Solutions to Quiz 6

MATH 139-02
Thursday, February 19, 2004

1. Let $f(x) = (0.75)^x$.

   (a) Estimate $f'(0)$ using $\Delta x = 0.001$.

   Solution: $\dfrac{f(0.001) - f(0)}{0.001} = \dfrac{(0.75)^{0.001} - (0.75)^0}{.001} \approx -0.28764$. Also, $\dfrac{f(0) - f(-0.001)}{0.001} = \dfrac{(0.75)^0 - (0.75)^{-0.001}}{0.001} \approx -0.29772$. Thus, it seems that $f'(0) \approx -0.297$.

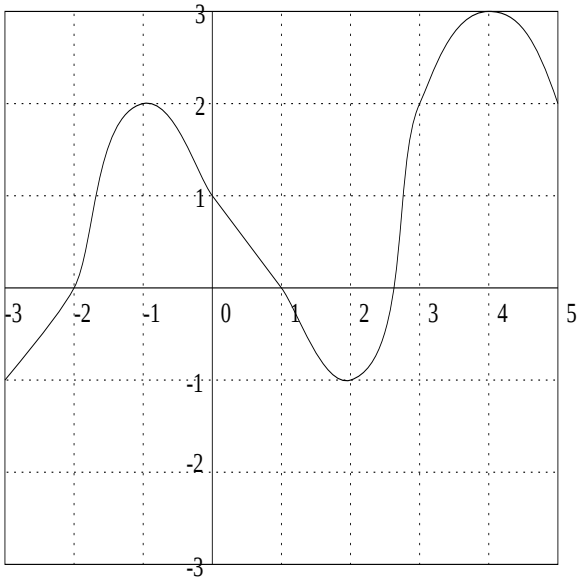
   (b) Explain why the answer you found in (a) has the sign it does. (Positive or negative.)

   Solution: Since f is decreasing everywhere, its derivative should be negative everywhere.

   (c) What is $\ln(0.75)$? What do you notice?

   Solution: $\ln(0.75) \approx -0.287682$, which is just about the value of $f'(0)$!

2. On the graph below, indicate in which regions $f'(x) > 0$, in which regions $f'(x) < 0$, and at what points $f'(x) = 0$.



Solution: f is decreasing for x between -1 and 2 and for $x > 4$. On these regions, $f'(x) < 0$. f is increasing for $x < -1$ and x between 2 and 4, so $f'(x) > 0$ on these regions. Finally, since the tangent lines at $x = -1, 2$, and 4 are horizontal, $f'(-1) = f'(2) = f'(4) = 0$.