

FAMAT State Convention 2003  
Logs and Exponents – Theta

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

1)  $23^{2x+27} = 1980$  and  $\log_3 20.03y = 0.725$ . Round  $x$  and  $y$  to the nearest hundredth, then find the sum of  $x$  and  $y$ .

- A) -2.18      B) -12.18      C) 0.17      D) 39.65      E) NOTA

2) Express  $(x^3 y^2)^{\frac{7}{n}}$  using radicals. All variables represent positive real numbers.

- A)  $\sqrt[n]{x^{21} y^{14}}$       B)  $\sqrt[n]{x^{10} y^9}$       C)  $\sqrt[7]{x^{3n} y^{2n}}$       D)  $\sqrt[7n]{x^3 y^2}$       E) NOTA

3) Solve  $\log_6 5(2y-3) = \log_6 25$

- A)  $\frac{7-3\sqrt{5}}{2}$       B) 2      C) 4      D)  $\frac{7+3\sqrt{5}}{2}$       E) NOTA

4) Solve  $\log_3 5 + \log_5 125 = \log_3 x$ .

- A) 8      B) 130      C) 135      D) 625      E) NOTA

5) Use a calculator to find the antilogarithm of .0036 to the nearest ten-thousandths place.

- A) -5.6268      B) -2.4437      C) 1.0036      D) 1.0083      E) NOTA

6) Simplify  $(\sqrt[3]{4^5})^{\sqrt{-8}}$ , round the answer to the nearest ten-thousandths place.

Find the sum of these digits in the rounded answer.

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

7) Which of the following is equivalent to  $\log\left(\frac{y^2}{x^3}\right)$ ?

- A)  $\frac{\log y^2}{\log x^3}$       B)  $\log x^3 + \log y^2$       C)  $2\log y - 3\log x$       D)  $\frac{2}{3}\log\frac{y}{x}$       E) NOTA

8) Simplify:  $x(\ln\sqrt{e^8})^x$ .

- A)  $5x$       B)  $4x^2$       C)  $4^{2x}$       D)  $x^2$       E) NOTA

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9) If  $\log 9 = r$  and  $\log 5 = s$ , what does  $\log 450$  equal ?

- A)  $r + s$       B)  $2r + s$       C)  $r + 2s$       D)  $r + s + 1$       E) NOTA

10) Find  $R^{-1}(36)$ :  $R(x) = \ln(x - 1)$

- A)  $e^{35} + 1$       B)  $e^{36} + 1$       C)  $e^{37} + 1$       D)  $\{ \}$       E) NOTA

11) Which of the following is equivalent to  $\frac{(\log x + \log y)(\log x - \log y)}{(\log x)(\log y)}$

- 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

12)  $\frac{1}{27} = 9^{(x+4)}$ ,  $x$  can be expressed in simplest form of an improper fraction as  $\frac{-A}{B}$ . Find  $A + B$ .

- A) 13      B) 14      C) 15      D) 16      E) NOTA

13) Find the sum of the  $x$  and  $y$  intercept(s) for this graph?  $y = \frac{1}{2}e^{(x+1)} - 8$   
Round final sum to the nearest hundredths place.

- A) -4.84      B) -4.85      C) -4.86      D) -4.87      E) NOTA

14) Rewrite as a single logarithm:  $2\log 5 - (-3\log x - 2\log y)$

- A)  $\log 10x^3y^2$       B)  $\log 25x^3y^2$       C)  $\log 5xy$       D)  $-3\log 5xy$       E) NOTA

15) Evaluate  $4^{\log_4 32}$

- A) 4      B) 8      C) 16      D) 32      E) NOTA

16) Solve:  $\log_x 25 > 2$ . The answer below is given in interval notation.

- A)  $(-5, 5)$       B)  $(-\infty, -5) \cup (5, \infty)$       C)  $(1, 5)$       D)      E) NOTA

17) If  $\log_3(x - 5) + \log_3(x + 2) = \log_3 18$ , then find the sum of the solutions for  $x$ .

- A) 3      B) 4      C) 5      D) 11      E) NOTA

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- 18) If  $(x^2y^4)^{ABC} = (x^3y^6)^{8AB^2C^2}$  and  $A > B > C > 0$ , then find BC.
- A)  $\frac{1}{24}$       B)  $\frac{1}{12}$       C) 1      D) 16      E) NOTA
- 19) Solve:  $\log_2(7x - 5) - \log_2(x + 1) = 2$  (NO Logs in answer)
- A) 0      B) 1      C) 2      D) 3      E) NOTA
- 20) A FAMAT member wants to deposit some money into an account that earns continuous interest at a rate of 2.003 percent. They would like to have a balance of \$ 2003.2004 after 12 years at this interest model. Round to the nearest penny then find the sum of the digits.
- A) 19      B) 20      C) 21      D) 22      E) NOTA
- 21) After a total of  $x$  years, a genius math student found out that they could quadruple their original investment of \$5. This genius was able to find a loaning institution that gave them an interest rate of 0.5 percent, compounding it monthly. Find the number of years rounded to the nearest year, then find the sum of the digits of the year.
- A) 13      B) 14      C) 15      D) 16      E) NOTA
- 22) Let  $R$  represent the interest rate which would be required for a person to triple their investment if they were to have the interest compounded quarterly for 36 years? Round  $R$  to the nearest thousandths place. Find the sum of the digits in the rounded value of  $R$ .
- A) 4      B) 5      C) 6      D) 7      E) NOTA
- 23) Solve for  $x$ :  $\log x > \log(x + 5)$ . Give your answer in interval notation.
- A)  $(1, \infty)$       B)  $(-5, \infty)$       C)  $(-5, 1)$       D)  $\{\}$       E) NOTA
- 24) If  $9^{x+1} = 8^{2x}$ , then let  $x$  be rounded to three decimal places, find the sum of the digits in the rounded answer of  $x$ .
- A) 2      B) 4      C) 6      D) 8      E) NOTA

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25) Simplify:  $(2x^{\sqrt{3}}y^7)^3$

- A)  $6x^{3\sqrt{3}}y^{21}$    B)  $8x^{3+\sqrt{3}}y^{21}$    C)  $8x^{3\sqrt{3}}y^{21}$    D)  $6x^{3\sqrt{3}}y^{10}$    E) NOTA

26) How many digits are in the expanded form of  $2003^{2004}$ .

- A) 6614   B) 6617   C) 15228   D) 15236   E) NOTA

27) Find the domain of  $f(x)$ :  $f(x) = \frac{\log(x^2 - 2x - 15)}{\sqrt{x^2 - 16}}$ , express answer in interval notation.

- A)  $(-\infty, -4] \cup [5, \infty)$    B)  $(-\infty, -5) \cup (5, \infty)$    C)  $(5, \infty)$    D)  $(4, \infty)$    E) NOTA

28) The graph of  $f(x) = b^x$  is decreasing forever. Which of the following must be true?

- A)  $b > 0, b \neq 1$    B)  $1 > b > 0$    C)  $b > 0$    D)  $b < 0$    E) NOTA

29)  $8 \log_R \left( \frac{BC^2}{(D)(\sqrt[4]{E})} \right)$  can be written in the form of  $M \log_R B + A \log_R C - T \log_R D - H \log_R E$ .

Find  $M + A + T + H$ .

- A) 1.75   B) 4   C) 8   D) 14   E) NOTA

30) Solve:  $e^{4x} + 4e^{2x} - 45 = 0$ . Round solution(s) to the nearest hundredth then add the digits of the solution(s)

- A) 6   B) 8   C) 10   D) 11   E) NOTA