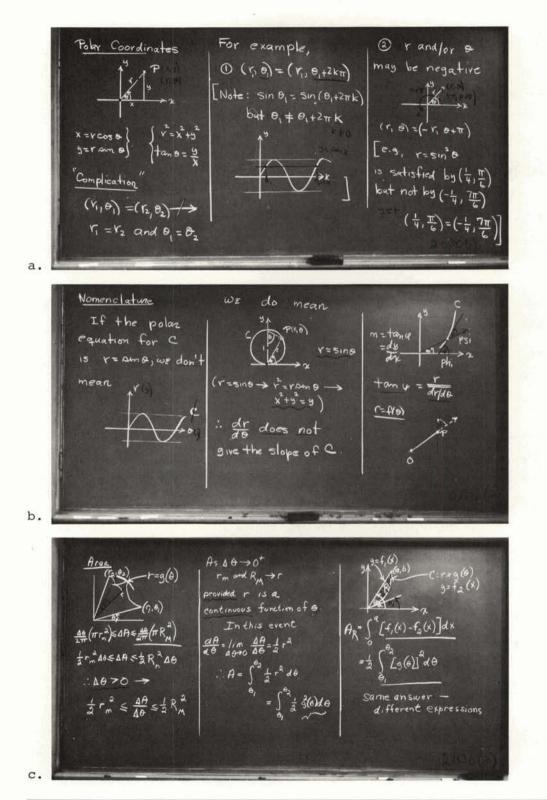
Study Guide Block 2: Vector Calculus

### Unit 4: Polar Coordinates I

1. Lecture 2.030



2.4.1

Study Guide
Block 2: Vector Calculus
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2. Read Thomas, Sections 11.1, 11.2, and 11.3.

3. Exercises:

2.4.1(L)

Describe the curve C if its polar equation is  $r = \cos \theta$ ,  $0 \le \theta \le \pi$ .

### 2.4.2

The curve C is given by the polar equation

 $\frac{1}{r^2} = 4 \cos^2 \theta + 9 \sin^2 \theta.$ 

Sketch C by converting its polar equation into the equivalent Cartesian form.

## 2.4.3(L)

a. Plot the curve C if its polar equation is  $r = \sec \theta$ ,  $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$ .

b. Plot the curve whose polar equation is  $r = \theta$ , and then write the equation of this curve in Cartesian coordinates.

#### 2.4.4(L)

- a. (1) The curve C is given by the polar equation  $r = f(\theta)$ . What can we conclude about the symmetry of C if we know that whenever  $(r_0, \theta_0)$  belongs to C so also does  $(-r_0, -\theta_0)$ ?
  - (2) With C as above, what can we conclude about its symmetry if we know instead that whenever  $(r_0, \theta_0)$  is on C so is  $(-r_0, \pi-\theta_0)$ ?
- b. Use the result of (a) together with the information contained in  $\frac{dr}{d\theta}$  to sketch the curve whose polar equation is r = sin 20.
- c. What is the Cartesian equation of the curve in (b)?

2.4.5(L)

- a. Let  $C_1$  and  $C_2$  be defined by the polar equations  $r = \cos \theta + 1$  and  $r = \cos \theta 1$ , respectively. Show that  $C_1$  and  $C_2$  have no simultaneous points of intersection.
- b. With C1 and C2 as in part (a), sketch these two curves.
- c. Explain why the results of (a) and (b) are not contradictory.

#### 2.4.6(L)

The curve  $C_1$  is defined by the polar equation  $r = \cos 2\theta$ , while  $C_2$  is defined by  $r = 1 + \cos \theta$ . Find all points at which  $C_1$  and  $C_2$  intersect.

#### 2.4.7(L)

Let C denote the curve whose polar equation is  $r = \sin \frac{\theta}{4}$ ,  $0^{\circ} \leq \theta \leq 720^{\circ}$ . If P denotes the point  $(\frac{1}{2}, 240^{\circ})$ , does P belong to C? Explain.

#### 2.4.8

Find all points of intersection of the curves  $C_1$  and  $C_2$  if the polar equation for  $C_1$  is  $r = 1 + \cos \theta$  and the polar equation for  $C_2$  is  $r = 1 + \sin \theta$ .

MIT OpenCourseWare http://ocw.mit.edu

# Resource: Calculus Revisited: Multivariable Calculus Prof. Herbert Gross

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