Louisiana Mu Alpha Theta

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

50th State Convention
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Baton Rouge, Louisiana

Individual – Alpha

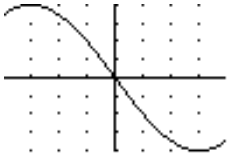
TEST RULES

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
ALPHA INDIVIDUAL TEST

1. If $f(x) = x^2 + 5x$, find $\dfrac{f(x+h) - f(x)}{h}$

2. Write an equation in terms of sine for the graph below (x scale is $\frac{\pi}{2}$, y scale is 1)



3. Solve $|x-4|^2 + |x-4| - 12 = 0$

4. Find the period of $f(x) = 4\cos(3x + \pi) - 5$

5. Find a point on the line $x = 2$ that is equidistant from $(9,2)$ and $(1,6)$

6. Simplify $\sec^2 x \cdot \cos^2 x + \tan^2 x$

7. There is a linear relationship between the number of hamburgers sold by a fast food restaurant each week and the number of discount coupons handed out the previous week. When 500 coupons were distributed, 1200 hamburgers were sold. When 650 coupons were distributed, 1450 hamburgers were sold. How many coupons should be distributed to sell 1600 hamburgers?

8. An angle θ has a terminal side that passes through the point $(-5,3)$. Find $\sec\theta$.

9. Find $f^{-1}(x)$, if $f(x)=\dfrac{x}{x-3}$

10. Solve $\cos^2 x-\sin^2 x-\sin x=0$ on $[0,2\pi)$

11. A quartic function has a zero of 4 and a root of multiplicity 3 at 0. If $f(1)=-15$, find $f(-1)$

12. Find all solutions of $2x^4-7x^3+5x^2-x=0$ (answer exactly)

13. Find the equation of an ellipse having a minor axis of length 4 and vertices $(2,0)$ & $(8,0)$

14. If $\cos\theta = A$, $\frac{3\pi}{2} < \theta < 2\pi$, find $\cos(2\theta)$

15. A manufacturer of lighting fixtures has daily production cost of $C(x) = 800 - 10x + .25x^2$ where c gives cost in dollars and x is the number of units produced. What is the minimum possible daily cost?

16. Find $\sin\left(2\cos^{-1}\left(\frac{1}{4}\right)\right)$ (answer exactly)

17. Solve $\log_2\left[\log_4\left(\log_3 x\right)\right] = -1$

18. In ΔABC, $a = 14$, $\angle A = 25^\circ$ and $\angle B = 75^\circ$. Find b (round to the nearest whole number)

19. Solve $\left(\frac{1}{64}\right)^x = 32 \cdot 2^{3x}$

20. Express $10cis\left(\frac{5\pi}{3}\right)$ in rectangular form