[Note: (1,1) satisfies $1+2-3=0$ ✓]

(6.) (8 pts) [Show all work.]

If y satisfies the equation

$$y^2 + 2xy - 3x = 0,$$

(a) find $\frac{dy}{dx}$.

By implicit differentiation:

$$2y\frac{dy}{dx} + 2x\frac{dy}{dx} + 2y - 3 = 0$$

so $$\frac{dy}{dx}(2y+2x) = 3-2y$$

$$\frac{dy}{dx} = \frac{3-2y}{2y+2x}$$

(b) Based on your answer to part (a), is the graph increasing, decreasing, or neither (*ie.*, tangent horizontal or undefined) at the point (1,1)? Explain.

$$\left.\frac{dy}{dx}\right|_{(1,1)} = \frac{3-2}{2+2} = \frac{1}{4}$$

Thus the graph is increasing at the point (1,1) because the derivative (or slope) is positive at that point.

(7.) (12 pts) A laboratory study investigating the relationship between diet and weight in adult humans found that the weight, W, of a subject, in pounds, was a function, f, of the daily average number of calories, c, consumed by the subject. In terms of diet and weight, interpret the following statements or expressions. [Be certain to include units and write in sentences.]

Given: $W = f(c)$.

(a) $f(1800) = 155$

A person who consumes on average 1800 calories per day weighs 155 lbs.

(b) $f'(2000) = 0$

At 2000 daily average calories, the person's weight is stable -- neither increasing or decreasing. The person's weight will not change if they consume more/less calories.

(c) $f^{-1}(162)$

The expression $f^{-1}(162)$ represents the average daily calories that a person weighing 162 lbs consumes.

Note: $f^{-1}(w) = c$

(d) What are the units of $f'(c)$?

The units of $f'(c)$ are in pounds per calorie.