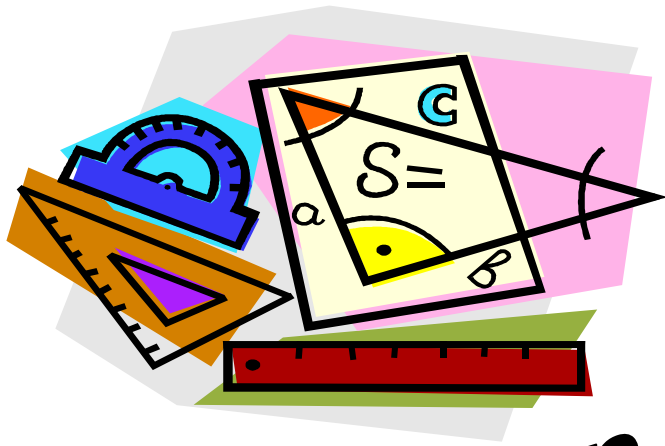


Level III



**Do NOT open until
you are told to do so.**

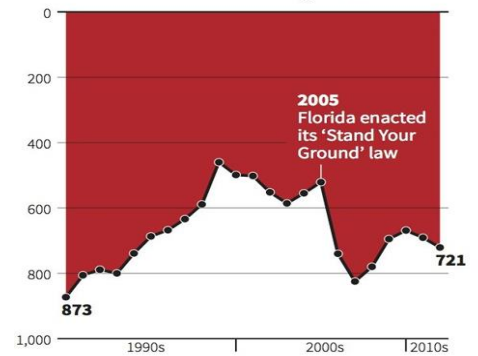
March 23, 2017

1. In 2005 the state of Florida enacted the “Stand Your Ground Law”. Which of the following statements are true based on the graph from the Florida Department of Law Enforcement?

- i. There were fewer murders committed using firearms in 2006 than in the previous year.
- ii. The lowest number of murders committed using firearms occurred in the late 1990s.
- iii. There were 873 murders committed using firearms in 1990.

Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

REUTERS

- a. i and iii b. i c. ii and iii d. iii e. i, ii, and iii

2. A fish has a tail that is as long as its head plus a quarter of the length of its body. Its body is three-fourths of its total length. If its head is 4 cm long, what is the total length of the fish?

- a. 64 cm b. 96 cm c. 108 cm d. 124 cm e. 128 cm

3. What is the x -coordinate of the point on the line $4x + 2y = 8$ that is closest to the origin?

- a. 2 b. 1 c. 1.6 d. 1.4 e. 1.8

4. Copiers A, B, and C are used to produce $3n$ copies, n on each copier. Copier A makes 18 copies per minute and copier B makes 9 copies per minute. If the average copy speed is 15 copies per minute, what is the rate in copies per minute at which copier C makes copies?

- a. 21 b. 24 c. 25 d. 30 e. 36

5. What is the graph of $x^2 + xy + x + 3y = 6$?
- a. an ellipse b. a parabola c. a hyperbola d. 2 parallel lines e. 2 intersecting lines
6. What is the minimum value of $f(x) = |x - 2| + |x + 2|$?
- a. 4 b. 3 c. 2 d. 1 e. 0
7. For real numbers m and n , compute mn , given that the graphs of $mx + 2y = 7$ and $8x + my = n$ intersect in more than one place.
- a. 56 b. -28 c. 28 d. 14 e. -56
8. The graph of the rational function $f(x) = \frac{-2x - 9}{x + 5}$ is a hyperbola. What is the equation of the line that passes through the vertices of the hyperbola?
- a. $y = 2x + 3$ b. $y = -x + 3$ c. $y = 2x - 1$ d. $y = x + 3$ e. $y = -2x - 9$
9. The speed of light is approximately 186,000 miles per second. A nanosecond is one billionth of a second. Which of the following most closely approximates the distance traveled by light in a nanosecond?
- a. 6 in b. 1 ft c. 2 ft d. 1.5 ft e. 8 in
10. Given $f(x) + f(x + 7) = 6x - 5$ and $f(5) + f(19) = 34$, what is $f(12)$?
- a. 29 b. 31 c. 23 d. 27 e. 28

11. What is the sum of the squares of the sines of the three angles of right triangle $\triangle ABC$?
- a. 2 b. $\sqrt{2}$ c. 1 d. $1+\sqrt{2}$ e. not determinable
12. The equation $x^2 - 2x + c = 0$ has solutions r and s . If $\frac{r}{s} = -2$, what is the value of c ?
- a. 2 b. 4 c. -4 d. -8 e. 6
13. If a and b are integers such that $a^2 + b^2 = 29$, what is the maximum value of $|a - b|$?
- a. 7 b. 5 c. 13 d. 11 e. 9
14. If $\log(st) = 5$ and $\log\left(\frac{s}{t}\right) = \frac{1}{2}$, what is the value of $\log(s)$?
- a. 2.25 b. -2 c. 2 d. -2.25 e. 2.75
15. If $6x + 5y = 28$, $x - 2z = 19$, and $2y + 9z = 37$, what is the value of $x + y + z$?
- a. 14 b. 10 c. 12 d. 15 e. 9
16. A square is inscribed in a circle which is inscribed in a square which is inscribed in a circle which is inscribed in a square! What is the ratio of the area of smallest square to the area of the largest square?
- a. $\frac{\pi}{9}$ b. $\frac{\pi}{6}$ c. $\frac{1}{8}$ d. $\frac{1}{4}$ e. $\frac{1}{2\sqrt{2}}$

17. Ali and Brianna live 5 miles from one another and want to meet at 1:00 pm. They decide to leave the same time and run until they meet each other. Ali's pace is 8 mph and Brianna's pace is 7 mph. At what time should they leave their homes?
- a. 12:25 pm b. 12:40 pm c. 12:30 pm d. 12:45 pm e. 12:50 pm
18. A toddler has 2 blue blocks, 2 red blocks, 1 purple block, and 1 yellow block. If the blocks are stacked vertically, how many different stacks of 3 blocks can the toddler make?
- a. 40 b. 50 c. 56 d. 48 e. 42
19. Alice can complete a certain job in 5 hours. She had been working for 2 hours when a friend came along and helped her finish. Together they completed the job in an hour. How long would the job have taken Alice's friend, working alone, to complete the job?
- a. 2.75 hr b. 2.5 hr c. 2.6 hr d. 2.4 hr e. 3 hr
20. Let $f(x) = \ln(6-x)$ and $g(x) = |x^2 - 10x + 15|$. The domain of $f(g(x))$ can be written in interval notation as $(a,b) \cup (c,d)$. What is $b+d$?
- a. 6 b. 11 c. 8 d. 12 e. 10
21. What is the area of the triangle whose side lengths are the solutions of $x^3 - 18x^2 + 105x - 200 = 0$?
- a. 18 b. 12 c. 16 d. 20 e. 10

22. The first term in a geometric sequence is 14 and the fifth term is 2016, what is the third term?
- a. 672 b. 336 c. 168 d. 504 e. 252
23. Ed needs to transport 49 guests to a wedding. Cars hold 5 guests and rent for \$29 each, while vans hold 7 guests and rent for \$41 each. What is the minimum cost to transport the 49 guests?
- a. \$280 b. \$285 c. \$282 d. \$287 e. \$290
24. Recall the following Roman Numeral values: VII = 7; IX = 9; XXV = 25; XLVI = 46; XCII = 92; and MDCLXI = 1661. Compute $\text{MMXLVII} \div \text{LXXXIX}$.
- a. XXXIV b. XLIII c. XXVI d. XXIV e. XXIII
25. Five sentences were written on the board in a logic class as a quiz, but someone erased the last two statements to keep the instructor from giving the quiz. Instead the instructor said you still have to take the quiz. It consists of one question – “How many of the original five statements were true?”
- Statement 1: Statement 2 is true.
- Statement 2: At most, one of these five statements is true.
- Statement 3: All five statements are true.
- Statement 4:
- Statement 5:
- a. 4 b. 3 c. 2 d. 1 e. 0

SHORT ANSWER

Place the answer in the appropriate space.

66. If (a, b, c) is a solution to the system of equations $\begin{cases} 5x + 3y + z = 2 \\ 6x + 5y + 4z = 8 \end{cases}$, then what is $a + b + c$?

67. Four sets each have k elements. Every intersection of two sets has $\frac{k}{2}$ elements, every intersection of three sets has $\frac{k}{3}$ elements, and the intersection of all four sets has $\frac{k}{4}$ elements. If the union has 75 elements, what is the value of k ?

68. Solve for x : $(3x)^{\log(3)} = (5x)^{\log(5)}$.

69. Given $f(x) = \frac{2^x - 1}{2^x + 1}$. What is the range of $f(f(x))$?

70. A club has N members. The club finds that the number of ways to staff the eight member executive committee is 42 times the number of ways to staff the six member nominating committee. How many members are in the club?

Answer Key

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

66. 2

67. 36

68. $\frac{1}{15}$

69. $\left(-\frac{1}{3}, \frac{1}{3}\right)$

70. 55