

# Math 385 Spring 2007

## Quiz 1

1. Find the solution to the initial value problem

$$\frac{dy}{dx} = 2y \cos x, \quad y(0) = 3.$$

**Answer:**  $y(x) = 3e^{2\sin x}$  (solve by separating variables)

2. Write a differential equation which models the following situation. Be sure to describe what each of your variables represent. If there are any additional parameters in your model, state any information which you know to be true about those parameters.

The acceleration of a sports car is proportional to the difference between 200 miles per hour and the current velocity of the car.

**Answer:** Let  $v(t)$  be the velocity of the car at time  $t$ , let  $a(t) = v'(t)$  be the acceleration of the car at time  $t$ . Then

$$v' = k(200 - v),$$

where  $k$  is a constant of proportionality.

**Alternate answer:** Let  $x(t)$  be the position of the car at time  $t$ , let  $v(t) = x'(t)$  be the velocity of the car at time  $t$ , and let  $a(t) = x''(t)$  be the acceleration of the car at time  $t$ . Then

$$x'' = k(200 - x'),$$

where  $k$  is a constant of proportionality.

*Remarks:*  $a = k(200 - v)$  was only worth partial credit; this is not yet a true differential equation because the relation between  $a$  and  $v$  ( $a = v'$ ) has not been made explicit.