

Name: \_\_\_\_\_

Solutions

**Math 1300-005 - Spring 2017**

Quiz 5 - 2/17/17

*On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work.*

Signature: \_\_\_\_\_

*Guidelines:* You are permitted to use notes, the book, in-class worksheets/solutions, and your classmates on this quiz. Computers and graphing technology of any kind, including calculators, are not allowed (exceptions made for those who have an e-book). Please show all work and clearly denote your answer.

1. (a) Let  $f(x) = x^2 - 3$  and  $g(x) = 4x + 1$ . Find  $f'(x)$  and  $g'(x)$ .

$$f'(x) = 2x, \quad g'(x) = 4$$

- (b) Based on part (a), what is  $f'(x)g'(x)$ ?

$$f'(x)g'(x) = (2x)(4) = 8x$$

- (c) Let  $h(x) = (x^2 - 3)(4x + 1)$ . What is  $h'(x)$ ?

$$h(x) = 4x^3 + x^2 - 12x - 3,$$

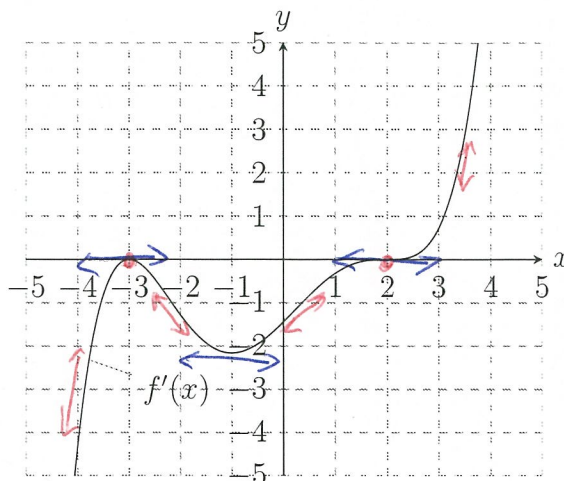
$$\text{so } h'(x) = 12x^2 + 2x - 12$$

- (d) True or False? Please explain your answer.

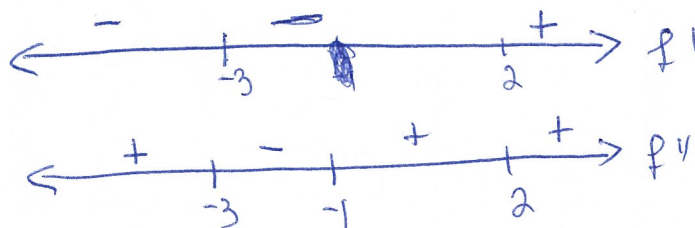
$$\frac{d}{dx}(f(x)g(x)) = f'(x)g'(x)$$

False, (a), (b), (c) above provide a counterexample  
 since  $8x \neq 12x^2 + 2x - 12$ .

2. Consider the graph of the derivative  $f'(x)$  of a function  $f(x)$ . Answer the following questions.



- (a) Construct sign charts for  $f'$  and  $f''$ . Be sure to label which is which!



- (b) On what interval(s) is  $f$  increasing? On what interval(s) is  $f$  decreasing? State the location of any local maximums or local minimums, if they exist. Be sure to justify ALL of your answers here.

$f$  increasing  $(2, \infty)$  since  $f' > 0$  there.

$f$  decreasing  $(-\infty, -3) \cup (-3, 2)$  since  $f' < 0$  there.

Local max: none,  $f'$  never goes  $(+)$  to  $(-)$

Local min: at  $x=2$ , since  $f'$  goes  $(-)$  to  $(+)$  there.

- (c) On what interval(s) is  $f$  concave up? On what interval(s) is  $f$  concave down? State the location of any inflection points, if they exist. Be sure to justify ALL of your answers here.

$f$  concave up  $(-\infty, -3) \cup (-1, 2) \cup (2, \infty)$  since  $f'' > 0$  there.

$f$  concave down  $(-3, -1)$  since  $f'' < 0$  there.

Inflection points at  $x=-3$ ,  $x=-1$  b/c  $f''$  changes sign at these  $x$ -values.