

Curriculum Guide Calculus

Unit 1: Functions and Models

Biblical Worldview Essential Questions:
What models of faith did God give in the Bible?

6 Lessons (1 week)

C#1

Objectives	Methods	Resources	Assessment
The students will <ol style="list-style-type: none">1. review basic ideas concerning functions.2. graph, transform and combine functions.3. represent functions in four ways: by an equation, in a table, by a graph, or in words.4. solve problems involving the main types of functions that occur in calculus.5. use functions as mathematical models of real-world phenomena.6. graph functions using graphing calculators.7. understand limitations of graphing calculators.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work

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Unit 2: Limits and Rates of Change

Biblical Worldview Essential Questions:
What limitations did God put on mankind?

13 Lessons (3 weeks)

C#1

Objectives	Methods	Resources	Assessment
The students will <ol style="list-style-type: none">1. understand historical development of limits from the tangent problem and the velocity problem2. develop “intuitive feel” for limits.3. use algebraic techniques for computing limits of functions.4. use algebraic techniques for computing limits at infinity.5. understand and use precise definition of limits.6. calculate limits using limit laws7. understand and use formal definition of continuity.8. investigate average and instantaneous rates of change and how they relate to limits.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work

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Unit 3: The Derivative

Biblical Worldview Essential Questions:
 What are examples of instantaneous changes in the Bible?

27 Lessons

C#2, C#3

Objectives	Methods	Resources	Assessment
The students will <ol style="list-style-type: none"> 1. investigate relationship between the slope of a curve at a point and the rate of change. 2. develop concept of derivative and relate it to rates of change and slopes of curves. 3. develop concept of the derivative as a function 4. determine when a function is not differentiable 5. use special techniques to find derivatives of functions. 6. apply derivatives to rates of change problems in the natural and social sciences 7. memorize and use formulas for derivatives of trigonometric functions. 8. find derivatives of composition of functions by using the chain rule. 9. perform implicit differentiation. 10. find higher order derivatives 11. solve related rate problems. 12. understand and use differentials to perform local linear approximation. 	<ul style="list-style-type: none"> • teacher lecture • teacher working examples on the board • related YouTube videos • student guided practice of problems in book • cooperative learning groups • individual assistance • partner work • homework 	<ul style="list-style-type: none"> • Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012 	<ul style="list-style-type: none"> • check homework • Quizzes • Tests • Oral response • Board work

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Unit 4: The Derivative in Graphing and Applications

Biblical Worldview Essential Questions:

A practical use of derivatives is for optimization.

How does the Bible tell us to optimize our Christian life?

20 Lessons

C#3, C#4

Objectives	Methods	Resources	Assessment
<p>The students will</p> <ol style="list-style-type: none"> 1. use the first derivative to determine where a function is increasing or decreasing. 2. find absolute extrema values on open and closed intervals. 3. understand and use Rolle's Theorem and the Mean-Value Theorem. 4. use the second derivative to determine where a function is concave up or concave down. 5. use the first and second derivative tests to determine where relative extrema and inflection points occur on the graph of a function. 6. use derivatives and previously learned properties of functions to completely analyze the graph of a function. 7. use derivatives to analyze rectilinear motion. 8. solve optimization problems. 9. find the antiderivative of a function 10. use a direction field to find the specific solution of a differential equation 	<ul style="list-style-type: none"> • teacher lecture • teacher working examples on the board • related YouTube videos • student guided practice of problems in book • cooperative learning groups • individual assistance • partner work • homework 	<ul style="list-style-type: none"> • Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012 	<ul style="list-style-type: none"> • check homework • Quizzes • Tests • Oral response • Board work

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Unit 5: Integrals

Biblical Worldview Essential Questions:
A technique of integration is to use substitution.
Where do we see substitution in the Bible?

20 Lessons (2.5 weeks)

C#4

Objectives	Methods	Resources	Assessment
<p>The students will</p> <ol style="list-style-type: none"> 1. understand historical development of integrals from area and distance problems 2. use the rectangle method for finding area between the graph of a function and the x-axis. 3. find area under the curve using the limit of the summation of areas of rectangles. 4. define and associate the definite integral as the limit of Riemann sums. 5. use properties of definite integrals 6. use the antiderivative method for finding area between the graph of a function and the x-axis. 7. use the Fundamental Theorem of Calculus to evaluate definite integrals. 8. relate antiderivative to the indefinite integral and memorize basic integration formulas 9. use properties of indefinite integrals and the net change theorem to solve problems. 10. perform integration using the substitution technique. 11. evaluate definite integrals using the substitution method. 	<ul style="list-style-type: none"> • teacher lecture • teacher working examples on the board • related YouTube videos • student guided practice of problems in book • cooperative learning groups • individual assistance • partner work • homework 	<ul style="list-style-type: none"> • Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012 	<ul style="list-style-type: none"> • check homework • Quizzes • Tests • Oral response • Board work

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Unit 6: Applications of the Definite Integral in Geometry, Science, and Engineering

Biblical Worldview Essential Questions:

Integration is used to find volumes of regular shaped objects.
What are some Bible verses that are about solid and liquid volumes?

15 Lessons

C#4

Objectives	Methods	Resources	Assessment
The students will 1. use the definite integral to find the area between two curves. 2. find volumes of three-dimensional solids by slices, disks and washers methods. 3. find volumes of three-dimensional solids by cylindrical shells methods. 4. use definite integrals to find “work” as defined in physics and engineering.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work

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Unit 7: Inverse Functions: Exponential, Logarithmic, and Inverse Trigonometric functions

Biblical Worldview Essential Questions:

Why did the lifespans of the patriarchs from Noah to Joseph decrease exponentially?

25 Lessons

C#6, C#7, C#10

Objectives	Methods	Resources	Assessment
The students will 1. find and graph inverse functions. 2. discover and use the relationship between the derivative of a function and the derivative of its inverse. 3. review properties and uses of exponential and logarithmic functions. 4. memorize and use the derivative formulas for exponential and logarithmic functions. 5. develop, memorize and use the derivative formulas for inverse trigonometric functions. 6. use L'Hospital's Rule to find limits of indeterminate forms.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work

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Unit 8: Techniques of Integration

Biblical Worldview Essential Questions:

Approximation is often “good enough.”

Why don't we find approximate measures in the Bible?

5 Lessons (4 weeks)

C#9

Objectives	Methods	Resources	Assessment
The students will perform numerical integration approximation using the Midpoint Rule and Trapezoidal Rule.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work

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Unit 9: Differential Equations

Biblical Worldview Essential Questions:

Why are there so many different English versions of the Bible?

13 Lessons (2 weeks)

C#12

Objectives	Methods	Resources	Assessment
The students will 1. model population growth using differential equations 2. express differential equations using direction fields. 3. solve separable differential equations. 4. solve exponential growth and decay problems.	<ul style="list-style-type: none">• teacher lecture• teacher working examples on the board• related YouTube videos• student guided practice of problems in book• cooperative learning groups• individual assistance• partner work• homework	<ul style="list-style-type: none">• Calculus: Graphical, Numerical, Algebraic, 4th Ed., Ross L. Finney . . . [et al.]; Pearson Education, 2012	<ul style="list-style-type: none">• check homework• Quizzes• Tests• Oral response• Board work