

Unit 7

Topics

The Analytic Geometry section of the course begins with this unit, which consists of two parts. The first is an introduction to polar coordinates for points in the xy -plane, and polar equations and their graphs. The second is a study of complex numbers. The two topics are related by the polar form of a complex number, which then leads to simple formulas for finding powers and roots of complex number via DeMoivre's Theorem.

- Polar Coordinates (9.1-2)
 - Converting from rectangular to polar coordinates
 - Converting from polar to rectangular coordinates
 - Equations in polar coordinates
 - Graphs of functions and relations given in polar coordinates
- Complex numbers (A.7 and 9.3)
 - Definition
 - Addition and subtraction
 - Multiplication
 - Division
 - Polar form
- DeMoivre's Theorem (9.3)
 - Powers of complex numbers
 - Roots of complex numbers

Study Guidelines for the 8th edition of Sullivan's *Precalculus*

The only way to learn mathematics is to do mathematics, so while these problems will not be collected or graded, you will probably not do well in the course if you do not complete these and check your work as described above.

Section 9.1: Polar Coordinates

- **Reading:** section 9.1
Read and work through examples 1-8 and their matched problems.
- **Practice Problems:** 9.1 #1-4, 11-83 odds, 84
- You can download and print [polar graph paper](#).
- **Section 9.2: Polar Equations and Graphs**
 - **Reading:** section 9.2
Read and work through examples 1-13 and their matched problems.
 - Many of the polar graphs (for example, the roses) are similar to the pictures that can be obtained by using a **spirograph**. Note that we can always rewrite any polar equation $r=f(t)$ as a set of parametric equations $x=f(t)*\cos(t)$, $y=f(t)*\sin(t)$. In a similar way, spirograph pictures are obtained by using certain parametric equations involving trigonometric functions. For the details, [see Anu Garg's wonderful spirograph applet](#).
 - **Practice Problems:** 9.2 #1-6, 13-27 odds, 29-36, 37, 43, 45, 49, 53, 57, 61-64, 65, 67, 69, 71, 73, 77, 81
 - You can download and print [polar graph paper](#).
- **Section A.7 (review): Complex Numbers**
 - **Reading:** section A.7, pages A54-A58
Concepts you should know:
 - definition of complex numbers
 - addition and subtraction of complex numbers
 - multiplication of complex numbers

- division of complex numbers
 - **Practice Problems:** Work through a representative sampling of problems #9-46 in this section until you feel comfortable with the concepts listed above.
- **Section 9.3:** The Complex Plane; DeMoivre's Theorem
 - **Reading:** section 9.3
Read and work through examples 1-6 and their matched problems.
 - The following applets illustrate the geometric distribution of the n complex n th roots of a complex number:
 - [complex square roots](#)
 - [complex cube roots](#)
 - [complex 4th roots](#)
 - [complex 5th roots](#)
 - **Practice Problems:** 9.3 #1-4, 11-59 odds, 61, 63-65
 - You can download and print [polar graph paper](#).