Analytical Geometry & Calculus I, II, & III
MAT 221, 231, & 241

(Revision: July 2017)

MAT221 Course Information

Course Description: An introduction to analytic geometry, limits, continuity, differential and integral calculus of single variable functions, and related applications.

Title: Thomas' Calculus Early Transcendentals, Single Variables, 14th edition
Author: Weir & Hass
Publisher: Pearson
ISBN: 9781323757857

Chapter	Section	Topic	Notes
Chapter 1		Functions	Select some topics to review
Chapter 2	All	Limits and Continuity	
Chapter 3	All	Differentiation	
Chapter 4	All	Applications of Derivative	
Chapter 5	All	Integration	
Chapter 7	7.1	Integrals and Transcendental Functions	

MAT221 Learning Outcome Statement: Upon completion of this course the student will be able to:

1. (Evaluation/Analysis level) Define and evaluate limits algebraically, numerically, or graphically.
2. (Knowledge/Recall level) Define various types of discontinuity.
3. (Evaluation level) Use multiple methods to differentiate functions.
4. (Application/Analysis level) Use the concepts of calculus to graph a function.
5. (Application level) Solve real-world applications using derivative.
6. (Evaluation level) Approximate the zeros of a function.
7. (Evaluation level) Integrate functions.
8. (Evaluation level) Define and evaluate definite integrals.
9. (Application level) Solve applications using integral calculus.
10. (Application level) Incorporate technology to support the problem-solving process.

Standards/Assessments:

1a. Evaluate limits algebraically, numerically, or graphically.
1b. Use the precise definition of limit to prove the existence of a limit.
2a. Determine the continuity of a function algebraically or graphically.
2b. Apply the Intermediate Value Theorem to show the existence of a zero.
3a. Use the limit definition to find the derivative of a function.
3b. Find the derivative of polynomial, radical, rational, exponential, logarithmic, trigonometric and inverse trigonometric functions by applying appropriate rules of differentiation.
4. Accurately determine the relative extreme, the concavity, and the points of inflection of a function using the First and Second Derivative Tests.
5. Solve motion, free-fall, related rates, optimization, and other applied problems using appropriate derivatives.
6. Use Newton's Method to approximate the zeros of a function.
7. Evaluate the indefinite integrals of polynomial, radical, rational, exponential, logarithmic, trigonometric and inverse trigonometric functions by applying the appropriate rules of integration.
8a. Apply the Fundamental Theorem of Calculus to accurately evaluate definite integrals.
8b. Use the upper and lower sums to approximate the area of a region.
9a. Solve initial value problems by applying appropriate integral calculus.
9b. Use correct integral calculus to solve motion problems.
10. Use a graphing calculator and/or computer software to verify the accuracy of graphs, integrals, and derivatives.

MAT231 Course Information

Course Description: Techniques of integration for both proper and improper integrals and with applications of physics and social science, elements of analytic geometry, and the analysis of sequences and series.

Title: Thomas' Calculus Early Transcendentals, Single Variables, 13th edition
Author: Weir & Hass
Publisher: Pearson
ISBN: 978-0-321-88407-7

Chapter	Section	Topic	Notes
Chapter 6	All	Applications of Definite Integrals	
Chapter 3	3.8 & 3.9	Differentiation	
Chapter 7	All	Integrals and Transcendental Functions	
Chapter 8	All	Techniques of Integration	
Chapter 9	9.1 & 9.2	First order Differential Equations	
Chapter 10	All	Infinite Sequences and Series	
Chapter 11	11.1-11.3	Parametric Equations and Polar Coordinates	

MAT231 Outcomes and Standards

Learning Outcomes:

1. (Evaluation level) Determine the volume of a solid of revolution.
2. (Evaluation level) Apply appropriate rules of differentiation to find the derivative of various functions.
3. (Evaluation/Analysis level) Apply various techniques of integration to find the proper and improper integrals.
4. (Application level) Model real-life problems by applying integration.
5. (Evaluation level) Apply various techniques to solve first-order differential equations.
6. (Analysis/evaluation level) Identify the convergence or divergence of sequences and series.
7. (Evaluation level) Develop a power series representation for elementary functions and estimate the series with a partial sum.
8. (Evaluation level) Analyze curves in the plane defined by parametric and polar equations.
9. Incorporate technology to support problem-solving processes.

Standards:

1. Calculate the volume of a solid of revolution using the washer and shell methods.

2. Find the derivative of inverse logarithmic, and hyperbolic functions.
3. Find the proper and improper integrals by applying appropriate integration techniques such as integration by parts, trigonometric integral, trigonometric substitution, partial fractions, integration tables, and numerical integration.
4. Identify and utilize the proper techniques of integration to solve problems related to distance, velocity, acceleration, arc length, area, volume, force, work, exponential growth, moments, and the centroid of a lamina.
5. Use an appropriate method to solve separable and linear first-order differential equations.
6a. Justify the convergence or divergence of a series by applying an appropriate rule, theorem or test.
6b. Determine whether or not a given sequence is increasing, decreasing, or monotonic.
7a. Represent a function as a power series by applying appropriate rules of integration and differentiation to a known series.
7b. Approximate the value of a Maclaurin or Taylor series to a specified degree of accuracy.
8a. Express a rectangular coordinate function as a system of parametric equations or polar equations.
8b. Graph a system of parametric equations or polar coordinate function.
9. Use a graphing calculator and/or computer software to verify the accuracy of graphs, integrals, and derivatives.

MAT241 Course Information

Catalog Description: Multivariable calculus including vectors, vector-valued functions, partial differentiation, multiple integration and an introduction to vector fields.

Title: Thomas' Calculus Early Transcendentals, Single Variables, 13th edition
Author: Weir & Hass
Publisher: Pearson
ISBN: 978-0-321-88407-7

Chapter	Section	Topic	Notes
Chapter 11	11.3 – 11.7	Parametric Equations and Polar Coordinates	
Chapter 12	All	Vectors and the Geometry of Space	
Chapter 13	All	Vector-Valued Functions and Motion in Space	
Chapter 14	All	Partial Derivatives	
Chapter 15	All	Multiple Integrals	
Chapter 16	16.1, 16.2, &16.4	Integrals and Vector Fields	

MAT 241 Outcomes and Standards

Learning Outcomes:

1. (Analysis Level) Examine the use of vectors in plane and in three-dimensional space.
2. (Analysis Level) Describe and compare the motion of an object in the plane or space curve.
3. (Analysis Level) Analyze the graphs of multivariable functions.
4. (Application Level) Solve real- world applications using multivariable derivative.
5. (Evaluation Level) Select multiple integrals to find characteristic attributes of multi-dimensional solids.
6. (Evaluation Level) Intrepret line and surface integrals.
7. (Synthesis Level) Incorporate technology to support problem-solving processes.

Standards:

1a. Accurately perform the operations of vectors.
1b. Find the parametric and symmetric equations of a line in space.
1c. Find an equation of a tangent plane in space.
2a. Correctly use the gradient of a function of two variables in applications.
2b. Find the precise curvatures of graphs represented by various equations.
3a. Thoroughly analyze a multivariable function by examining its contour diagrams (family of level curves) and sketching a three dimensional graph.
3b. Apply the appropriate definitions and rules of continuity, limits to analyze the behavior of multivariable functions.
4. Solve optimization and other applied problems using appropriate partial derivatives.
5a. Correctly set up and compute double and triple integrals in rectangular, polar, cylindrical, or spherical coordinates to find the surface area and the volume of a geometric solid.
5b. Use appropriate double or triple integrals to find the mass, center of mass, or moments of inertia of a lamina of variable density.
6a. Use Green's Theorem to correctly evaluate a line integral.
6b. Accurately evaluate surface integrals.
7. Use a graphing calculator or computer software to verify the accuracy of graphs, integrals, and derivatives.