Mathematics 172

Quiz 23 Name: Key

You must show your work to get full credit.

Consider the system of two differential equations:

$$\frac{dx}{dt} = x\left(\frac{6-2x-3y}{6}\right)$$
$$\frac{dx}{dt} = y\left(\frac{6-3x-2y}{6}\right)$$

What these equation tell us is that if we know both the values of x and y, then we can use then to compute the values of the derivatives x' and y'.

1. If $x(2) = 5$ and $y(2) = 1$ find the following"

$x'(2) =$ -5.83 $y'(2) =$ -1.83

$x'(2) = x\left(\frac{6-2x-3y}{6}\right) = 5\left(\frac{6-2(5)-3(1)}{6}\right) = -5.83$

$y'(2) = y\left(\frac{6-3x-2y}{6}\right) = 1\left(\frac{6-3(5)-2(1)}{6}\right) = -1.83$

2. Again with $x(2) = 5$ and $y(2) = 1$ estimate the following:

$x(2.3) \approx$ 3.25 $y(2.3) \approx$ $.451$

$x(1.9) \approx$ 5.583 $y(1.9) \approx$ 1.183

$x(2.3) \approx x(2) + x'(2)(2.3-2)$
$= 5 - 5.83(.3) = 3.25$

$y(2.3) \approx y(2) + y'(2)(2.3-2)$
$= 1 - 1.83(.3) = .451$

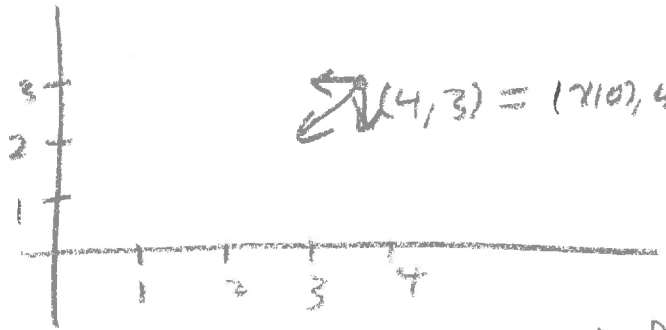
$x(1.9) \approx 5 - 5.83(-.1) = 5.583$

$y(1.9) \approx 1 - 1.83(-.1) = 1.183$

3. If $x(0) = 4$ and $y(0) = 3$ then plot the point $(4, 3)$ and draw an arrow showing what direction that it is moving.

$x'(0) = 4\left(\frac{6-2(4)-3(3)}{6}\right) = -7.33$ so x decreasing

$y'(0) = 3\left(\frac{6-3(4)-2(3)}{6}\right) = -6$ and y decreasing



The point is moving down and to the left.