

NOTA means "none of the above answers is correct"

1. Which set of quadrants contains the graph of the equation $y = -\frac{2}{3}x + 4$?
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) $y = \frac{-2}{3}x - 2$ B) $y = \frac{2}{3}x - 2$ C) $y = \frac{3}{2}x - 2$ D) $y = \frac{-3}{2}x - 2$ 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 $\frac{2}{3}(3x - 6) - \frac{3}{5}(5x - 15) = \frac{1}{4}(2x - 3) - \frac{1}{2}\left(x + \frac{3}{2}\right)$, 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) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{a}$ B) $x = -b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$ C) $x = \frac{-b \pm \sqrt{b^2 - 2ac}}{2a}$
- D) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ E) NOTA

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

- A) $16x^3y^3z^7$ B) $16x^5y^3z^8$ C) $32x^3y^2z^7$ D) $64x^3y^2z^7$ 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 : $y = \frac{mx}{p-x}$

- A) $x = \frac{yp}{m+y}$ B) $x = \frac{p}{y}$ C) $x = \frac{m-y}{yp}$ 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) $\{\text{Reals}\}$ E) NOTA

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

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

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

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

19) Find the power of x if the expression $\frac{(2x^5y^5)^2}{(4x^4y)^3} \div \frac{(8x^5y^2)^{-2}}{(32x^{-3}y^2)^{-4}}$ 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 $-2 \leq -8 - 3x$?

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

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

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

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

- A) $\frac{-6x+18}{(2x-1)(x-3)}$ B) $\frac{6}{2x-1}$ C) $\frac{-6}{2x-1}$ D) $\frac{-6x+2}{(2x-1)(x-3)}$ 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 $\frac{2}{3}$ the length of the other. How long is the shorter piece?
- A) 9" B) $10\frac{4}{5}$ " C) $16\frac{1}{5}$ " 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 $-\frac{2}{3}$.
- 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

January Regional

Algebra I Team Questions

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

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

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

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

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

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

Question # 4 Solve each equation below.

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

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

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:

$$y \leq 2x + 6 \quad 3x + 2y \leq 12 \quad y \geq -6$$

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

A: $|3x + 4| \leq 5$

B: $2x - 3 < x < 4x + 5$

Question # 8

There are 97 students in Lincoln MA Θ . There are 28 students in Spanish club, and 42 students in the Scrabble Club. Twenty-five are in both MA Θ and the Scrabble Club. Seventeen students are in both Spanish club and MA Θ . 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 $\frac{(8a^7b^6c^7)^8}{(6a^5b^2c^{10})^6}$

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:

$$y = \frac{3}{4}x - 3$$

$$5x + 2y = -10$$

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

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. $\frac{5}{4}$
4. -11
5. 15
6. 84
7. -4
8. 119
9. 26
10. 2997
11. $11\frac{1}{3}$
12. 129
13. $a = \frac{7b-1}{3b-5}$
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 $\frac{156}{336}$ of collection, or $\frac{13}{28}$: **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 $x = \frac{13}{2}$; 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 $x = \frac{py}{m + y}$ **A**14) slope = $\frac{5-4}{3-1} = \frac{1}{2}$. So $\frac{6-4}{x-1} = \frac{1}{2} \Rightarrow x-1 = 4$, so $x = 5$ **D**

15) $(4x^2 - 25) - (x^2 - 4) - (9x^2 - 16) - (25x^2 - 49) = 19x^2 - 54$; **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 $5 + \frac{13}{3} - 4 + 12$ which = $\frac{52}{3}$ **D**18) Cross multiply and get $4x + 20 = -5x + 15$, so $x = -\frac{5}{9}$ **E**19) Just simplify the powers of x : $\frac{x^{10}}{x^{12}} \div \frac{x^{-10}}{x^{12}} = x^{20}$. **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) $\frac{10x+10}{(2x-1)(x-3)} - \frac{8(2x-1)}{(x-3)(2x-1)} = \frac{10x+10-16x+8}{(2x-1)(x-3)} = \frac{-6x+18}{(2x-1)(x-3)} = \frac{-6(x-3)}{(2x-1)(x-3)} = \frac{-6}{2x-1}$ **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 $x = 16\frac{1}{5}$. The shorter piece is $\frac{2}{3}$ of that, or $10\frac{4}{5}$. **B**

26) $\frac{-2}{3} = \frac{k-3}{5-(k+2)}$; so $\frac{-2}{3} = \frac{k+3}{3-k}$. 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 $-\frac{3}{2}$. The equation is $y = -\frac{3}{2}x + 1$, 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**

