



Louisiana Mu Alpha Theta

affiliated with
Mu Alpha Theta
National High School and Junior College
Honorary Mathematics Club

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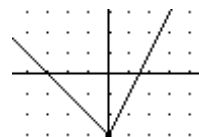
Individual - Mu A

TEST RULES

1. Do not begin test until you are told to do so.
2. You must supply your own #2 pencil.
3. Only ACT approved calculators are allowed on all tests.
4. Print your name, school, and your code on your answer sheet.
5. In case of a tie, winners will be determined according to the order in which the answer sheet was turned into the moderator.
6. Do all scratch work on your test.

MU ALPHA THETA - 2010
MU A INDIVIDUAL TEST

1. Find $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{4x}\right)^x$
2. Give the equation of the oblique asymptote for $y = \frac{x^2 - 6x - 1}{x + 3}$
3. Find a so $f(x) = \begin{cases} x^3 - a & x \geq 0 \\ \frac{\sin(x+2)}{2} & x < 0 \end{cases}$ is continuous on $(-\infty, \infty)$
4. Find $\lim_{x \rightarrow 0} \left(\frac{\sqrt{x+9} - 3}{x} \right)$
5. Find $\lim_{h \rightarrow 0} \left(\frac{3^{2+h} - 3^2}{h} \right)$
6. Find a function of the form $f(x) = ax^2 + bx + c$ having a horizontal tangent when $x = 1$ and for which the tangent line at $(2, 3)$ has equation $y = 2x - 1$
7. $h(x)$ is graphed below and $g(x)$ is a function for which $g(1) = \frac{1}{2}$ and $g'(1) = -3$
If $j(x) = \frac{h(x)}{g(x)}$, find $j'(1)$



8. Values of $f(x)$ and $f'(x)$ are represented in the table below.

If $k(x) = [f(x)]^2$, find $k'(5)$

x	$f(x)$	$f'(x)$
2	2	4
5	5	-3

9. Find the instantaneous rate of change of $f(x) = x^{x-1}$ when $x = 2$ (answer exactly)

10. Find $(f^{-1})'(\frac{1}{3})$ if $f(\frac{1}{3}) = \frac{2}{3}$, $f(1) = \frac{1}{3}$, $f'(1) = \frac{2}{3}$ and $f'(\frac{1}{3}) = 1$

11. Find an equation for the tangent line to $xy + 2x - 5y = 2$ at $(3, 2)$

12. Use the differential to estimate the change in $y = (x^2 + 5)^3$, as x changes from 1 to 1.02

13. The height of a cone is decreasing at 3 cm/s while its radius is increasing at 2 cm/s. Find the rate of change of the volume when the radius is 4 cm and the height is 6 cm.

14. Find the coordinates of all inflection points on $f(x) = x^5 - 5x^4 + 3x - 1$

15. Find a value on $[0,3]$ that satisfies the Mean Value Theorem for $f(x) = \frac{x-1}{x+1}$

16. If $f(x) = \begin{cases} |x-2| & -2 \leq x \leq 1 \\ |x| & 1 < x \leq 2 \end{cases}$, find the average value of $f(x)$ on $[-2,2]$

17. Suppose h is a function with the following values. Find $\int_1^2 h''(x) dx$

x	1	2
$h(x)$	-2	6
$h'(x)$	2	5
$h''(x)$	3	13

18. Find $\int \frac{dx}{x(\ln x)^2}$

19. If a is constant, find $\int_a^5 (2x + a) dx$

20. The marginal cost of producing x units of a product is given by $\frac{2}{x^{1/3}}$.

The cost of producing 8 units is \$20. Find the cost of producing 64 units.