NCEA Math Lesson Plan

Grade: 9-12 **Subject:** Mathematics

Domain:
AP Calculus

Topic:
Limits and Infinity

Standard Number(s) and Description:
F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Vocabulary to be Highlighted:
Infinite, omnipresence, omnipotence, omniscience

Mathematical Practices (#):
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Essential Questions:
From a theological standpoint, what does infinity mean?
From a mathematical standpoint, what does infinity mean and what does it mean when a limit approaches infinity?
What does it mean when we say God is infinite?

Materials/Tools (include technology):
Graphing calculators
Geogebra.com

Connections to Other Math Domains:

Connections to Other Subject Areas:
Theology

Catholic Identity Component:

Students will explore the meaning of infinity from a mathematical standpoint and a theological standpoint to consider what it means to say God is infinite.

Resources (attachments):
"What does it mean that God is infinite?" http://www.gotquestions.org/infinite-God.html

"What does it mean to say that God is infinite?" http://carm.org/infinite-god

Infinity assessment and answer key (below)

Activities/Timeline:
Lesson Description:
Students will use technology to explore graphs at infinity. Students will learn about the nature of infinity and numerical and algebraic methods of evaluating limits at infinity. Once the students have a clear understanding of limits at infinity, they will learn about the infinite nature of God. Students will obtain an intuitive understanding of the limiting process, how to calculate limits using algebra, how to estimate limits from graphs or tables of data, and how to describe asymptotic behavior in terms of limits involving infinity.

Entry Activity/Pre-Activity:
Numerical: TI Graphing Calculator
Algebraic: Solving algebraic expression
Graphic: Geogebra.com
Infinite limit b: http://www.geogebratube.org/student/m55869
Infinite limits: http://tube.geogebra.org/student/m54331

Activity:
Teach lesson on limits at infinity- include graphically, numerically, algebraically. Have students read the articles on the infinite nature of God, then have students complete the assessment below.

Individual Assignment:
Have students create their own functions that 1) approach positive infinity from left and right and 2) approach positive infinity on one side and negative infinity on the other. Ask students to use available technology and submit their responses electronically.

Formative Assessment (what to look for, how/when to look):

Summative Assessment:
Students will complete the infinity assessment (below). Use the answer key (below) to grade the assignment.

Infinity Assessment

AP CALCULUS NAME:

Answer the following questions using complete sentences. Draw the graphs clearly and well defined.

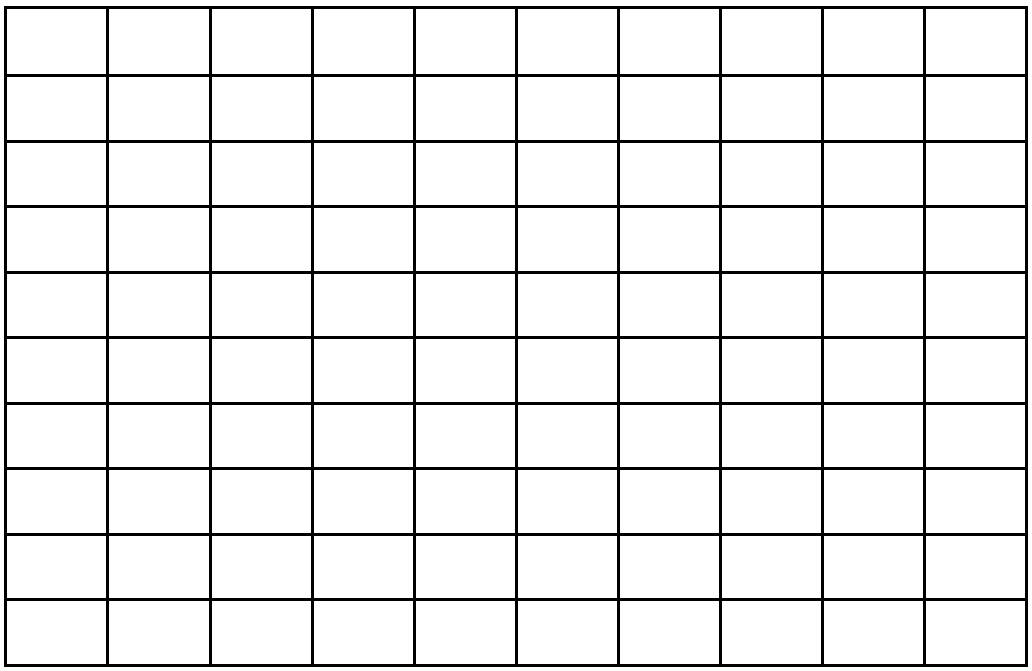
1. Draw a graph of a function (f) such that f approaches infinity as x approaches c.

2. What is a mathematical definition for infinite?

3. What is a theological definition for infinite?

4. Draw a graph according to the following restrictions.

a. Label the x-axis as time in years since your birth.
b. Let the y-axis represent total knowledge.
c. Draw a relation or function that demonstrates God's knowledge over a period of time.
d. Draw a function that demonstrates your knowledge over the same period of time.



5. Explain why you drew each graph. Why did you think the function of God's knowledge each year would look like that? Why did you think the function of your knowledge each year would look like that?

Assessment Answer Key

Questions 1-5: Answers will vary

Question 4c: The graph of God's knowledge should cause some debate among the students. As God's knowledge is infinite and not a defined, finite value, over any period the graph would be off the charts. Thus, a graph that is constantly at infinity is impossible to draw on a defined Cartesian plane.

Question 4d: Hopefully, the students' graphs show an increase as time goes on!