbb{R}^2$ (two points, or a direction vector and a known point), determine vector, parametric, symmetric, and scalar equations of a line.
    - State a normal to the line. State a direction vector of the line. Use dot product to prove these vectors are perpendicular.
2. Determine all equations of a line in $\mathbb{R}^3$. Why are there no "scalar" equations of lines in $\mathbb{R}^3$?
3. What are skew lines?
4. The angle between intersecting lines is the same as the angle between their direction vectors.

Planes

1. Given points *A*, *B*, *C*, and *D*, (or two direction vectors, or a direction vector and enough info to get a second direction vector) determine:
    - The Vector, Parametric and Cartesian equations of the plane through the points *A*, *B*, *C*.
    - Why are there no symmetric equations of planes?
    - The Vector equation of the line through a point *D* perpendicular to the plane of the first part.
    - The angle between planes is the same as the angle between their normals.
    - The angle between a line and a plane is $90^\circ - \theta$, where θ is the angle between the normal of the plane and the direction of the line.

Systems of Equations

1. Determine the solutions, if any, the following.

    - Intersecting Lines with Lines and Lines with Planes (**you may (*probably will*) need to "parameterize" your solution set**).
    - Systems of Equations (feel free to use Gaussian Elimination or Gauss-Jordan Elimination).

Suggested Review Problems (on Photocopied Pages)

Chapter 6 (Vector Basics): Pg. 344 – 347 #4 – 8, 11, 16, 17, 18, 21
Chapter 7 (Some Applications of Vectors): Pg. 418 – 421 #2, 4, 7, 9, 10b, 12, 14, 18, 20, 22, 30
Chapter 8 (Equations of Lines and Planes): Pg. 480 – 483 #3 – 6, 8, 9, 11, 20, 24, 29, 34
Chapter 9 (Intersections and Systems of Equations): Pg. 552 – 555 #5, 6, 12a (hint: $\vec{m} \cdot \vec{n}$), 13a, 14, 19

Cumulative Review: Pg. 557 – 560 #1, 3 – 7, 11, 18, 20, 21, 22, 25ab, 28, 31, 34