Midterm 2 Expectations

Prerequisites

Math is a naturally cumulative subject so you are still expected to be familiar with the prerequisites and material from Midterm 1 (as stated in that expectations document), though you will not be tested directly on it.

What you need to know about geometry for Midterm 2

• How to find the area of a region bounded by given curves in the $xy$-plane. You may be asked to set up and/or integrate for area given with respect to $y$ instead of with respect to $x$. (5.4 and 8.1)

• How to find the volume of a solid that has known cross-sections taken perpendicular to some axis. (8.1)

• How to find the volume of a solid of revolution around the $x$-axis. (8.2)

• The basic area formulas for squares, rectangles, triangles, circles, and semicircles.

What you need to know about differential equations for Midterm 2

• How to solve an differential equation of the form $y' = f(t)$ or $y'' = f(t)$ for the general solution or for a particular solution, given initial (or other) values. (6.3)

• More specifically, how to solve physical problems that invoke the relationship between position, velocity, and acceleration: Finding position functions from velocity and an initial position, etc. (6.3)

• The difference between velocity and speed. The difference between displacement (integral of velocity) and distance traveled (integral of speed). (6.3)

• How to verify that a particular curve (or family of curves) satisfies a given differential equation. (11.1)

• How to solve a separable differential equation for the general solution, or for a particular solution, given initial (or other) values. (11.4)

• How to use a phase diagram to study autonomous differential equations and make qualitative conclusions about them (specifically the values they take as $t \to \infty$). (11.2)

• Terms related to differential equations: order (11.1), separable (11.4), autonomous.
• How to find equilibria of an autonomous differential equation, distinguish between stable, unstable, and metastable equilibria (11.5, 11.7), and use equilibria calculations to make qualitative statements about the asymptotic behavior of a system (by taking limits as \( t \to \infty \)).

• The explicit solution to the exponential differential equation \( P' = kP \), what the constant \( k \) means and how its sign (positive or negative) affects solutions. You should also know that the exponential differential equation has applications in modeling population growth, computing continuously compounded interest, and radioactive decay (half-life). (11.5)

• You do not need to know the explicit solution to the logistic differential equation. (Being able to analyze its behavior through its phase diagram is much more important in practice.)