

Name _____ Calculus I Test 1B Spring 2006 Mike Huff

The Difference Quotient (6 points)

1. If $f(x) = -3x^2 + 2x - 1$, find and simplify $\frac{f(x+h) - f(x)}{h}$

Solving Exponential Equations (4 points)

2. Solve for x exactly.

a) $e^{\cos x} = e^{\sqrt{3}/2}$

b) $e^{\ln x^2} = e^7$

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Solving Equations (6 points)

3. Solve for x *exactly*.

a) $\log(x) - \log(x - 1) = 1$

b) $\ln(\ln(x)) = 1$

c) Solve: $x \frac{1-2x}{2\sqrt{x-x^2}} + \sqrt{x-x^2} = 0$

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Secant and Tangent Lines (6 points)

4. Let $f(x) = \cos 2x$, to find the following:

a) The slope M_{PQ} of the secant line through the points $P = (0, f(0))$ and

$$Q = \left(\frac{\pi}{12}, f\left(\frac{\pi}{12}\right) \right).$$

b) Find an approximate equation for the tangent line to $f(x) = \cos x$ at $x = 0$.

Average Velocity (8 points)

5. Suppose the height of a projectile fired vertically upward from a height of 108 feet with an initial velocity of 500 feet per second is given by $h(t) = -16t^2 + 500t + 108$.

a) What is the height of the object after 2 seconds?

b) Find the average velocity over the time period $[2, 2.001]$.

c) Find the instantaneous velocity at $t = 2$ seconds.

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Continuity (6 points)

6. Give an example of a function that has a removable discontinuity at $x = 2$ and $x = 4$, has $\lim_{x \rightarrow -\infty} f(x) = -2$, and an infinite discontinuity at $x = 3$.

Limits and Continuity (8 points)

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

a) $\lim_{x \rightarrow -2^-} f(x)$

b) $\lim_{x \rightarrow -2^+} f(x)$

c) $\lim_{x \rightarrow -2} f(x)$

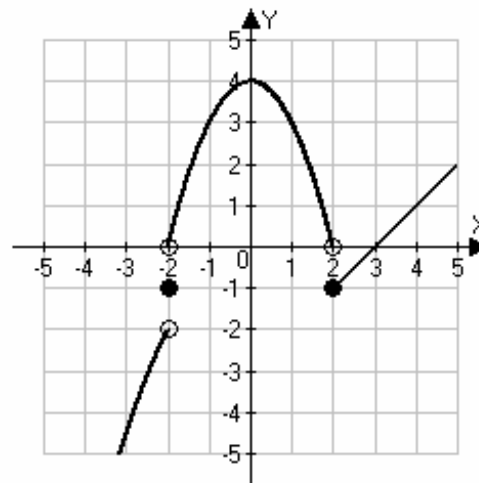
d) $f(-2)$

- e) Is f continuous at $x = -2$? Explain.

f) $\lim_{x \rightarrow 0} f(x)$

g) $\lim_{x \rightarrow 2} f(x)$

- h) Is f continuous from the right at $x = 2$? Explain



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Limits (6 points)

8. Find the value of the limit: $\lim_{x \rightarrow -2} \left(\frac{\frac{1}{2} + \frac{1}{x}}{2 + x} \right)$

Limits (6 points)

9. Find the value of the limits:

a) $\lim_{x \rightarrow \infty} \frac{3x^2 - 3x + 5}{(2x - 2)(x + 2)}$

b) $\lim_{x \rightarrow -\frac{1}{2}^+} \frac{(2x + 3)(3x + 5)}{(x - 2)(4x + 2)}$

c) $\lim_{x \rightarrow -3^-} \frac{(3x + 3)(x + 5)}{(x - 2)(x + 3)}$

Limits (6 points)

10. Find the value of the limit: $\lim_{x \rightarrow -2} \frac{6x^2 + 13x - 5}{6x^2 + 7x - 3}$

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Continuity (6 points)

11. At what value or values of x is the function discontinuous?

$$f(x) = \begin{cases} -x & x \leq -1 \\ 1 - x^2 & -1 < x < 1 \\ x - 1 & x \geq 1 \end{cases}$$

Limits at Infinity (6 points)

12. Find the value of the following limits:

a) $\lim_{x \rightarrow \infty} e^{x-x^2}$

b) $\lim_{x \rightarrow -\infty} (\ln 2) \cdot e^x$

Limits at Infinity (6 points)

13. Find the value of the limit: $\lim_{x \rightarrow \infty} \left(\sqrt{x^2 + 4x + 1} - x \right)$

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Intermediate Value Theorem (6 points)

14. Use the Intermediate Value Theorem to show that there is a root of the equation

$$e^{-x^2} = x \text{ on the interval } (0,1).$$

Squeeze Theorem (6 points)

15. If $2x - 1 \leq f(x) \leq x^2$ for $0 < x < 3$, find $\lim_{x \rightarrow 1} f(x)$. Be careful to explain your reasoning.

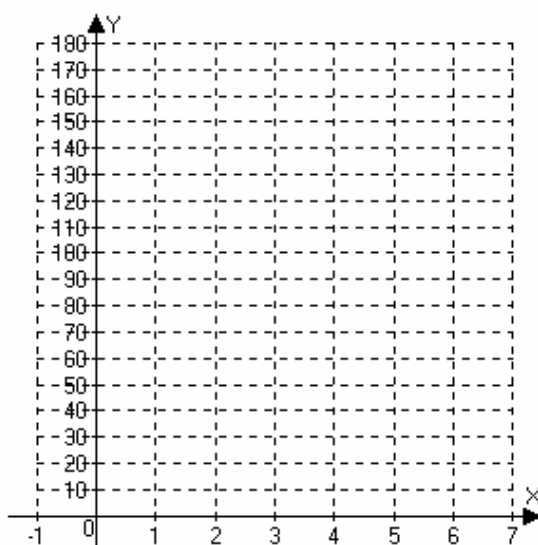
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Average Velocity (8 points)

16. A rocket that has just been launched from the ground is moving as given in the following table.

Time(min)	0	1	2	3	4	5
S (kilometers)	0	10	30	60	120	180

a. Graph the data.



b. Using the data, compute the *average velocity* of the rocket on the following time intervals:

a) $[2, 3]$

b) $[3, 4]$

c) Estimate the velocity of the rocket when $t = 3$ seconds. State your reasoning.

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MATH 2413
Test 1
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Deadline: 2/10/2006

Tools: Any calculator