1. Movies tickets at a local movie theater cost $4 for children and $7 for adults. If 27 tickets were sold and $165 was collected, how many children's tickets were sold?

    A) 7   B) 8   C) 11   D) 10   E) NOTA

2. If two sides of a triangle are defined by the vectors i + 5j and 3i - 4j, what is the area of the triangle?

    A) $\dfrac{19}{2}$ B) 7   C) 17   D) $3\sqrt{5}$ E) NOTA

3. A dinner party is being planned for eight people; among the eight attendees Eric is dating Stephanie and Russell is dating Heather. If all eight people are assigned random seats around a circular table, what is the probability that both Eric and Russell get to sit next to their dates?

    A) $\dfrac{1}{24}$ B) $\dfrac{2}{15}$ C) $\dfrac{2}{21}$ D) $\dfrac{1}{8}$ E) NOTA

4. Jack and Josh are writing a test together for Mu Alpha Theta Nationals 2010. If Jack could write the test by himself in two weeks, and together they can write the test in eight days, how many days would it take Josh to write the test by himself?

    A) $\dfrac{64}{3}$ B) 8   C) 6   D) $\dfrac{56}{3}$ E) NOTA

5. The ratio of the volumes of two cones with equal heights is 1:3. The radius of the larger cone is 2cm longer than the radius of the smaller. What is the area base of the larger cone in square centimeters?
    A) $(10+4\sqrt{2})\pi$ B) $(12+6\sqrt{2})\pi$ C) $(12+6\sqrt{3})\pi$ D) $(8+6\sqrt{3})\pi$ E) NOTA

6. Determine the value of $(1+i)^{2005} + (1-i)^{2005}$.

    A) $2^{2006} + i \cdot 2^{2005}$ B) 2^{2006} C) -2^{1003} D) $(1+i)(-2)^{1003}$ E) NOTA

7. A ship leaves port and sails 200 km with a bearing of $45°$, it then changes its bearing to $165°$ and sails 200 km. What is its bearing from its original starting point?

    A) $105°$ B) $115°$ C) $100°$ D) $135°$ E) NOTA

8. Find the smallest positive integers m and n which satisfy the following equation: $\left(\sqrt{3}+i\right)^{m} = \left(1-i\right)^{n}$.

    A) $m=6, n=8$ B) $m=3, n=6$ C) $m=4, n=8$ D) $m=12, n=48$ E) NOTA

9. How many distinct four-letter sequences containing exactly 2 vowels and 2 consonants can be made from the letters in the word COLORADO?

    A) 216   B) 180   C) 210   D) 240   E) NOTA

10. A ladder with one end on the ground is to reach over a fence six feet high to a wall that is two feet behind the fence. To the nearest foot, what is the length of the shortest ladder than can be used?

    A) 4   B) 12   C) 10   D) 11   E) NOTA

11. A person invests $25,000 in three accounts, paying 6%, 8%, and 9% simple interest. Because of the risk factor, she wants to invest twice as much in the 6% account as in the 9% account. If she wants to earn $1850 in interest after one year, how much should she invest at 9%?

    A. $3000   B. $5000   C. $6000   D. $10000   E. NOTA

12. Jack, Kjell, Daniel, Sol and Sierra are working on an Interschool test and have 20 seemingly identical questions remaining. In how many ways can the questions be divided such that each problem is being worked on by only one person?

    A) 3876   B) 7225   C) 9125   D) 1024   E) NOTA

13. Let $f(x) = 3\sin(2x-1)+2$. Define A=amplitude, B=period, C=phase shift, and D=the number of zeros of $f(x)$ on the interval $0 < x \le 2\pi$. Compute: $\dfrac{A+B+C}{D+1}$.

    A) $\dfrac{4+\pi}{5}$ B) $\dfrac{2\pi+7}{10}$ C) $\dfrac{3-\pi}{4}$ D) $\dfrac{2+\pi}{4}$ E) NOTA

14. What is the sum of the complex cube roots of 27 that can be expressed in the form $a+bi$ with b non-zero?

    A) 27   B) -3   C) 4   D) $2-6i$ E) NOTA

15. Aria, James, and Jones are playing darts. Each of them has a $33.\overline{3}\%$ change of hitting the bull's eye each time they throw a dart at the dart-board. If they each take turns throwing a dart at the dart-board with Aria going first, James second, and Jones third, repeating until someone hits the bull's eye, what is the probability of James being the first to hit the bull's eye?

    A) $\dfrac{4}{9}$ B) $\dfrac{2}{9}$ C) $\dfrac{14}{27}$ D) $\dfrac{6}{19}$ E) NOTA

16. Consider the following matrix $A = \begin{bmatrix} 1 & 4 & 7 \\ 0 & -3 & 6 \\ 0 & 0 & 7 \end{bmatrix}$. An *eigenvalue* is a value λ such that $\det|\lambda I - A| = 0$.

    What is the largest *eigenvalue* of A?

    A) 5   B) 3   C) 7   D) 12   E) NOTA

17. A sphere of ice cream with a volume of 288pi cubic inches is to be coated uniformly with chocolate. What will the surface area of the chocolate covered ice-cream be when the chocolate coating has a volume triple that of the original ice cream?

   A) $288\pi 2^{\frac{1}{3}}$ B) $169\pi 2^{\frac{1}{2}}$ C) $288\pi\sqrt{3}$ D) $244\pi 2^{\frac{1}{3}}$ E) NOTA

18. A rectangle has sides of length $\sin x$ and $\cos x$ for some x. What is the ratio of the perimeter to the area of the rectangle when its perimeter is at a maximum given that $2\sin x\cos x = \sin(2x)$?

   A) $4\sqrt{2}$ B) $2\sqrt{3}$ C) $\sqrt{2}$ D) $\dfrac{3\sqrt{3}}{2}$ E) NOTA

19. If Ubuntu pulls a lever with a force of 4 Newtons at an angle of $30°$ with the horizontal and Debian pulls the same lever with a force of 6 Newtons at an angle of $135°$ with the horizontal, what is the square of the magnitude of the net force from Ubuntu and Debian on the lever?

   A) $50 + 10\sqrt{6}$ B) $42 - 8\sqrt{2} + 14\sqrt{6}$ C) $52 + 12\sqrt{2} - 12\sqrt{6}$
   D) $42 - 12\sqrt{2}$ E) NOTA

20. A robotic blimp is flying such that its vertical speed, $h(t)$, is described by the function $h(t) = t^3 + t^2 - 64t - 64$. For what value of positive t will the blimp's vertical speed be equal to 0?

   A) $2 + \sqrt{3}$ B) $2\sqrt{6}$ C) 4   D) 8   E) NOTA

21. Evan is running laps around the track at a local park. Evan doesn't know how long the loop that he is running is, but he does know how fast he is running. Evan's workout consists of four intervals: he runs that first at a 5 minute per mile pace, the second at 6 minutes per mile, the third at 10 minutes per mile and the fourth at 8 minutes per mile. What was Evan's average speed over the workout in miles per hour?

   A) $\dfrac{29}{4}$ B) $\dfrac{480}{71}$ C) $\dfrac{38}{5}$ D) $\dfrac{118}{15}$ E) NOTA

22. Using Descartes' Rule of Signs, what is the maximum number of possible negative roots of the polynomial: $P(x) = x^6 - 5x^5 + 3x^4 + 6x^3 - 8x^2 - 20x + 24$?

   A) 2   B) 6   C) 3   D) 4   E) NOTA

23. When three positive numbers are multiplied two at a time, three distinct products are formed: 27, 32 and 24. What is the product of all three of the original numbers?

   A) 24   B) 68   C) 144   D) 124   E) NOTA

24. Sierra's Pizza Company only sells pizzas in the shape of an annulus. So a d-inch diameter pizza sold by Sierra's Pizza Company is like a normal circular pizza, except it always has a circle with a diameter of $\dfrac{d}{2}$ inches removed from the center. If an 8-inch diameter pizza from Sierra's Pizza Company serves two students, how many students should two 12-inch diameter pizzas serve?

    A)9   B) 8   C) 18   D) 6   E) NOTA

25. Suppose that this test is scored in the following manner: 4 points for a correct answer, -1 points for an incorrect answer, and 0 points for an unanswered question. How many different combinations of correct, incorrect, and unanswered questions are there in order to score a total of 26 points given that this question is answered correctly?

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

26. What is the remainder when $x^{2005} - 3x^{1002} + 4x^{1000} + x^2 + x - 1$ is divided by $x + 2$?

    A) $2^{2006} - 1$ B) $2^{2005} - 2^{1002} + 1$ C) $2^{2005} + 2^{1003} + 5$ D) $-2^{2005} - 2^{1003} + 1$ E) NOTA

27. Let $A = \sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots}}}$ and $B = \sqrt{9 - \sqrt{9 - \sqrt{9 - \cdots}}}$. Find AB.

    A) $3\sqrt{6}$ B) $\dfrac{3\left(\sqrt{26} - 2\right)}{2}$ C) $\dfrac{3\left(\sqrt{37} - 1\right)}{2}$ D) $4\sqrt{5} - 2\sqrt{2}$ E) NOTA

28. A parabolic arch has a base 60 feet wide and a maximum height of 40 feet. A dump truck that is 30 feet wide is to be filled evenly with dirt and driven underneath the arch. Given that the dirt is to be packed in the shape of a rectangular prism with width equal to that of the truck, how high can the dirt be piled so that the truck still fits underneath the arch?

    A) 30   B) 32.5   C) 25   D) $\dfrac{100}{3}$ E) NOTA

29. A bouncy ball is dropped out of a window and falls 48 feet before hitting the ground. If after each bounce the ball regains 75% of its previous height, how far has the ball traveled in feet when it finally stops moving?

    A) 288   B) 192   C) 172   D) 336   E) NOTA

30. How many of the fifteenth roots of two can be expressed in the form $a+bi$ with $a>b$?
    A) 8   B) 7   C) 4   D) 3   E) NOTA

1. B
2. A
3. B
4. D
5. C
6. C
7. A
8. B
9. A
10. D
11. B
12. A
13. B
14. B
15. D
16. C
17. A
18. A
19. C
20. D
21. B
22. A
23. C
24. A
25. B
26. D
27. C
28. A
29. D
30. B