Written Homework

Your carefully written solutions to the following questions will be due at the beginning of class on Monday, July 14.

1. Find all the values of $a$ such that the slope of the tangent line to the graph of $y = \frac{1}{x}$ is parallel to the line $y = 8 - 9x$. (Hint: Start by finding the slope of the tangent line at $x = a$.)

2. Let $f(x) = \frac{x}{x+1}$. Find all the values of $x$ where $f'(x) = 4$.

3. Let $f(x) = x^3 - 9x$. (a) Use the derivative of $f$ to find the intervals where $f$ is increasing and where $f$ is decreasing. (b) Use the second derivative of $f$ to find the intervals where $f$ is concave up and where $f$ is concave down.

4. Peyton throws a ball. We picture Payton and the ball as shown in the coordinate plane below:

In this coordinate system, the parametric equations for the motion of the ball are $x(t) = 65t$ and $y(t) = -16t^2 + 28t + 6$, where $t$ represents the number of seconds that have passed since Peyton has thrown the ball. The position of the ball in the $xy$-plane at time $t$ is the point $P(t) = (x(t), y(t))$. The ground is represented in this figure by the $x$-axis.

(a) Where is the point $P(0)$ on the graph?

(b) Label the point where the ball hits the ground. Find the coordinates of this point, and determine when this happens.

(c) Calculate $x'(t)$ and $y'(t)$. (These are called the horizontal and vertical velocities of the ball, respectively.)

(d) When is the vertical velocity of the ball zero? Find the exact coordinates of the point where the ball is when this happens.

(e) What is the vertical velocity of the ball when it hits the ground?