Name _____ Calculus I Test 2 Fall 2005 Mike Huff

(6 points)

1. Suppose the height of a projectile fired vertically upward from a height of 1024 feet with an initial velocity of 256 feet per second is given by

$$h(t) = -16t^2 + 256t + 1024\,.$$

a) What is the height of the object after 7 seconds?

b) What is the instantaneous velocity of the object after 7 seconds?

c) What is the acceleration of the object after 7 seconds?

(5 points)

2. A company that manufactures and sells paint estimates that it can sell $g(p)$ gallons of paint at a price of p dollars per gallon. Interpret the following expressions in terms of gallons and dollars.

a) $g(10) = 15{,}500$

b) $g^{-1}(16000) = 9.50$

c) $g'(8.5) = 0$

d) If $g'(11) = -200$, what can you say about the effect of increasing the price of paint from \$11 per gallon to \$12 per gallon?

e) What are the units of $g'(p) = \dfrac{dg}{dp}$

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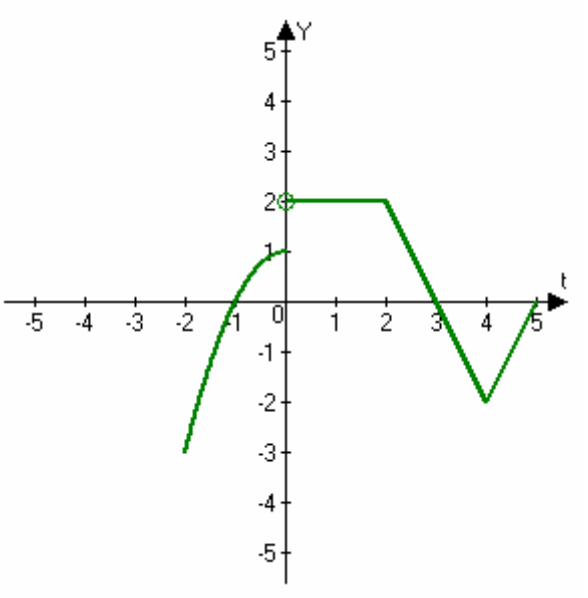
(6 points)

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

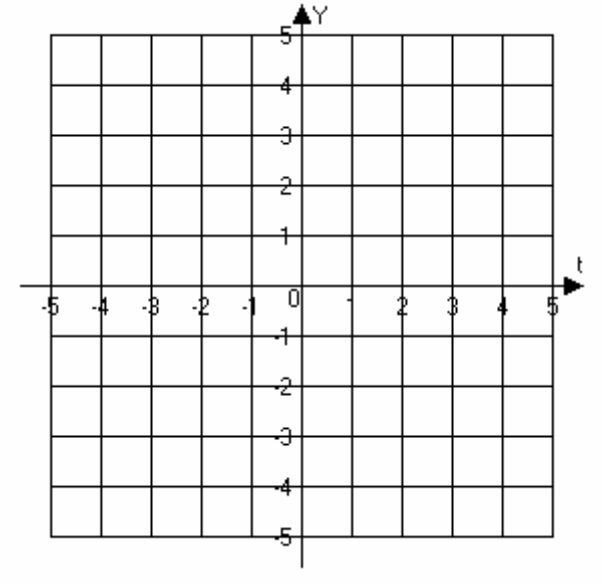
a) For what values of x is the function not differentiable?

b) What is $f'(1)$?

c) What is $f'(3)$?



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



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(5 points)

4. Use the definition of the derivative to find $f'(-1)$ where $f(x) = -2x^2 + 3x + 2$.

(5 points)

5. Find an equation of the tangent line to $f(x) = -2x^2 + 3x + 2$ at the point $(-1, -3)$.

(5 points)

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

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(7 points)

7. The following is a graph of f', the derivative of some polynomial function f. Use the graph to answer the following questions.

   a) On what interval(s) is f increasing?

   b) On what interval(s) is f decreasing?

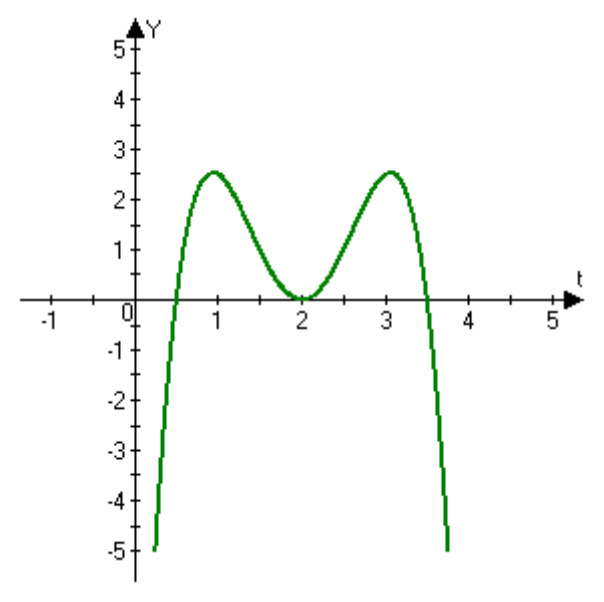
   c) Where does f have a local minimum?

   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?

   g) Does f have any inflection points? If yes, where are they?



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(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 $(\sin x)' =$

i) The derivative of the cosine function is $(\cos x)' =$

j) The derivative of the secant function is $(\sec x)' =$

k) The derivative of the cosecant function is $(\csc x)' =$

l) The derivative of the tangent function is $(\tan x)' =$

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

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

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(8 points)

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

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

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

(12 points)

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

a) $f(x) = x^3 \sin x$

b) $f(x) = \left(x^2 + x^{3/4}\right)\left(\cos x - x^3\right)$

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

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(6 points)

10. A particle moves according to the position function $s(t) = 3t^3 - 18t + 4, t \geq 0$, where *t* is measured in seconds and *s* is in meters. Use calculus to find the following exactly:

    a) The velocity at time *t*.

    b) What is the velocity after 3*s*?

    c) When is the particle at rest?

    d) When is the particle at moving forward?

    e) Find the acceleration at time *t*.

    f) What is the acceleration after 3*s*?

(8 points)

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

    $y = e^x(x - \cos x)$

    a) $f(x) = \frac{x}{1 - \sin x}$

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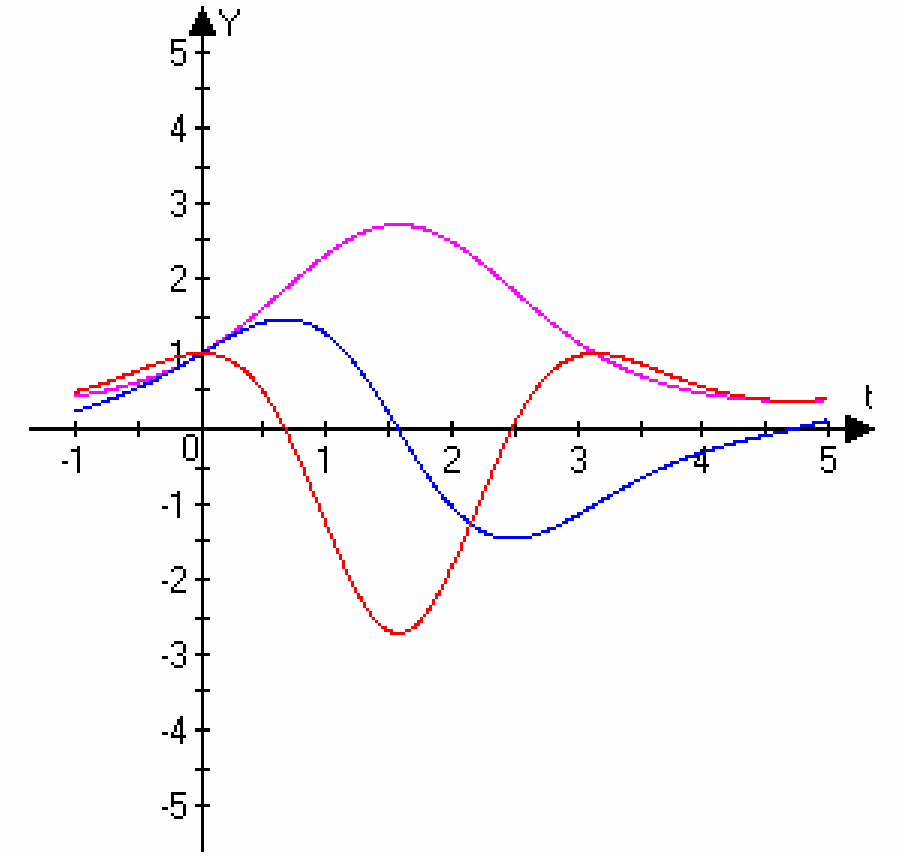
(5 points)

12. Let $f(x) = \sqrt{2}x + 2\cos x$. Does f have any horizontal tangent lines in the interval $-2\pi \le x \le 2\pi$? If so, where? If not, why not?

(3 points)

13. The graph below contains the graphs of three functions - f, f', and, f''. Place the correct label on each graph.



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(6 points)

14. Find the derivative, $\frac{dy}{dx}$, for the function $y = \frac{ax+b}{cx+d}$.

(6 points)

15. For each of the functions A-F whose graphs are given on the next page, Match the function with its derivative function G-I. Place your answers here:

a) $A' =$ _____

b) $B' =$ _____

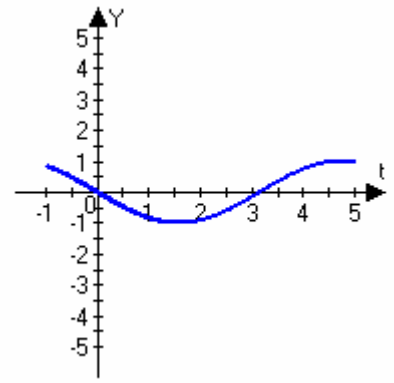
c) $C' =$ _____

d) $D' =$ _____

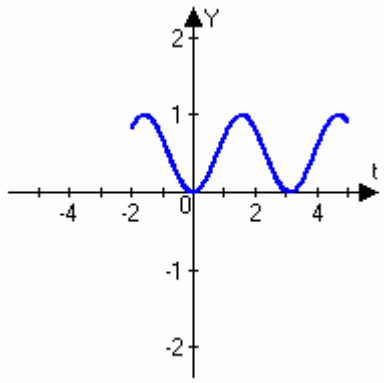
e) $E' =$ _____

f) $F' =$ _____

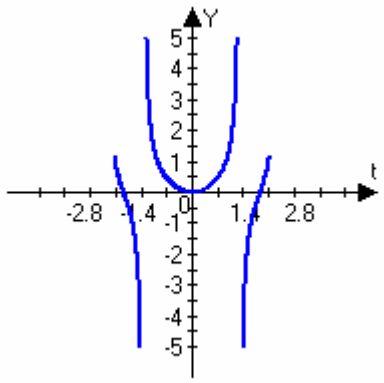
A



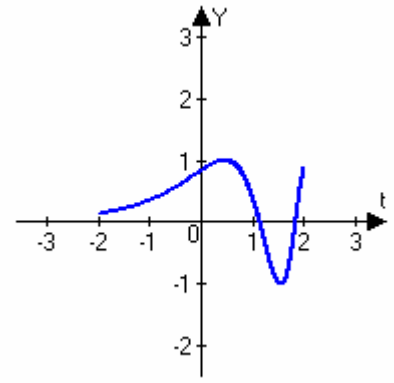
B



C



D



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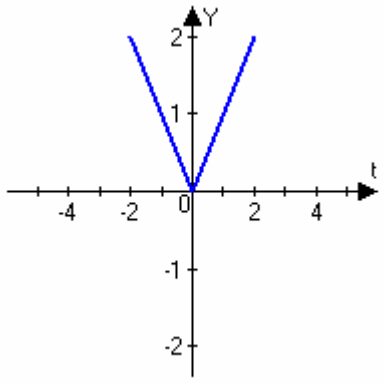

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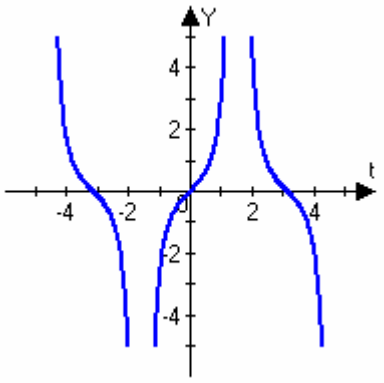
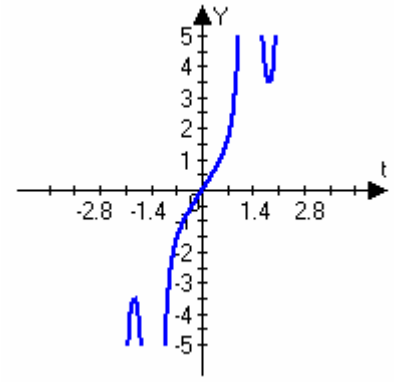
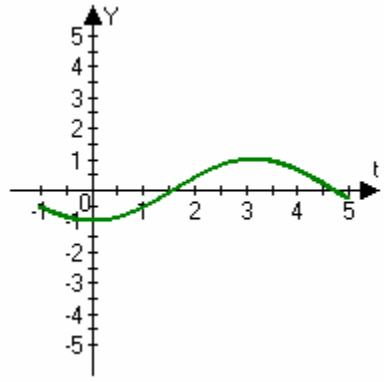


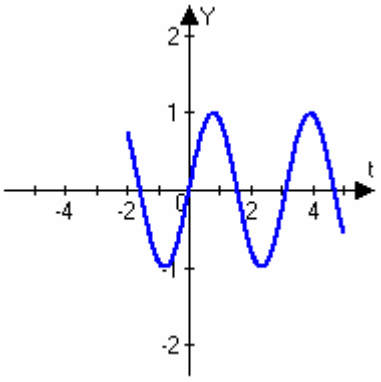
G



H



I



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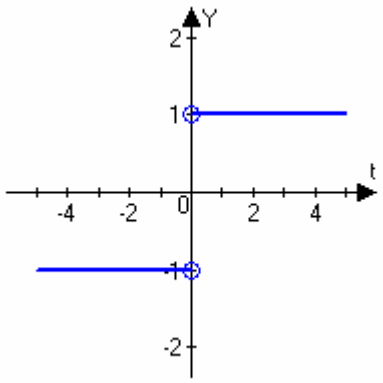
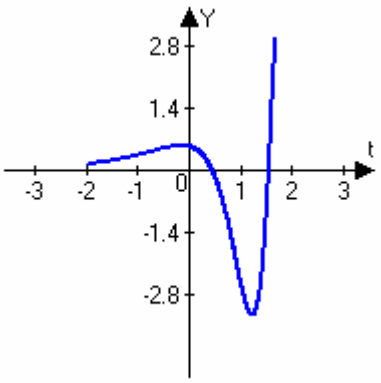


K



L