

**ALPHA INDIVIDUAL  
FAMAT State Convention 2004**

**For all questions, E. NOTA means none of the above answers is correct.**

1) Find which of the following trig functions is equal to  $\frac{7}{24}$  if the angle (MAO) in standard position with its terminal side in quadrant three, has a value of  $\frac{-24}{25}$  for the sine of (MAO).

- A) cotangent      B) tangent      C) cosecant      D) secant      E) NOTA

2) If a reference angle of an angle is 60 degrees and its terminal side is in quadrant 3, then find which of the following is the answer for the cosine of the angle.

- A)  $\frac{-\sqrt{3}}{2}$       B)  $\frac{\sqrt{3}}{2}$       C)  $\frac{-1}{2}$       D)  $\frac{1}{2}$       E) NOTA

3) Find the value for  $k$ , such that the remainder of  $(2x^4 - kx^2 - 4x + 2) \div (x - 2)$  is 6.

- A) 4      B) 5      C) 6      D) 7      E) NOTA

4) Find the area of a triangle that has side measures of 3.142 inches, 2.718 inches, and 1.414 inches. (After rounding your area to the nearest hundredths place, Find the sum of the digits).

- A) 10      B) 11      C) 12      D) 13      E) NOTA

5) What is the value of  $\sec\left(\sin^{-1}\left(\frac{1}{2}\right)\right)$  ?

- A)  $\frac{\sqrt{3}}{2}$       B)  $\frac{1}{2}$       C)  $\frac{2\sqrt{3}}{3}$       D) 2      E) NOTA

6) Which function of  $X$  can be equivalent to  $\frac{\cot X}{\sec X} \left( \frac{\sin^3 X + \cos^2 X \sin X}{\sec^2 X - \tan^2 X} \right) \frac{\csc X}{\cos X}$ ?  $0 < X < \frac{\pi}{6}$

- A)  $\sin X$       B)  $\cos X$       C)  $\csc X$       D)  $\tan X$       E) NOTA

7) Find the sum of the x and y intercept(s) for this graph?  $y = \frac{1}{4}e^{(x+3)} - 2004$

Round the sum to the nearest hundredths place.

- A) -2004      B) -1998.98      C) -992.99      D) 225.48      E) NOTA

- 8) Choose the equation of a line at a distance of 5 units from  $3x - 4y + 12 = 0$ .
- A)  $3x - 4y + 36 = 0$     B)  $4x - 3y + 12 = 0$     C)  $4y - 3x + 3 = 0$     D)  $3x - 4y - 13 = 0$     E) NOTA
- 9) What are the rectangular coordinates of  $(-\sqrt{3}, 135^\circ)$ ?
- A)  $\left(\frac{\sqrt{6}}{2}, \frac{-\sqrt{6}}{2}\right)$     B)  $\left(\frac{-\sqrt{6}}{2}, \frac{\sqrt{6}}{2}\right)$     C)  $(\sqrt{3}, -\sqrt{3})$     D)  $(-3, 3)$     E) NOTA
- 10) Which of the following is the cross product of the vectors  $(4, -1, 0)$  and  $(-2, 1, 3)$ ?
- A)  $(-3, -12, -2)$     B)  $(-8, -1, 0)$     C)  $(2, 0, 3)$     D)  $(-4, 12, 6)$     E) NOTA
- 11) Which of the following choices is a pair of perpendicular vectors?
- A)  $(0, 4), (0, -4)$     B)  $(4, -2), (3, -6)$     C)  $(-1, 3), (6, 2)$     D)  $(-2, 3), (2, -3)$     E) NOTA
- 12) The following points form a circle which passes through the points  $(-4, 0), (2, 2),$  &  $(0, -2)$ . Find the length of the radius.
- A) 2    B)  $\sqrt{6}$     C)  $2\sqrt{2}$     D)  $\sqrt{10}$     E) NOTA
- 13) Find the length of the major axis of the ellipse with the equation of  $4x^2 + 9y^2 - 24x = 0$ .
- A) 3    B) 4    C) 6    D) 18    E) NOTA
- 14) Find the foci of the hyperbola with the equation of  $5(x + 4)^2 - 7y^2 = 35$ .
- A)  $(-4 \pm 2\sqrt{3}, 0)$     B)  $(-4, \pm 2\sqrt{3})$     C)  $(-4 \pm 8, 0)$     D)  $(-4, \pm 8)$     E) NOTA
- 15) Write the equation of an ellipse with the center  $(-3, 6)$ , major axis of 14, and minor axis of 10. (Major axis is parallel to the x axis).
- A)  $\frac{(x+3)^2}{25} + \frac{(y-6)^2}{49} = 1$     B)  $\frac{(x+3)^2}{49} + \frac{(y-6)^2}{25} = 1$
- C)  $\frac{(x+3)^2}{196} + \frac{(y-6)^2}{100} = 1$     D)  $\frac{(x+3)^2}{100} + \frac{(y-6)^2}{196} = 1$     E) NOTA

16) Which choice below is the best description for the type of conic section for the following equation;

$$5x^2 + 4y - 6x + 7y^2 - 13xy = 2004 ?$$

- A) Parabola                  B) Hyperbola                  C) Ellipse                  D) Circle                  E) NOTA

17) Find the length of the conjugate axis of a conic section with an eccentricity of  $5/4$  and focal points located at  $(0, 19)$  &  $(0, -1)$ .

- A) 6                          B) 8                          C) 10                          D) 12                          E) NOTA

18) Identify the equation of a parabola whose focus is at  $(5, -1)$  and whose directrix line is  $x = 3$ .

- A)  $x^2 + 2x - 4y + 17 = 0$                   B)  $x^2 - 2x - 4y + 5 = 0$                   C)  $y^2 + 2y - 4x + 17 = 0$   
D)  $y^2 - 2y - 4x + 5 = 0$                   E) NOTA

19) A committee of 5 is to be chosen at random from 4 juniors and 7 seniors. What is the probability that the committee will contain exactly 3 seniors and 2 juniors?

- A) 210                          B) 84                          C) 462                          D) 105                          E) NOTA

20) Solve for the value(s) of  $x$ :  $7^{x-2} = 37.23$ . ( After rounding your answer(s) to the nearest hundredths, find the sum of the digits in your rounded answer ).

- A) 17                          B) 18                          C) 19                          D) 20                          E) NOTA

21) Evaluate:  $\lim_{x \rightarrow 3} \left( \frac{x^3 - 27}{x - 3} \right)$

- A) 0                          B) 24                          C) -18                          D) 27                          E) NOTA

22) Find the coefficient for the fourth term of the binomial expansion of  $(2x - y)^8$ .

- A) -1792                          B) -56                          C) 56                          D) 1792                          E) NOTA

23) The graph of  $f(x) = (\cos x)^4 + x^{2004} + 2004$  is symmetric with respect to

- A) the  $x$ -axis                  B) the  $y$ -axis                  C) the origin                  D)  $y = x$                   E) NOTA

24) Which of the following is equivalent to  $\frac{5x+3}{x^2-3x}$ ,  $x \neq 0$  or  $3$  ?

- A)  $\frac{1}{x} + \frac{-6}{x-3}$                   B)  $\frac{1}{x-3} + \frac{-6}{x}$                   C)  $\frac{-1}{x-3} + \frac{6}{x}$                   D)  $\frac{-1}{x} + \frac{6}{x-3}$                   E) NOTA

25) For the following system of equations, find the value of 'y' for their point of intersection.

$$x + y + z = 2004$$

$$2x - y - z = 2004$$

$$x + 2y + 3z = 2004$$

- A) -2004                      B) -1966                      C) -668                      D) 2004                      E) NOTA

26) If  $23^{(2x+27)} = 2004$  and  $\log_5(2004y) = 2.004$ . Find  $(x + y)$  to the nearest ten thousandths place.

- A) -12.2751                      B) -10.3254                      C) 0.1732                      D) 39.6873                      E) NOTA

27) Which of the following is equivalent to  $\frac{(\log x + \log y)(\log x - \log y)}{(\log x)(\log y)}$ ,  $x > 0, y > 0$ ?

- A)  $\log_y x - \log_x y$                       B)  $\log_x y - \log_y x$   
C)  $\log x - \log y$                       D)  $\log y - \log x$                       E) NOTA

28) A FAMAT member wants to deposit some money into an account that earns interest that is compounded monthly at a rate of 20.04 percent (annual rate), they would like to have a balance of \$ 50,000 after four years using this interest model. How much money must they have as their Principal Amount ( After rounding your answer to the nearest hundredths, Find the sum of the digits )?

- A) 28                      B) 29                      C) 30                      D) 31                      E) NOTA

29) Find the domain of the function f and put your answer in interval notation.

$$f(x) = \frac{\sqrt{x^2 - 25}}{\log(x^2 - 4x - 12)}$$

- A)  $(-\infty, -2) \cup (6, \infty)$                       B)  $(-\infty, -5) \cup (5, \infty)$   
C)  $(-\infty, -5] \cup [5, \infty)$                       D)  $(-\infty, -5] \cup (6, \infty)$                       E) NOTA

30) For the given equation, find the real solution(s). ( When the solution(s) are rounded to the nearest ten thousandths place, find the sum of the digits ).  $e^{2004x} + 6e^{1002x} - 27 = 0$

- A) 1                      B) 2                      C) 8                      D) 10                      E) NOTA