THETA APPLICATIONS
FAMAT STATE CONVENTION 2004

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

1. The arithmetic mean of two numbers is 26. Find the product of the numbers if three times one of the numbers is one-fourth the other number.
   a. 12 b. 24 c. 96 d. 192 e. NOTA

2. The table shows the gross income for ACME Inc. in the millions of dollars. Predict the gross income, in millions of dollars for the year 2004, if the gross income follows the same pattern.

Year	2000	2001	2002	2003
Sales	269.4	297.8	326.2	354.6

   a. 373.4 b. 383.0 c. 401.6 d. 411.4 e. NOTA

3. Tickets for the school's dance cost $4 for students and $5 for their guests. To cover expenses, at least $2500 worth of tickets must be sold. If 320 guest tickets are sold, how many student tickets must be sold to cover expenses?
   a. 225 b. 278 c. 320 d. 712 e. NOTA

4. For the following system of equations, what value of H will make the system have infinitely many solutions? $2x + y - 3z = -3$
   $3x + 2y + 4z = 5$
   $-6x + Hy + 9z = 9$
   a. –4 b. –3 c. 3 d. 4 e. NOTA

5. Find the slope of the line through the points of the function $f(x) = 3x'' - 8x + 4$, where $x = 0$ and $x = 4$.
   a. 4 b. 5 c. 16 d. 20 e. NOTA

6. A petri dish has a culture containing 50 bacteria. The number of bacteria doubles every three-fourths of an hour. Find the number of bacteria after eight and a half hours. (nearest whole number)
   a. 4150 b. 129016 c. 5.62×10^{12} d. 4.64×10^{22} e. NOTA

7. The lateral surface area of a cone can be found by using $A = \pi rl$, where r is the radius and l is the slant height. Find the height of the cone, to the nearest whole inch, when the r = 5 in. and the surface area is 300 sq. in.
   a. 13 b. 14 c. 18 d. 19 e. NOTA

8. A particular amusement park, a single adult ticket cost $20, a combo ticket for an adult with one child cost $30, and a combo ticket for an adult with two children cost $35. The cashier collected $415 in sales for 28 people, 15 of whom were adults. How many $20 tickets were sold?
   a. 2 b. 3 c. 5 d. 7 e. NOTA

9. A brick path of uniform width is constructed around the outside of a 30 by 40 foot rectangular pool. Find the width of the path, in feet, if there is enough brick to cover 296 square feet. Ignore thickness.
   a. 2 b. 4 c. 5 d. 6 e. NOTA

10. The function $A(x) = 0.4x^2 - 36x + 1000$ describes the number of accidents per 50 million miles driven as a function of age (x, in years old) where 16 [x [80. State the age interval for when the number of accidents is increasing.
    a. [16,32) b. (64,80] c. [16,48) d. (45,80] e. NOTA

11. A company has a cost function of $C(x) = - 0.34x + 13.62$ and a sales function of $S(x)= 0.51x + 11.14$, where x represents the number of years after 1985, C(x) and S(x) represent millions of dollars. Find the slope of the combination function
    $(S - C)(x)$.
    a. – 0.34 b. 0.17 c. 0.51 d. 0.85 e. NOTA

12. A runner starts the marathon, 26.2 miles, from a standing start, completing the entire distance, and collapsing exactly on the finish line. The elapsed time is 3 hours 14 minutes. What is the average minutes per mile pace to the nearest second?
    a. 7:24 b. 7:48 c. 8:10 d. 8:34 e. NOTA

13. Three consecutive odd integers have a product of 315. Find the sum of the three integers.
    a. 15 b. 21 c. 27 d. 33 e. NOTA

14. The Alpha star is 3.34×10^{53} million miles away from Earth. The Theta star is that same distance squared from Earth. Which expression in scientific notation, is Theta's distance from Earth (in million of miles)?
    a. $6.68x10^{55}$ b. $11.16x10^{55}$ c. $3.34x10^{106}$ d. $1.12x10^{107}$ e. NOTA

15. The distance d in miles from an observer to the horizon over flat land can be estimated using $d = 1.23 \exists \sqrt{(h)}$, where h is the height in feet of the point of observation. How far is the horizon for an NBA player whose eyes are 7 feet above the ground? (nearest hundredth of a mile)
    a. 2.93 b. 3.01 c. 3.25 d. 60.27 e. NOTA

16. Which equation with $3x + 5y = -6$ will the determinant of the matrix composed of coefficients of the variables be equal to 0?
    a. $5x + 3y= -4$ b. $5x – 3y= 8$ c. $–1.2x – 2y= -5$ d. $6x – 10y= -12$ e. NOTA

17. How many real number solutions does $○'x – 5 ○'' - 4○'x – 5 ○' = -3$ have?
    a. 0 b. 1 c. 2 d. 3 e. NOTA

18. Lucy has a lemonade stand that has lemonade and cookies. On day 1, she sold 33 glasses of lemonade and 6 cookies. Each day afterward, she sold 3 fewer glasses and 4 more cookies. On which day did she sell twice as many cookies as lemonade?
    a. day 3 b. day 5 c. day 6 d. day 7 e. NOTA

19. A large rectangular sheet of cardboard 20 in. by 24 in. has congruent squares cut away at the corners. The four rectangular tabs are folded up to form a rectangular box, open at the top. What is the domain of the length of each side of the box?
    a. (0,10) b. (0,12) c. (0,24) d. (0,≡) e. NOTA

20. Steve earns a salary of $20800 per year plus 2% commission on his sales. If the mean price of the cars he sells is $30500, what is the minimum number of cars by the average price must he sell to make an annual income of at least $45000?
    a. 35 b. 40 c. 74 d. 108 e. NOTA

21. It takes 10 hours to fill a cylindrical water tank from pipe X. It takes 8 hours to fill the same tank from pipe Y. It takes 16 hours to drain that same tank. If the tank is currently 40% full, how many more hours will it take to completely fill the tank if both pipes and the drain is left open?
    a. 80/23 b. 80/13 c. 48/23 d. 48/13 e. NOTA

22. A baseball player hits a high pop-up with an initial velocity of 30 m/s, at a point 1 meter above the ground. The height of the ball in meters is modeled by the function $h(t)= -5t'' + 30t + 1$, where t is measured in seconds. How many seconds does a player on the opposing team have to catch the ball if it is caught at 1 meter above the ground?
    a. 1 b. 3 c. 6 d. 46 e. NOTA

23. A college instructor states that the midterm exam will count for 35% of each student's grade and the final exam will count for 65%. A grade of at least 90 is required for an A. If your midterm grade was 92, what is the minimum grade (integer, no rounding) on the final necessary for an A in the course?
    a. 87 b. 88 c. 89 d. 90 e. NOTA

24. A lawyer makes $275 per hour in court and $125 per hour in the office. The court is in session a maximum of 25 hours per week. The lawyer is required to work a minimum of 20 hours per week in the office. It takes at least 2 hours preparation in the office for every hour spent in court. The lawyer limits the work week to a maximum of 60 hours. Find the maximum amount of money to be earned within these constraints.
    a. $7500 b. $10500 c. $12000 d. $14375 e. NOTA

25. How many distinguishable letter patterns can be obtained by arranging the letters in RETROSPECTIVE?
    a. (13!)/(8!) b. ${}_{13}C_4$ c. ${}_{13}C_3$ d. ${}_{13}P_9$ e. NOTA

26. A job pays a salary of $24,000 the first year. Each year thereafter, the salary increases 5%. In which year, will the total lifetime salary equal $1,000,000?
a. 24th b. 41st c. 42nd d. 77th e. NOTA

27. A suspension bridge has 2 towers that rise 660 feet above the road and are 5280 feet apart. The cable between the towers has the shape of a parabola and just touches the road midway between the towers. What is the height, to the nearest foot, of the cable 300 feet from a tower?
a. 9 b. 130 c. 519 d. 585 e. NOTA

28. Sue spends $100 on the first day and spends of this the next day. She continues to spend of the previous day's amount each and every day thereafter. Find the sum of money Sue spends altogether.
a. $133 1/3 b. $233 1/3 c. $300 d. $400 e. NOTA

29. An elliptical playing field with the longest axis 1200 feet long, the goal posts are the foci and 120 feet from the boundary along the long axis. What is the maximum width of the playing field perpendicular to the long axis?
a. 360 b. 1176 c. 1124 d. 1537 e. NOTA

30. Two equations $2x - 2xy + y = 2$ and $3x + 2xy - y = 3$ intersect four times. What is the greatest distance between any two points of intersection?
a. 2 b. $2\sqrt{2}$ c. $2\sqrt{5}$ d. $4\sqrt{2}$ e. NOTA