

MAT 231 Analytical Geometry and Calculus II

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

Prerequisites: MAT221

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

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 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. (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. (Synthesis Level) Incorporate technology to support problem-solving processes.

Sample problems from this course:

1. Find the volume of the solid generated by revolving the regions bounded by

the lines and curves $y = e^{\left(-\frac{1}{4}\right)x}$, $y=0$, $x=0$ and $x=4$ about the x -axis.

The volume of the resulting solid is _____ units cubed.

(Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression.)

2. Find the derivative of y with respect to x .

$$y = \ln\left(\frac{1}{x\sqrt{x+5}}\right)$$

3. Evaluate the integral.

$$\int_{\pi/2}^{2\pi} \sqrt{1 - \sin^2 t} dt$$

$$\int_0^{\pi} 10 \sin^4 x dx$$

4. An electric elevator with a motor at the top has a multistrand cable weighing 5.5 lb/ft. When the car is at the first floor, 130ft of cable are paid out, and effectively 0 ft are out when the car is at the top floor. How much work does the motor do just lifting the cable when it takes the care from the first floor to the top?

The amount of work required is _____ ft-lb.

(simplify your answer.)

5. Solve the differential equation

$$\frac{dy}{dx} = \frac{1}{7} \sqrt{y} \cos^2 \sqrt{y}$$

6. Consider the series

$$\sum_{n=0}^{\infty} (-1)^n (5x + 2)^n$$

(a) Find the series' radius and interval of convergence.

(b) For what values of x does the series converge absolutely?

(c) For what values of x does the series converge conditionally?

7. Use power series operations to find the Taylor series at $x=0$ for

$$x^2 \sin x$$

8. Find an equation for the line tangent to the curve at the point defined by the

given value of t . Also, find the value of $\frac{d^2y}{dx^2}$ at this point.

$$x = 2t, y = \sqrt{t}, t = \frac{1}{9}$$