NOTA means "none of the above answers is correct"

1. Which set of quadrants contains the graph of the equation $y = \dfrac{-2}{3}x + 4$?

   A) I, II, III   B) II, III, IV   C) I, III, IV   D) I, II, IV   E) NOTA

2. What is the lowest common multiple of 24, 36, and 16?

   A) 4   B) 72   C) 144   D) 192   E) NOTA

3. Three consecutive odd integers have a sum of 81. Find the sum of the second and third integers.

   A) 54   B) 56   C) 57   D) 58   E) NOTA

4. Find the equation of the line with x-intercept of 3 and y-intercept of -2.

   A) $y = \dfrac{-2}{3}x - 2$ B) $y = \dfrac{2}{3}x - 2$ C) $y = \dfrac{3}{2}x - 2$ D) $y = \dfrac{-3}{2}x - 2$ E) NOTA

5. In a book collection containing 336 books, there are 24 more nonfiction books than fiction books. What part of the collection is fiction? (A book is either nonfiction or fiction.)

   A) $\frac{3}{7}$ B) $\frac{13}{28}$ C) $\frac{15}{28}$ D) $\frac{4}{7}$ E) NOTA

6) What is the sum of the solutions of the equation $15 - |2x - 3| = 8$?

   A) 0   B) 3   C) 5   D) 7   E) NOTA

7) If $x^2 = 25$ and $y^2 = 9$, what is the least possible value of $y - x$?

   A) -3   B) -2   C) 2   D) 3   E) NOTA

8) Given the equation $\dfrac{2}{3}(3x - 6) - \dfrac{3}{5}(5x - 15) = \dfrac{1}{4}(2x - 3) - \dfrac{1}{2}\left(x + \dfrac{3}{2}\right)$, what is the value of $4x - 17$?

   A) 3   B) 9   C) 15   D) 25   E) NOTA

9) The ratio of green, blue, and orange m&m's is 5 to 3 to 4, respectively. If there are 156 m&m's altogether, how many are orange?

   A) 13   B) 39   C) 52   D) 65   E) NOTA

10) Which of the following is the quadratic formula?

A) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{a}$

B) $x = -b \pm \dfrac{\sqrt{b^2 - 4ac}}{2a}$

C) $x = \dfrac{-b \pm \sqrt{b^2 - 2ac}}{2a}$

D) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

E) NOTA

11) Find the greatest common factor of $192x^5 y^3 z^7$ and $160x^3 y^2 z^8$.

A) $16x^3 y^3 z^7$
B) $16x^5 y^3 z^8$
C) $32x^3 y^2 z^7$
D) $64x^3 y^2 z^7$
E) NOTA

12) The sum of two numbers is 31. Their difference is 19. Find their product.

A) 150
B) 330
C) 400
D) 1,550
E) NOTA

13) Solve for x: $y = \dfrac{mx}{p - x}$

A) $x = \dfrac{yp}{m + y}$
B) $x = \dfrac{p}{y}$
C) $x = \dfrac{m - y}{yp}$
D) no solution
E) NOTA

14) The following points lie on the same line: $(1, 4)$, $(x, 6)$, and $(3, 5)$. What must be the value of x?

A) 2
B) 3
C) 4
D) 5
E) NOTA

15) Simplify: $(2x + 5)(2x - 5) - (x + 2)(x - 2) - (3x + 4)(3x - 4) + (5x + 7)(5x - 7)$

A) $-31x^2 + 44$
B) $19x^2 - 54$
C) $19x^2 - 46$
D) $37x^2 - 54$
E) NOTA

16) The domain of $f(x) = -2x + 6$ is $\{0, -1, 2, 3\}$. What is the range of $f(x)$?

A) $\{0, 2, 4, 6\}$
B) $\{0, 2, 6, 8\}$
C) $\{0, 2, 4, 8\}$
D) {Reals}
E) NOTA

17) Simplify the following expression: $5 + 13 \div 3 - 4 + 6 \div \frac{1}{2}$

A) 2
B) $\dfrac{5}{2}$
C) 11
D) $\dfrac{52}{3}$
E) NOTA

18) Solve for x: $\dfrac{x+5}{x-3} = \dfrac{-5}{4}$

A) $\dfrac{-35}{4}$ B) $\dfrac{-9}{5}$ C) 5 D) $\dfrac{5}{9}$ E) NOTA

19) Find the power of x if the expression $\dfrac{(2x^5y^5)^2}{(4x^4y)^3} \div \dfrac{(8x^5y^2)^{-2}}{(32x^{-3}y^2)^{-4}}$ is simplified and written with only positive exponents.

A) 0 B) 4 C) 20 D) 24 E) NOTA

20) Simplify: $(x^2 - 3x + 2)(x^2 + 2x - 3)$

A) $x^4 - x^3 - 7x^2 + 13x - 6$ B) $x^4 - x^3 - 6x^2 - 6$ C) $x^4 - x^3 - 5x^2 - 5x - 6$

D) $x^4 - 6x^2 - 6$ E) NOTA

21) Which of the following is a solution of the disjunction $5 - 2x < -5$ or $-2 \le -8 - 3x$?

A) -2 B) 0 C) 2 D) 5 E) NOTA

22) What best describes the solution to the linear system: $\begin{aligned} y &= \dfrac{1}{2}x - 5 \\ -2x + 4y &= -20 \end{aligned}$

A) no solution B) one solution C) 2 solutions D) infinitely many solutions E) NOTA

23) Express as a single fraction in lowest terms: $\dfrac{10(x+1)}{(2x-1)(x-3)} - \dfrac{8}{x-3}$

A) $\dfrac{-6x+18}{(2x-1)(x-3)}$ B) $\dfrac{6}{2x-1}$ C) $\dfrac{-6}{2x-1}$ D) $\dfrac{-6x+2}{(2x-1)(x-3)}$ E) NOTA

24) Factor $72x^2 + 5x - 12$ into the form $(Ax + B)(Cx + D)$ with A, B >0. What is the sum $A + B + C + D$?

A) 12 B) 16 C) 18 D) 20 E) NOTA

25) A stick 27 inches long is cut into 2 pieces so that the length of one piece is ⅔ the length of the other. How long is the shorter piece?

A) 9"   B) 10⁴/₅"   C) 16¹/₅"   D) 18"   E) NOTA

26) Find the value of k such that the line containing the points $(5, k)$ and $(k + 2, -3)$ has a slope of -⅔.

A) -15   B) -3   C) 3   D) 15   E) NOTA

27) Solve for x: $9^{3x-2} = 81^{x+1}$

A) 0   B) 4   C) 9   D) no solution   E) NOTA

28) Line L has equation $2x - 3y = -3$. Line M has the same y-intercept as line L and is perpendicular to L. Find the equation of line M in standard form.

A) $3x - 2y = 1$ B) $3x - 2y = 2$ C) $2x - 3y = -3$ D) $3x + 2y = 2$ E) NOTA

29) To prepare for this competition, Jim bought 5 lucky pencils and 3 erasers for $7.05. Also wanting to be well prepared, Jeff bought 3 lucky pencils and 2 erasers for $4.30. Not to be outdone, Marshall plans to buy 4 lucky pencils and 4 erasers. How much will Marshall's supplies cost altogether?

A) $5.20   B) $6.20   C) $7.20   D) $8.40   E) NOTA

30) Simplify $(3x^2 + 4x - 17) - (2x^2 - 5x - 7)$

A) $x^2 - x - 24$ B) $x^2 + 9x - 10$ C) $5x^2 - x - 24$ D) $x^2 - x - 10$ E) NOTA

Question # 1 $f(x) = 2x^2 - 5x + 3$; $g(x) = 7 - 3x$; $h(x) = \dfrac{x-5}{2}$

Find the value of $f(-1) + g(7) - h(g(2)) + g(f(3))$

Question # 2 Let $a \odot b = 3a + 10b$ and let $c \, ✩ \, d = c^2 - d^2$.

Find the value of $[5 \odot (-12 \odot 3)] \odot [8 \, ✩ \, (4 ✩ 3)]$

Question # 3 Find the product of the slopes of the following four lines:

$y = \dfrac{2}{3}x - 5$ $5x + 4y = 7$ $y - 3 = \dfrac{5}{6}(x + 5)$ $x = \dfrac{-5}{9}y - 2$

Question # 4 Solve each equation below.

$$6(a + 3) - (2a - 5) = 5 \qquad 4(3b - 1) = -2(5b + 2) \qquad \dfrac{c}{c+2} = \dfrac{1}{5} \qquad \dfrac{d}{3} + \dfrac{1}{2} = \dfrac{5}{2}$$

Use your solutions to find the value of the expression $\quad 2a + \dfrac{b}{d} - \dfrac{1}{c}$

Question # 5

Let A = the original number described as follows:
The sum of the digits of a 2-digit number is 6.
If the digits are reversed, the new number is 9 less than 4 times the original number.

Let B = the number of nickels as described by the following:
Pedro has 30 coins in nickels and quarters. They are worth $5.10 altogether.

Let C = the age of Napoleon NEXT year as described below:
This year Napoleon Dynamite is 12 years younger than his Uncle Rico. In 7 years, the sum of their ages will be 60.

Find the value of $B + C - A$

Question # 6 What is the area (in square units) of the region defined by this system of inequalities:

$y \le 2x + 6$ $3x + 2y \le 12$ $y \ge -6$

Question # 7 Find the sum of the integers in the solutions of inequalities A and B:

A: $|3x + 4| \le 5$ B: $2x - 3 < x < 4x + 5$

Question # 8

There are 97 students in Lincoln MAΘ. There are 28 students in Spanish club, and 42 students in the Scrabble Club. Twenty-five are in both MAΘ and the Scrabble Club. Seventeen students are in both Spanish club and MAΘ. Eleven are in both Spanish Club and Scrabble Club. Five students are in all three clubs. How many students are there altogether?

Question #9

What is the positive exponent of a in the simplified form of $\dfrac{(8a^7 b^6 c^7)^8}{(6a^5 b^2 c^{10})^6}$

Question # 10

Two mystery numbers are described below.   What is the sum of these 2 numbers?

1st number: I am a 3 digit number; I am divisible by 5. I am a perfect square and the sum of my digits is 9.

Second number: I am a 4 digit number. I am a palindrome.   I am divisible by both 4 and 9; none of my digits is divisible by 3.

Question # 11

Find the sum of the x- and y- intercepts of the following lines:

$$y = \frac{3}{4}x - 3 \qquad\qquad 5x + 2y = -10 \qquad\qquad y - 5 = \frac{-1}{3}(x + 2)$$

Question # 12

What is the sum of the first 10 prime numbers?

Question # 13

Solve for a in terms of b: $3ab - 5a = 7b - 1$

Question # 14

What is the equation of the line that has no slope and contains the point (4, -2)?

Question # 15

Find the sum of the digits of the least common multiple of 180 and 144.

Test Answers:

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

Team Answers

1. -13
2. 15
3. $^5/_4$
4. -11
5. 15
6. 84
7. -4
8. 119
9. 26
10. 2997
11. 11 ⅓
12. 129
13. $a = \dfrac{7b-1}{3b-5}$
14. 4
15. 9

1) I, II, IV **D**

2) $24 = 2^3 \cdot 3$,

   $LCM = 2^4 \cdot 3^2 = 16 \cdot 9 = 144$ **C**

3) $x + x + 2 + x + 4 = 81; 3x = 75 \Rightarrow x = 25$ The integers are 25, 27, and 29, so the sum of the 2nd and 3rd is 56 **B**

4) Points are (3, 0) and (0, -2), so slope = $\frac{2}{3}$. Equation is $y = \frac{2}{3}x - 2$: **B**

5) let $f = $ # fiction ,and let $f + 24 = $ # nonfiction

   $f + 24 + f = 336 \Rightarrow f = 156$ Fiction is $^{156}/_{336}$ of collection, or $^{13}/_{28}$: **B**

6) $2x - 3 = 7$ *or* $2x - 3 = -7 \Rightarrow x = 5$ *or* -2 The sum is 3: **B**

7) $x = \pm 5; y = \pm 3$ Least value of $y - x = -3-5 = -8$ **E**

8) $2x - 4 - 3x + 9 = \frac{1}{2}x - \frac{3}{4} - \frac{1}{2}x - \frac{3}{4}$; So $x = ^{13}/_2$; and $4x - 17 = 9$ **B**

9) $5x + 3x + 4x = 156; x = 13$, orange $= 4x = 52$ **C**

10) **D**

11) The GCF of 192 and 160 is 32, so $32x^3y^2z^7$ **C**

12) $x + y = 31$ *and* $x - y = 19$. Adding gives us $2x = 50$, so $x = 25, y = 6$. The product is 150 **A**

13) $py - xy = mx; \Rightarrow py = mx + xy \Rightarrow py = x(m + y)$, so $x = \dfrac{py}{m + y}$ **A**

14) slope $= \dfrac{5 - 4}{3 - 1} = \dfrac{1}{2}$. So $\dfrac{6 - 4}{x - 1} = \dfrac{1}{2} \Rightarrow x - 1 = 4,$ *so* $x = 5$ **D**

15) $\left(4x^2 - 25\right) - \left(x^2 - 4\right) - \left(9x^2 - 16\right) - \left(25x^2 - 49\right) = 19x^2 - 54$; **B**

16) $f(0) = 6; f(-1) = 8, f(2) = 2, f(3) = 0$, so the range is $\{0, 2, 6, 8\}$ **B**

17) Using order of operations, we get $5 + ^{13}/_3 - 4 + 12$ which $= ^{52}/_3$ **D**

18) Cross multiply and get $4x + 20 = -5x + 15$, so $x = ^{-5}/_9$ **E**

19) Just simplify the powers of x: $\dfrac{x^{10}}{x^{12}} \div \dfrac{x^{-10}}{x^{12}} = x^{20}$. **C**

20) Distributing gives $x^4 + 2x^3 - 3x^2 - 3x^3 - 6x^2 + 9x + 2x^2 + 4x - 6$ which $= x^4 - x^3 - 7x^2 + 13x - 6$ **A**

21) Solving each part gives us $x > 5$ *or* $x \leq -2$; -2 lies in this solution set; **A**

22) Change the second equation to slope-intercept form; the equations are identical; the lines coincide, so **D**

23) $\dfrac{10x + 10}{(2x - 1)(x - 3)} - \dfrac{8(2x - 1)}{(x - 3)(2x - 1)} = \dfrac{10x + 10 - 16x + 8}{(2x - 1)(x - 3)} = \dfrac{-6x + 18}{(2x - 1)(x - 3)} = \dfrac{-6(x - 3)}{(2x - 1)(x - 3)} = \dfrac{-6}{2x - 1}$ **C**

24) $(9x + 4)(8x - 3)$, so A + B + C + D = 18 **C**

25) Let $x = $ longer piece. $x + \frac{2}{3}x = 27$, so $x = 16^1/_5$. The shorter piece is $\frac{2}{3}$ of that, or $10^4/_5$. **B**

26) $\dfrac{-2}{3} = \dfrac{k - -3}{5 - (k + 2)}; so \dfrac{-2}{3} = \dfrac{k + 3}{3 - k}$. Cross multiply: $3k + 9 = -6 + 2k \Rightarrow k = -15$ **A**

27) Convert both to common base of 9: $9^{3x-2} = 9^{2x+2}$; set exponents equal and solve. $x = 4$ **B**

28) L has y-intercept 1, slope of $\frac{2}{3}$, so slope of M is $-^3/_2$. The equation is $y = -^3/_2x + 1$, or $3x + 2y = 2$ **D**

29) $5p + 3e = 705$ and $3p + 2e = 430$; solving gives $p = 120$ and $e = 35$, so $4p + 4e = \$6.20$ **B**

30) Combine like terms and watch your signs! $x^2 + 9x - 10$ **B**

1) $f(-1) = 10$, $g(7) = -14$, $g(2) = 1$, $h(1) = -2$, $f(3) = 6$, and $g(6) = -11$; so

$f(-1) + g(7) - h(g(2)) + g(f(3)) = 10 + -14 - -2 + -11 =$ **-13**

2) $-12 * 3 = -6$ and $5 * -6 = -45$; $4 \odot 3 = 7$ and $8 \odot 7 = 15$; $-45 * 15 = -135 + 150 =$ **15**

3) The slopes are, in order: $\dfrac{2}{3} \cdot \dfrac{-5}{4} \cdot \dfrac{5}{6} \cdot \dfrac{-9}{5}$, so the product is $^5/_4$

4) Solving gives us: $a = -9/2$, $b = 0$, $c = \frac{1}{2}$, and $d = 6$. $2a + \dfrac{b}{d} - \dfrac{1}{c} = 2\left(\dfrac{-9}{2}\right) + \dfrac{0}{6} - \dfrac{1}{1/2} = -9 + 0 - 2 =$ **-11**

5) A: Set up with the equations $t + u = 6$ and $10u + t = 4(10t + u) - 9$; Solving gives us A = 15

B: Set up with equations $n + q = 30$ and $5n + 25q = 510$. Solving gives 12 nickels, 18 quarters, so B = 12

C: Set up with N = R – 12 and R + 7 + R -12 + 7 = 60. Solving gives R = 29 and N = 17, so next year, C = 18

B + C – A = 12 + 18 – 15 = **15**

6) The region defined by these inequalities is a triangle with vertices at (0,6), (-6,-6) and (8,-6). The base of this triangle is 14, the height is 12, so the area is ½ (14)(12) = **84** (square units)

7) Solving A: $x \leq \frac{1}{3}$ and $x \geq -3$, so the integers are { 0. -1, -2, -3}. Solving B: x < 3 or x > -5/3, which is the integers {-1, 0, 1, 2}, so the sum of these integer solutions is **-4**

8)
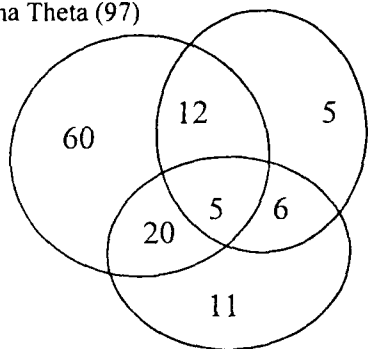
Mu alpha Theta (97)   Spanish (28)

Fill in a Venn diagram starting with the intersection of all 3 sets (students who are members of all 3 clubs). Working your way out, you get the following: The total number of students is **119**

Scrabble (42)

9) Just simplify the powers of a: $\dfrac{a^{56}}{a^{30}} = a^{26}$ so the power of a is **26**

10) The first number is 225, the second is 2,772. Their sum is **2,997.**

11) The intercepts are: (0, -3), (4,0), (0,-5), (-2,0), (0, 4⅓), and (13,0); their sum is **11⅓**

12) The first 10 prime numbers are: 2,3,5,7,11,13,17,19,23,and 29. Their sum is **129**

13) To solve $3ab - 5a = 7b - 1$ for a factor out a, and solve. This gives us: $a(3b - 5) = 7b - 1$, so $a = \dfrac{7b - 1}{3b - 5}$

14) A line with no slope is vertical and is of the form x = c, where c is the x coordinate of every point on the line. Therefore the equation is **x = 4**

15) To find the least common multiple of 180 and 144, first do prime factorizations of each number: $180 = 2^2 \cdot 3^2 \cdot 5$ and $144 = 2^4 \cdot 3^2$. The LCM is the union of these factors, so LCM = $2^4 \cdot 3^2 \cdot 5 = 720$, and the sum of the digits is **9**