

Theta Applications – FAMAT State 2003

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

1. One pipe fills a cylindrical container in 4 hours, a second pipe fills it in 7 hours, and a third pipe can drain it in 10 hours. If all three pipes are open, how long will it take to increase the volume from 25% to 80% full (nearest thousandth)?
 A. 1.116 hrs B. 1.878 hrs C. 2.220 hrs D. 3.415 hrs E. NOTA

2. A ball is dropped from a height of 10 feet. At each bounce, it rises to the height of $\frac{1}{2}$ the previous height. How far will it travel altogether by the time it comes to rest?
 A. 20 ft B. 30 ft C. 40 ft D. 500 ft E. NOTA

3. A boat travels 25 km upstream and then turns around and travels 25 downstream. The total time for the trips is 6 hours. If the stream flows at 4 km/hr, how fast does the boat travel in still water in km/hr?
 A. $6\frac{1}{6}$ B. $6\frac{1}{4}$ C. $\frac{25 - \sqrt{1201}}{6}$ D. $\frac{25 + \sqrt{1201}}{6}$ E. NOTA

4. Find the equilibrium quantity of P when demand D and supply S are given by $D=900-20P$ and $S=175+5P$ where P represents the amount of the product produced.
 A. 29 B. 175 C. 320 D. 900 E. NOTA

5. The length of an antenna wire for an international short wave band of 25 meters should be 40 feet, and a wave band of 31 meters should be 48 feet. Let M represent the wave band length in meters and F the length of the antenna wire in feet. Write a linear equation to the data points.
 A. $F=(\frac{4}{3})M+5$ B. $F=6M+40$ C. $F=(\frac{3}{4})M-5$ D. $F=8M+25$ E. NOTA

6. At Blue High, students who earn a “B” grade ($80 \leq \text{grade} < 90$), receive a dinner voucher for the Links Country Club for up to \$100. Tim’s test grades are 75, 80, 90, 100, and 92 account for 60% of his grade. His quiz grades are 80, 90, 100, 95, 78, 84, and 93 account for 20% of his grade. The final exam is the remaining 20% of the course grade. Between what integral values must his final exam be to win a dinner voucher. No voucher for an “A” and maximum grade on the exam is 100.
 A. [48,93] B. [49,94] C. [49,100] D. [50,99] E. NOTA

7. Jamika’s parents invested \$5000 at 12.5% annual interest compounded quarterly (4 times a year) for her 13 years schooling. How much money will have accumulated in the account at the end of this time period (nearest penny)?
 A. \$7459.36 B. \$13125 C. \$23118.14 D. \$24768.29 E. NOTA

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8. What are the interval of values which are possible number of ounces of pure copper to mix with 7 pounds of pure silver to produce an alloy that is between 75% and 90% silver, inclusively?
 A. $[\frac{7}{9}, 2\frac{1}{3}]$ B. $[5\frac{1}{4}, 6\frac{3}{10}]$ C. $[12\frac{4}{9}, 37\frac{1}{3}]$ D. $[42, 50\frac{2}{5}]$ E. NOTA
9. A shuttle service operating between an airport and the resort complex charges a fare of \$10 and carries 300 people per day. The accountant estimates that it will lose 15 passengers for each dollar the fare is increased. Find the fare for the shuttle service to charge for maximum income.
 A. \$10 B. \$15 C. \$20 D. \$30 E. NOTA
10. The linear term of a quadratic equation was incorrectly written by Abel who made no other mistake. He found the roots of his equation to be 6 and -3 . Cain made a similar mistake by incorrectly copying the constant term and found the roots -5 and -3 . What were the roots of the original equation, copied correctly?
 A. $\frac{3 \pm \sqrt{69}}{2}$ B. $-4 \pm \sqrt{31}$ C. $-4 \pm \sqrt{34}$ D. No roots E. NOTA
11. To lift a 300-pound boulder, a 12-foot steel bar was placed over a stone acting as a fulcrum. How far from the boulder must the stone be placed so that a 75-pound weight on the end of the steel bar will just raise the boulder (ignore the weight of the bar) so the bar is level on the fulcrum?
 A. 2.4 ft B. 3 ft C. 9 ft D. 9.6 ft E. NOTA
12. The rocket boys on their first rocket launch used the equation $h(t) = -5t^2 + 985t + 3000$ with $h(t)$ representing the altitude (feet) in flight at t seconds. Find the maximum altitude of the rocket with the given equation.
 A. 3000 ft B. 15000 ft C. 48511.25 ft D. 51511.25 ft E. NOTA
13. At 1:00 PM, Maverick headed true north at 75 mph. At 2:00 PM, Iceman headed true southeast at 100 mph. Find the distance between the two men at 4:00 PM (nearest mile).
 A. 301 B. 350 C. 366 D. 393 E. NOTA
14. A mysterious bacteria population grows continuously at a rate of 1.5% per hour. If the population was 500 initially, find the number of hours it takes for the population to increase 40% of the original 500 (nearest tenth).
 A. 2.2 B. 22.4 C. 56.8 D. 70.3 E. NOTA
15. A local manufacturer produces hiking boots and sandals. To stay in business it must produce at least 10 boots each day and is limited to 80 boots with the current facilities. It is limited to 150 sandals per day. The total production is limited to a 180 boots and sandals combined. The profit on hiking boots is \$115 and on sandals is \$16. Find the maximum profit.
 A. \$3550 B. \$5850 C. \$9200 D. \$12780 E. NOTA

16. When three water pumps, X, Y, and Z, are running together, they produce 3700 gallons per hour. When only pumps X and Y are operating, 2200 gallons per hour are produced. When only pumps X and Z are operating, 2400 gallons per hour are produced. What is the difference (gallons per hour) in the pumping capacity of pumps Z and Y?
 A. 200 B. 400 C. 600 D. 900 E. NOTA
17. Calculator City has 500 people employees. 223 people work in department A. 210 people work in department B. 207 people work in department C. 55 of the people in department A also work in C. 72 of the people in department B also work in C. 48 of the people in department A also work in B. 120 people work solely in department B. Find the total number of employees that work in either all three departments or none of the three departments.
 A. 23 B. 30 C. 35 D. 47 E. NOTA
18. The volume of a given mass of a gas varies directly as the temperature and inversely as the pressure. If the volume is 231 cubic centimeters when the temperature is 42 degrees and the pressure is 20 kilograms/square centimeter, what is the volume when the temperature is 30 degrees and the pressure is 15 kilograms/square centimeter?
 A. 110 B. 121.275 C. 123.75 D. 220 E. NOTA
19. A ladder 13 feet long leans against a wall. The bottom of the ladder is 5 feet from the wall. How much would the lower end of the ladder have to be pulled away so that the vertical and horizontal distance traveled is equal?
 A. 5 B. $\frac{-5 + \sqrt{313}}{2}$ C. 8 D. 12 E. NOTA
20. A group of students share equally in the \$140 cost of a limousine. At the last minute 3 students drop out and this raises the share of each remaining student \$15. How many were in the group at the onset?
 A. 4 B. 7 C. 10 D. 20 E. NOTA
21. The policeman uses the formula $r^2 = 20L$ to determine the speed of a skidding car, where r is speed in miles per hour and L is the length of the skid in feet. What was the speed of the car that produced a skid mark 275 feet long (nearest mph)?
 A. 21 B. 37 C. 58 D. 74 E. NOTA
22. Upon graduation from college, you wish to purchase an oceanfront condominium. The condo costs \$175000. You must put 5% down and get a 30-year mortgage at 7.125% annually, simple interest. You have both the homeowners insurance (required by the lender) of \$975 annually and property taxes of \$3300 annually averaged added to the monthly mortgage payment. What will be the combined monthly payment to the nearest penny?
 A. \$1343.36 B. \$1448.91 C. \$1805.16 D. \$1837.85 E. NOTA

23. The height of a street light is $X+16$ feet. The height of a small tree, $X+1$ feet, is planted $X-10$ feet from the street light and its shadow is $X-7$ feet. Find the ratio of the height of the street light to the height of the tree.
 A. $3/7$ B. $4/7$ C. $3/4$ D. $4/3$ E. NOTA
24. Dennis has 5 blue and 4 white marbles in his left pocket, 4 blue and 5 white marbles in his right pocket. If he transfers one marble at random from his left pocket to his right pocket, what is the probability of then drawing a blue marble from his right pocket?
 A. $2/25$ B. $2/9$ C. $5/18$ D. $41/90$ E. NOTA
25. The Navy JROTC has 3 red flags, 4 yellow flags, and 2 blue flags to arrange on a vertical pole. Find the number of possible distinguishable signals.
 A. 288 B. 1260 C. 15120 D. 362880 E. NOTA
26. The equations $2x^2 + 5y^2 = 9$ and $4x^2 - y^2 = 7$ have several points of intersection. Find the area of the convex polygon whose vertices are those points of intersection.
 A. $2\sqrt{2}$ B. 5 C. $4\sqrt{2}$ D. 8 E. NOTA
27. A rectangular plot is to be fenced and then divided into four rectangular lots by running fences across the middle both ways. If 600 meters of fencing are available, what must the dimensions of the plot to give maximum total area?
 A. 50m x 50m B. 100m x 100m C. 200m x 200m D. 300m x 300m E. NOTA
28. A cashier has 49 coins in the cash drawer consisting only of nickels, dimes, and quarters totaling \$6.45. If the number of nickels is doubled, the number of dimes is tripled, and the number of quarters remains the same, there would be 103 coins. Find the difference in the number of quarters and the number of nickels in the cash drawer.
 A. 1 B. 5 C. 6 D. 10 E. NOTA
29. A motor boat travels 33 miles at full throttle with the wind in $1\frac{1}{2}$ hours. On the return trip at full throttle, it takes $4\frac{1}{8}$ hours travelling into the wind. Discount any water currents. What is the speed of the wind?
 A. 7 mph B. 8 mph C. 14 mph D. 15 mph E. NOTA
30. One leg of an isosceles triangle is lengthened by 8 inches and the other leg is shortened by 8 inches to make a new right triangle. If the hypotenuse of the new triangle is $2\sqrt{2}$ inches longer than the hypotenuse of the original triangle, how long was the leg of the original triangle?
 A. 7 in B. 15 in C. 23 in D. 30 E. NOTA