Theta 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. Not all figures are to scale.
6. Put team name and school code on answer sheet.
7. Good luck and have fun!

School_____

Team Name (math puns encouraged)_____

Team Members_____

1. _____
2. _____
3. _____
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17. _____
18. _____
19. _____
20. _____

Haynes MAO 2019- Theta Team

1) Simplify the expression $2(a-3)+4b-2(a-b-3)+5$

2) A cab ride costs \$3.25 for the first half-mile and \$0.70 for each mile after the first half-mile. How far can Advait travel for \$12?

3) Compute the number of diagonals in a decagon.

4) Harshita has 25 coins consisting of nickels, dimes, and quarters for a combined total of \$4.90. If the number of dimes is 1 less than twice the number of nickels, how many quarters does Harshita have?

5) Solve for x in the equation $9^x + 9^x + 9^x = 729$.

6) The arithmetic mean of a and b is 6.2, the mean of b and c is 7.3 and the mean of a and c is 4.5. What is the value of $a + b + c$?

7) There are three integer values of x that make the equation $x^3 + 6x^2 + 11x + 6 = 0$ true. What is the least of these values?

8) A right triangle has an area of 120 square units, and a leg length of 24 units. What is the perimeter of the triangle, in units?

9) A 16 inch-diameter pizza and a 12 inch-diameter pizza are each cut into eight congruent slices. Sania ate three slices of the 12-inch pizza. Mahir ate three slices of the 16-inch pizza. How many more square inches of pizza did Mahir eat than Sania?

10) John Kwon, who lives in Korea, is trying to contact his friends Neel and Suraj back in Louisiana via Facetime. However, the connections on each person's device are messed up such that John can only join a call every 6 minutes, Neel can only join a call every 39 minutes, and Suraj can only join every 14 minutes. Assuming they all start dialing at the same time, how long (in minutes) will it be until they can have a successful video chat about math?

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

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

13) 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?

14) An equilateral triangle with side length 12 is inscribed in a circle. Find the area *inside* the circle but *outside* the triangle.

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

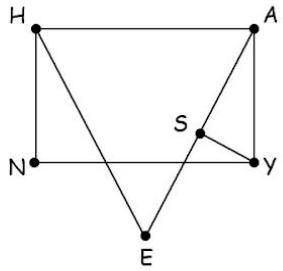
16) The Haynes basketball team was successful on 75% of their 2-point attempts and 60% of their 3-point attempts. The team scored a total of 57 points. They attempted 5 more 2-pointers than 3-pointers. How many 3-point shots did they attempt?

17) 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?

18) Haynes Academy Basketball All-star Tarick Ahmad typically makes 90% of his free throws. However, when Baggis are present, this percentage drops to 75%. If Tarick shoots 80 free throws with nobody present, but then Hassan Malik, a major Baggi, shows up for the next 20 free throws, what is the square root of the expected total number of free throws Tarick will make?

19) 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)

20) In rectangle HAYN, HA=2AY. Triangle HAE overlaps rectangle HAYN and is equilateral. S is the midpoint of AE. Determine $\angle ASY$.



Answer Key

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

1. $6b + 5$
2. 13 (miles)
3. 35
4. 17
5. 5/2 or 2.5 or equivalent
6. 18
7. -3
8. 60 (units)
9. $21\pi/2$ (sq. inches)
10. 546 (minutes)
11. $x^6/3$
12. -4
13. 790 (handshakes)
14. $48\pi - 36\sqrt{3}$ or equivalent factored form
15. $3 - ln4$
16. 15
17. 6 (cups)
18. $\sqrt{87}$
19. 2048
20. 75°