

Name _____

Test 2
Calculus 1
Math 2413
Fall 2009
Mike Huff

Tools: Any calculator
Deadline: 10/28/09

Calculus I Test 2 Mike Huff

Show all work on the test paper for partial credit.

(4 points)

1. A laboratory study was done to investigate the relationship between the diet and weight of adults. The study determined that the weight of a subject, W , in pounds, was a function, $W = f(c)$, of the average number of calories per day, c , consumed by the subject. Interpret the following statements in terms of diet and weight:

a) $f(1750) = 150$

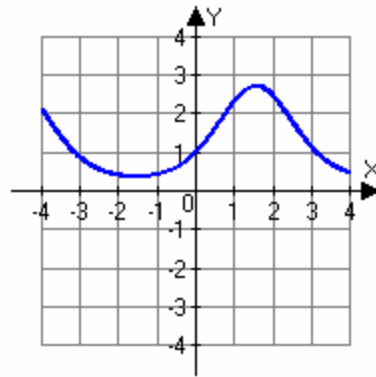
b) $f^{-1}(165) = 2205$

c) What are the units of $f'(c) = \frac{dW}{dc}$

d) $f'(2000) = 0$

(2 points)

2. Use the graph of f to estimate $f'(0)$.



(4 points)

3. a) State the definition of the derivative $\frac{dy}{dx}$ for a function $y = f(x)$.

b) True or false: If a function $y = f(x)$ is differentiable then it is continuous.

c) True or false: If a function $y = f(x)$ is continuous then it is differentiable.

(6 points)

4. a) Use the definition of the derivative to find $f'(3)$ where $f(x) = x^2 + 3x + 2$.

b) Use the result from a) to find an equation of the tangent line to $f(x) = x^2 + 3x + 2$ at the point $(3,20)$.

(6 points)

5. Use the definition of the derivative to find $f'(x)$ where $f(x) = \frac{1}{x}$.

(5 points)

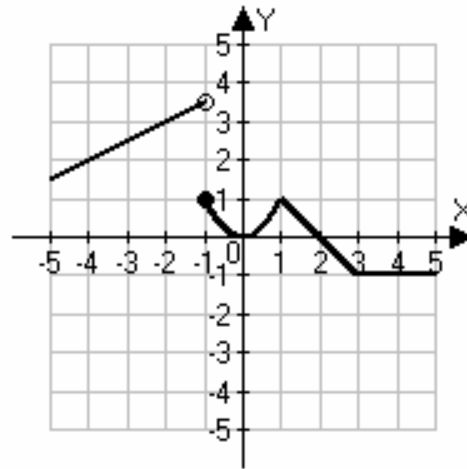
6. Use the graph of the function $f(x)$ below to answer the following questions:

a) For what values of x is the function not differentiable?

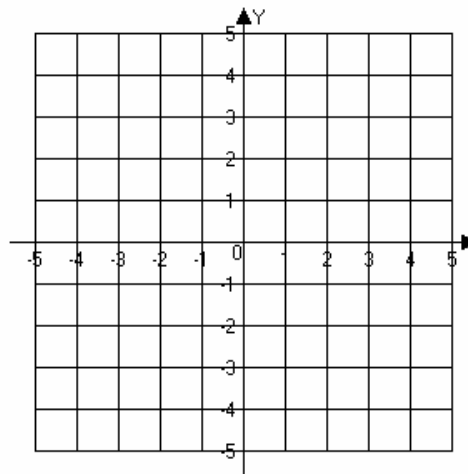
b) What is $f'(-3)$?

c) What is $f'(2)$?

d) What is $f'(4)$?



e) Make a rough sketch the derivative of f below.

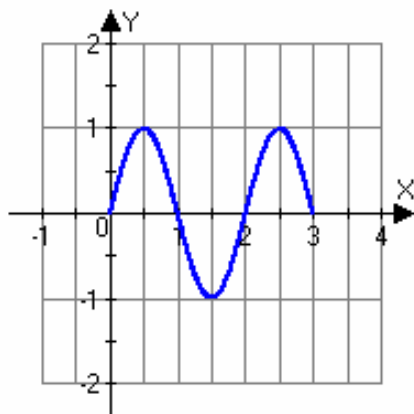


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(8 points)

7. The following is a graph of f' , the derivative of some function f .

- a) On what interval(s) is f increasing?
- b) On what interval(s) is f decreasing?
- c) Where does f have a local minimum?
- d) Where does f have a local maximum?
- e) On what interval(s) is f concave up?
- f) On what interval(s) is f concave down?



f' _____

f'' _____

(7 points)

8. Rules of Differentiation

Fill in the following formulas:

a) The derivative of a constant function $f(x) = k$ is

b) The derivative of the function kf is $(kf)' =$

c) The derivative of the sum function $f + g$ is $(f + g)' =$

d) The derivative of the difference function $f - g$ is $(f - g)' =$

e) The derivative of the product function fg is $(fg)' =$

f) The derivative of the quotient function (f/g) is $\left(\frac{f}{g}\right)' =$

g) If n is any integer, then $(x^n)' =$

h) The derivative of the sine function is $\frac{d(\sin x)}{dx} =$

i) The derivative of the cosine function is $\frac{d(\cos x)}{dx} =$

j) The derivative of the secant function is $\frac{d(\sec x)}{dx} =$

k) The derivative of the cosecant function is $\frac{d(\csc x)}{dx} =$

l) The derivative of the tangent function is $\frac{d(\tan x)}{dx} =$

m) The derivative of the cotangent function is $(\cot x)' =$

n) The derivative of the exponential function is $(e^x)' =$

(8 points)

9. Suppose the height of a projectile fired vertically upward from a height of 1127 feet with an initial velocity of 258 feet per second is given by the function

$$h(t) = -16t^2 + 258t + 1127.$$

- a) What is the height of the object after 10 seconds?
- b) Find the instantaneous velocity at $t = 10$ seconds.
- c) Find the acceleration at $t = 10$ seconds.

(8 points)

10. Find the derivative, $f'(x)$, for each of the following functions:

a) $f(x) = -2x^4 + 3x^{5/2} - \frac{3}{2}x^{-3} + x + \pi^e$

b) $f(x) = 2 \sin x - 3 \cos x - 4e^x$

(9 points)

11. Find the derivative, $f'(x)$, for each of the following functions:

a) $f(x) = x^2 \cos x$

b) $f(x) = (x^3 + x^{3/2})(\sin x - x^2)$

c) $f(x) = \frac{x^2}{1 - 2x^2}$

(9 points)

12. Find the derivative, $\frac{dy}{dx}$, for the function:

a) $f(x) = \frac{1 - xe^x}{x + e^x}$

b) $f(x) = \frac{x^2}{1 - x \cos x}$

(6 points)

14. Let $f(x) = x - 2 \cos x$. Does f have any horizontal tangent lines in the interval $-2\pi \leq x \leq 2\pi$? If so, where? If not, why not?

(6 points)

15. The number of people $P(t)$ (in thousands) infected t months after an epidemic begins is approximated by $P(t) = 5 - 0.20t - \frac{7}{3t^2}$ where $1 \leq t \leq 12$. When will the number of people infected start to decline? According to the model, what is the maximum number of people infected?

(6 points)

16. Suppose a certain drug is administered to a patient, with the percent of concentration in the bloodstream t hr later ($t \geq 0$) given by $C(t) = \frac{5t}{t^2 + 1}$. On what time interval is the concentration of the drug increasing?