Alpha Team Test

Haynes Mu Alpha Theta 2019

Instructions

1. You have 50 minutes for this test.
2. No calculators allowed on this test.
3. Units are not required unless problem specifically says [units required]
4. Provide exact answers unless otherwise stated.
5. Put team name and school code on answer sheet.
6. Good luck and have fun!

School_____

Team Name (math puns encouraged)_____

Team Members_____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
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13. _____
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17. _____
18. _____
19. _____
20. _____

Haynes MAO 2019- Alpha Team

1) Aakash's life is getting complicated! Help him simplify his life by simplifying this expression: $\frac{4x^2y}{8xy^2} \div \frac{12xy^2}{8x^6y^3}$

2) Noor needs you to find ONE integer solution to $x^2 + 15 = 2^y$. Do it.

3) Trig is fun! Given point $P(5, -7)$ on the terminal side of an angle θ in standard position, determine $csc\ \theta$.

4) Let $x = 3ln2 + 5ln3 - 2ln18$. Find e^x.

5) At a Haynes Mu Alpha Theta meeting, there are 50 students. 30 of the students all know each other, and the other 20 know no one. People who know each other hug, and people who do not know each other shake hands. How many handshakes occur?

6) Maggie needs to find the minimum value of $f(x) = 3x^2 - 12x + 8$. Help her out.

7) If $log_2\,(log_2\,(log_3\,9)) + 4 = (log_3\,k)(log_k\,x)$ and $k > 1$, solve for x

8) Find $sin\ x$ if $64^{cot\ x} = 256^{cos\ x}$ and $0 < x < \pi$.

9) For positive integers *a, b,* and *c,* $ab = 24,\ bc = 72,\ ac = 48$. Find $a + b + c$.

10) Solve for x: $-3e^{3-x} + 2e^{6-2x} = 20$.

11) In triangle ABC, $b = 20,\ c = 14,\ \cos A = -\frac{2\sqrt{6}}{7}$. Find the area of the triangle.

12) The Haynes basketball team was successful on 75% of their 2-point attempts and 60% of their 3-point attempts. The team scored a total of 57 points. They attempted 5 more 2-pointers than 3-pointers. How many 3-point shots did they attempt?

13) Yesterday Shiv drove 1.5 hours longer than Eddie at an average speed 6 miles per hour faster than Eddie. Kyle drove 3 hours longer than Eddie at an average speed 12 miles per hour faster than Eddie. Shiv drove 70 miles more than Eddie. How many more miles did Kyle drive than Eddie?

14) Find the domain of the function $f(x) = \cos^{-1}(\sqrt{2 - \ln x})$

15) Marium is making things complex! Simplify $(1+i)^4(2-2i)^3$

16) Marzook has an equation of $x^4 + Ax^3 + Bx^2 + Cx + D = 0$ that has roots $3+\sqrt{2},\ 3-\sqrt{2},\ -3+i\sqrt{2},$ and $-3-i\sqrt{2}$. Find A+B+C+D.

17) Given that $3xy = 12$, where x and y are positive integers such that $x > y$, what is the value of $8^x / 2^y$? (simplify exponents)

18) What is the sum of all the solutions to the equation $24x^3 - 6x^2 + 8x - 2 = 0$?

19) Let $g = x + 3y$. What is the coefficient of x^5y^2 when g^7 is expanded?

20) Anupam is filling cups of soda for all the amazing MAO competitors. Each cup is a cylinder with a diameter of 4 inches and a height of $18/\pi$ inches. The soda comes from a completely filled jug in the shape of a rectangular prism, with a square base 6 inches on each side and with a height of 12 inches. How many cups can Anupam completely fill from the soda in the jug?

Answer Key

(Note: units are not required if they are in parentheses; if provided, however, units must be correct)

1. $x^6/3$
2. Any of the following answers are acceptable: (-1, 4), (1, 4), (-7, 6), (7, 6)
3. $-\sqrt{74}/7$
4. 6
5. 790
6. -4
7. 81
8. 3/4
9. 22
10. $3 - ln4$
11. 100
12. 15
13. 158 (miles)
14. $[e,\ e^2]$ or $e \leq x \leq e^2$
15. $64 + 64i$
16. 35
17. 2048
18. 1/4
19. 189
20. 6 (cups)