**Pre-Calculus Exploratory Research Project *TOPIC Choices ☺***

*How much teacher support: \*Very little \*\*Some \*\*\* Lots*

1. **\*Quadric Surfaces (3-Dimensional Conics)**
   1. Learn how to graph the 3-D shape created by rotating a given conic section around a given axis.
   2. Learn how to find the area of a plane slicing through a given quadric surface or the volume of a 3-D figure bound within a quadric surface.
   3. Good Websites:
      1. <http://www.math.umn.edu/~rogness/quadrics/index.shtml>
      2. <http://www.math.ubc.ca/~feldman/m200/quadric.pdf>
      3. <http://www.mathreference.com/la-qf,3d.html>
2. **\*\*Harmonic Analysis**
   1. Given two sinusoids, learn how to form a new graph by adding or multiplying y-coordinates.
   2. Given a graph formed by adding or multiplying two sinusoids, learn how to find the equations of the two original sinusoids.
   3. Good Websites:
      1. <http://cda.morris.umn.edu/~mcquarrb/Precalculus/Resources/Lecture4.6.html>
      2. <http://cnx.org/content/m11643/latest/>
      3. <http://math.furman.edu/~dcs/soundwave/soundwave.html>
3. **\*\*\*Vectors in 2-D and 3-D Space**
   1. Given two 2-D or two 3-D vectors, learn how to find their lengths, add them, subtract them, and use the results to analyze real-world problems.
   2. Learn how to sketch a position vector that terminates in the first octant.
   3. Good Websites:
      1. <http://www.frontiernet.net/~imaging/vector_calculator.html>
      2. <http://members.tripod.com/~Paul_Kirby/appletgreatcircle/greatc.html>
      3. <http://www.engr.umd.edu/HAMLET/Vector3D/index.htm>
4. **\*\*\*Proof by Induction**
   1. Learn how to prove certain types of mathematical properties using mathematical induction.
   2. Learn how to prove the distributive property using induction.
   3. Learn how to identify properties that are best proven by mathematical induction and then prove them.
   4. Good Websites:
      1. <http://comet.lehman.cuny.edu/sormani/teaching/induction.html>
      2. <http://www.tech.plym.ac.uk/maths/resources/PDFLaTeX/induction.pdf>
5. **\*\*\*Matrices and Matrix Transformations**
   1. Given two matrices, learn how to find their sum and product, and use them to solve a system of linear equations.
   2. Given a square matrix, learn how to find its multiplicative inverse.
   3. Given a desired dilation and/or rotation, learn how to write a matrix that will perform the transformations when multiplied by a matrix representing the geometric figure.
   4. Learn how to predict patterns that will arise when different transformations are performed on a fixed shape repeatedly.
   5. Good Websites:
      1. <http://www.geom.uiuc.edu/java/LeapFractal/>
      2. <http://www.geom.uiuc.edu/java/IFSoft/>
      3. <http://www.sosmath.com/matrix/inverse/inverse.html>
6. **\*\*\*Complex Numbers on the Polar Plane**
   1. Learn how to write a complex number in polar form.
   2. Learn how to translate Cartesian form to polar form, and vice versa.
   3. Learn how to perform arithmetic operations with complex numbers in polar form.
   4. Good Websites:
      1. <http://www.math.ubc.ca/~feldman/m200/complex.pdf>
      2. <http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=61>
7. **Parametric Equations**
   1. Learn how to write some common equations into parametric equations.
   2. Learn how parametric equations can be applied to the physics of bodies in motion or in modeling and design.
   3. Good Websites:
      1. <http://tutorial.math.lamar.edu/Classes/CalcII/ParametricEqn.aspx>
      2. <http://www.mathopenref.com/coordparamcircle.html>
8. **A topic of your choice**
   1. Choose a topic that extends something we have done this year.
   2. Your topic must either be based on a specific assignment we have done or on the CA Precalculus standards: (which are a conglomeration of the material at the four sites below)
   3. You must write a description of what you want to study, why it’s relevant, and where you will get your resources. If you think you have a good topic, but are not sure if it is acceptable, talk to your teachers.
   4. Where to find the Standards:
      1. <http://www.cde.ca.gov/be/st/ss/mthtrig.asp>
      2. <http://www.cde.ca.gov/be/st/ss/mthanalysis.asp>
      3. <http://www.cde.ca.gov/be/st/ss/mthlinearalgebra.asp>
      4. <http://www.cde.ca.gov/be/st/ss/mthprobstat.asp>

Look at the websites that interest you. Talk to me to help you pick a good topic for you.