Entering Geometry Honors Summer Homework



Name

_____

Please read all instructions before beginning this packet.

Show all work directly in this packet.
If you need additional space, use lined paper and clearly label each problem.
Submit the completed printed packet when you return to school in August.

To maintain your academic progress, the math department at CSN expects you to spend approximately one hour per week working on these problem sets. Most problems can be completed without a calculator, but use when necessary.

Your grade will be based on:

- Completion
- Accuracy
- A beginning-of-year assessment given during the first week of school

Please give your best effort. This work helps reflect your individual strengths and areas for growth, and it also allows the department to analyze overall student performance. Teachers will use this information to adjust instruction and better support your learning.

Please reach out to your teacher or the department chair with any questions or concerns.

Test 1

For all questions, e is NOTA, which denotes that "none of the above" answers is correct.

1. Evaluate. $\left|-\frac{-(-|-3|-|4|)^2}{[|-3|-(-|-4|)]^2}\right|$

a. 7 b. 1 c. -1 d. -49 e. NOTA

2. Simplify. $\frac{x^2-9}{x-4}\cdot\frac{x^2-x-12}{x^2+x-12}\div(x+3)$

a. $\frac{x+3}{x+4}$ b. $\frac{x-4}{x+3}$ c. $\frac{x-3}{x-4}$ d. $\frac{(x+3)(x+3)}{x+4}$ e. NOTA

3. Solve for x. $x+3+4x=13+x-7$

a. $x=\frac{5}{9}$ b. $x=\frac{3}{8}$ c. $x=\frac{3}{4}$ d. no solution e. NOTA

4. What is $x+y$? $\begin{cases}\frac{5}{9}x-\frac{2}{3}y=7\\ \frac{4}{9}y=8-\frac{x}{3}\end{cases}$

a. $\frac{19}{2}$ b. $\frac{27}{2}$ c. $\frac{45}{2}$ d. $\frac{51}{2}$ e. NOTA

5. The x-intercept of $3x+4y=12$ is the vertex of the quadratic function $y=-a(x-b)^2+c$. What is the value, of a in the quadratic, for the y-intercept to be -32?

a. -2 b. 2 c. ½ d. -4 e. NOTA

6. Solve for x. $-3|-2x|+7=-(3+4)x$

a. $x=-\frac{7}{13}$ b. $x=7,-7$ c. No solution d. $x=0$ e. NOTA

7. What value of *a* would make the solution to the equation "infinitely many solutions"?
$2a+3-4x+7=3\left(-\frac{4}{3}x+7\right)$

a. - 5 b. $\frac{11}{2}$ c. 10.5 d. 21 e. NOTA

8. The four lines (i-iv) below are parallel. Find the value of $c+d-b$

i. $y=3x+7$ ii. $26x+cy=14$ iii. $x=\frac{b}{9}y-4$ iv. $dx=y$

a. -12 b. $-\frac{35}{3}$ c. $-\frac{26}{3}$ d. 9 e. NOTA

9. Which solution is 5 units away from zero?

a. $|-x| = -5$ b. $|x| = -5$ c. $-|x| = 5$ d. $-|x| = -5$ e. NOTA

10. You have a total for $9.60 in quarters and nickels. You have 3 times as many quarters than nickels. How many coins do you have?

a. 12 b. 36 c. 48 d. 24 e. NOTA

11. The surface area of a rectangular prism is $196\ in^2$. The base, height and width, respectively, are $3x$ inches, 4 inches, and 2 inches. What is the length of the base? ($SA = 2(bh + bw + hw)$)

a. $\frac{5}{3}$ in b. 100 in c. 15 in d. $33\frac{1}{3}$ in e. NOTA

12. Which is <u>not</u> a factor of $x^6 - x^4 - x^4 + x^6$?

a. 1 b. $4x^2$ c. $(x + 1)$ d. $(x - 1)$ e. NOTA

13. What is the value of $y\sqrt{x}$?

$$\begin{cases} \frac{j^{x-2}}{j^y} = j^3 \\ \frac{j^2 \cdot j^{x+2}}{j^{2y}} = j^{10} \end{cases}$$

a. No solution b. -2 c. -4 d. 4 e. NOTA

14. The length of a rectangle is 8 centimeters more than 4 times the width. The perimeter of the rectangle is 2 centimeters less than 12 times the width. What is the area of the rectangle?

a. 9 cm^2 b. 76 cm^2 c. 106 cm^2 d. 396 cm^2 e. NOTA

15. For what value of *k*, would the system have infinitely many solutions?

$$\begin{cases} 4x + 2ky = 6 \\ 12x + 6y = 18 \end{cases}$$

a. -3 b. -1 c. 1 d. 3 e. NOTA

16. For what negative integer *b* is the ordered pair (1,*b*) a solution to the system of inequalities?

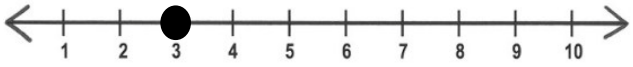
$$\begin{cases} 3y - x < -7 \\ 12x + 12y > -36 \end{cases}$$

a. -4 b. -3 c. -2 d. -1 e. NOTA

17. One equation in a system of equations is $y = -\frac{1}{3}x + 7$. The other equation has a y-intercept of -3 and a slope of $\frac{c}{12}$. What is the value of c if the x-value of the solution to the system is 3.

a. 3 b. 4 c. 36 d. 42 e. NOTA

18. Select the inequality that has the solution represented by the number line.



a. $x \leq 3 \; and \; x \geq 3$ b. $x \leq 3 \; or \; x \geq 3$ c. $x > 3 \; and \; x \geq 3$

d. $x < 3 \; or \; x > 3$ e. NOTA

19. Which function has the largest x-intercept?

a. $f(x) = (2x - 3)(x + 3)$ b. $f(x) = 4x^2 - 9x - 9$

c. $f(x) = 15(x + 3)^2 - 10$ d. $f(x) = 5x^2 + 18x$ e. NOTA

20. What is the *c* value if there is one x-intercept? $y = -10x^2 + 30x + c$

a. -30 b. $-\frac{45}{2}$ c. $\frac{9}{2}$ d. 18 e. NOTA

21. How many liters of 25% alcohol solution should be added to 40 liters of a 60% alcohol solution to make a 50% solution?

a. 16 liters b. 30 liters c. 56 liters d. 72 liters e. NOTA

22. Which statement(s) are <u>false</u>?

i. All rational number are real numbers.
ii. All natural numbers are whole numbers.
iii. All irrational numbers are real numbers.
iv. All are integers whole numbers.

a. i, ii, iii, iv b. ii, iv c. i, ii, iii d. iv e. NOTA

23. Paul can mow his yard in 5 hours. His brother Steve can mow the yard in 4 hours. How long will it take them if they work together? Give your answer to the nearest minute.

a. 131 min b. 132 min c. 133 min d. 134 min e. NOTA

24. Evaluate when $x = 10$.

$$\left(\frac{(2x-4)(x+5)(x-7)(2x+9)}{(x-7)(x-5)(x-2)^2(x+3)}\right)^2$$

a. $\frac{87}{52}$ b. $\frac{1}{36}$ c. $\frac{289}{36}$ d. $\frac{1}{9}$ e. NOTA

25. Write the equation with the given zeros: $x = -2, x = 4, x = 5$

a. $x^3 + 7x^2 - 2x - 40$ b. $x^3 + 7x^2 + 2x + 40$
c. $x^3 - 7x^2 - 2x - 40$ d. $x^3 - 7x^2 + 2x + 40$ e. NOTA

26. The distance between Orlando International Airport and Sky Harbor International Airport in Phoenix is 1848 miles. A plane leaves Orlando with a tailwind and takes 3 hours 45 minutes to arrive at Sky Harbor. On the return flight with a headwind it takes 4 hours 30 minutes. If the plane has a rate of 550 miles per hour what is the wind speed?

f. 40 mph b. 45 mph c. 50 mph d. 55 mph e. NOTA

27. Which point lies on the line: $2y + 3x = 3$

g. $(5, -6)$ h. $(-6, 5)$ i. $(-5, 6)$ j. $(-6, -5)$ k. NOTA

28.Which of the following is **not** true?

l. $a^{-2}b^0c^{-1} = \frac{1}{a^2c}$ m. $ab^{-1}c^{-2} = \frac{a}{bc^2}$ n. $a^{-1}b^1c = \frac{c}{ab}$ o. $\frac{c}{a^{-1}b^{-1}} = abc$ p. NOTA

29.If $f(x) = ax^2 + bx + c$ has 2 and -4 as the two zeros in the most simplified form, what is the value of a + b + c?

q. -6 r. -5 s. 16 t. 2 u. NOTA

30.Use the given information to write a function of the form $f(x) = ax^2 + bx + c$, then find the y-coordinate of the vertex?

- Parabola is not reflected.
- $f(x)$ has an axis of symmetry at $x = \frac{5}{12}$.
- Y-intercept is at (0,-1)

v. $-\frac{49}{24}$ w. $\frac{25}{24}$ x. $\frac{17}{8}$ y. $\frac{31}{6}$ z. NOTA

1. Write the equation for $y + 2 = \frac{1}{2}(x - 4)$ in Standard Form $(ax + by = c)$.

A) x + 2y = 0 B) x – 2y = 8 C) 2x – y = 10

D) 4x – 2y = 0 E) NOTA

2. Nick is six years older than Victoria. Six years ago, Nick was twice as old as Victoria was. How old is Victoria now?

A) 18 B) 15 C) 12 D) 8 E) NOTA

3. Evaluate: $\frac{1}{\frac{1}{3}-\frac{1}{4}}$

A) 12 B) $\frac{12}{7}$ C) $\frac{7}{12}$ D) $\frac{1}{12}$ E) NOTA

4. What is the degree of the following polynomial: $2x^3 - 5x^5 + 7x^2 + 6^6$?

A) 6 B) 5 C) 3 D) 2 E) NOTA

5. Simplify: $\sqrt{\frac{27a^6 \cdot 4b^5}{64a^{-2}b^{15}}}$

A) $\frac{3a^4}{4b^5}$ B) $\frac{3\sqrt{3}a^2}{8b^5}$ C) $\frac{3\sqrt{3}a^4}{8b^5}$

D) $\frac{3\sqrt{3}a^4}{4b^5}$ E) NOTA

6. Solve for x:

$$-9(x - 3) + 2x \geq 2(4 - x)$$

A) $x \leq -\frac{19}{5}$ B) $x \geq -1$ C) $x \leq -\frac{1}{6}$

D) $x \leq \frac{19}{5}$ E) NOTA

7. How many positive integral factors does 300 have?

A) 18 B) 16 C) 14 D) 12 E) NOTA

8. What is the sum of all of the integral factors of 300?

A) 16 B) 120 C) 648 D) 868 E) NOTA

9. Simplify $\frac{x-2}{x^2-7x+6} \div \frac{x-6}{x^2-3x+2}$

A) $\frac{x^2-4x+4}{x^2-12x+36}$ B) $\frac{x^2-4}{x^2-36}$ C) 1

D) $\frac{1}{x^2-2x+1}$ E) NOTA

10. Solve for x:

$$\sqrt{x+3} + 3 = 2$$

A) -4 B) -2 C) 0 D)2 E) NOTA

11. Write .00072 in scientific notation.

A) 7.2×10^{-3} B) 7.2×10^{-4} C) 72×10^{-6} D) $.72\times10^{-3}$ E) NOTA

12. Evaluate: $3 + 14 \times 2 \div 7 - 1 \times 0$

A) 0 B) 3 C) 7 D) 10 E) NOTA

13. Consider the set of numbers {4, 11, -3, 8, 29}. Which of the following sets does **not** contain **every** element of this set?

A) $\mathbb{N}$ B) $\mathbb{Q}$ C) $\mathbb{R}$ D) $\mathbb{Z}$ E) NOTA

14. How many of the following values equal one?

I. 0^0 II. 0! III. $\sqrt{1-2}$ IV. 3^0

A) 0 B) 1 C) 2 D) 3 E) NOTA

15. Brandon's favorite number B is both prime and has the interesting property that $F_B = B$, where F_n denotes the nth Fibonnaci number and $F_1 = F_2 = 1$. What is B?

A) 1 B) 2 C) 3 D) 5 E) NOTA

16. The determinant of a matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is defined as $ad - bc$. Find the determinant of the matrix $\begin{pmatrix} 5 & -2 \\ 3 & 7 \end{pmatrix}$.

A) 15 B) 20 C) 29 D) 41 E) NOTA

17. The functions $y = 2^x$, $y = 11x - 2$, and $y = x^2 + 8x - 20$ intersect at the point (a, b). What is $a + b$?

A) 20 B) 36 C) 37 D) 70 E) NOTA

18. If $f(x) = 3x - 4$ what is $f\left(f\left(f(f(3))\right)\right)$?

A) 87 B) 83 C) 33 D) 29 E) NOTA

19. A series is defined recursively as $a_{n+1} = 3a_n - 1$, $a_1 = 5$. What is a_5?

A) 25 B) 98 C) 122 D) 365 E) NOTA

20. Andrew is playing Pokémon Go! He is at the point (13,6) when he sees an Eevee at (19,14). When he looks further into the distance, though, he sees a Charmander at (23, 30), and these are super rare! Andrew only has enough time to walk a distance of 15 units. He'd rather catch the Charmander than the Eevee, but he'd rather have caught the Eevee than having not caught any Pokémon at all. Knowing this, which character should he go after?

A) Charmander B) Eevee C) Neither

D) Both are the same distance E) NOTA

21. Find the positive integer *n* such that

$$3^1 \cdot 3^2 \cdot 3^3 \cdot \ldots \cdot 3^n = 3^{253}.$$

A) 22 B) 23 C) 24 D) 25 E) NOTA

22. Townsend and Tommy both love odd numbers. Townsend's favorite odd number is 355, and Tommy's favorite is 555. What is the sum of all of the odd numbers (inclusive) between these two?

A) 200 B) 30,200 C) 45,600 D) 50,000 E) NOTA

23. How many numbers less than 100 have exactly three divisors?

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

24. For what value of k would the system of equations 2x + 3y = 6 and 5x – ky = 8 be inconsistent?

A) $\frac{15}{2}$ B) $\frac{7}{2}$ C) $-\frac{1}{2}$ D) $-\frac{15}{2}$ E) NOTA

25. Which of the following values of x satisfy the equation: $-1^x = 1$?

A) 1 B) 4 C) 5 D) 7 E) NOTA

26. Find the value of n such that

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} = \frac{n}{64}.$$

A) 60 B) 63 C) 64 D) 128 E) NOTA

27. Let x and y be real numbers such that

$$x + y = 17 \text{ and } x^2 - y^2 = 221.$$

Find $x - y$.

A) 13 B) 11 C) 9 D) 3 E) NOTA

28. Calculate: $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right)\cdots\left(1-\frac{1}{2020}\right)=?$

A) 2020 B) 2019 C) $\frac{1}{2019}$ D) $\frac{1}{2020}$ E) NOTA

29. Simplify: $\sqrt{3+2\sqrt{\frac{169}{4}}}-\sqrt{19-\sqrt{324}}$.

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

30. What is the sum of the distinct solutions to the equation:

$$|x^2-4x-5|-x=1\ ?$$

A) 0 B) 5 C) 8 D) 9 E) NOTA

1. Simplify and write without negative exponents: $(5x^{-4}y^{-6}z^{5})(-4x^{5}y^{5}z^{-3})(-4x^{2}yz^{-1})$

a. $-80x^{3}y^{2}z$ b. $80x^{3}z$ c. $80x^{-40}y^{-30}z^{15}$ d. $80x^{3}y^{2}z$ e. NOTA

2. Write an equation for the line that is parallel to the line described by 3x – y + 4 = 0 and contains the point (2, -3).

a. $y = 3x - 9$ b. $3x + y = 3$ c. $y = -\frac{1}{3}x + \frac{8}{3}$ d. $3x - y = -9$ e. NOTA

3. Find the y-coordinate of the ordered pair that satisfies both of the equations:

y = 6 – x and 2x – 3y = 22.

a. -3 b. -2 c. 1 d. 4 e. NOTA

4. If the range of the function $f(x) = 3x - 5$ is limited to the set of even whole numbers less than 9. Find the sum of the numbers in the domain.

a. $\frac{20}{3}$ b. $\frac{40}{3}$ c. 15 d. 20 e. NOTA

5. Simplify: $\frac{9x^{3}+5x^{2}-7x}{x} - \frac{6x^{4}-8x^{3}}{2} + \frac{5x^{7}+10x^{5}-15x^{3}}{5x^{2}}$.

a. $x^{5} + 3x^{4} - 6x^{3} - 9x^{2} - 2x + 7$ b. $x^{5} - 3x^{4} - 2x^{3} + 9x^{2} + 2x - 7$

c. $x^{5} - 3x^{4} + 6x^{3} + 9x^{2} + 2x - 7$ d. $x^{5} - 3x^{4} - x^{3} + 9x^{2} + 5x - 7$ e. NOTA

6. Solve the inequality: $-3x - 4 > 8 \ \ or \ \ 2x - 12 < 2$.

a. $x < -4$ b. $x < 7$ c. $-4 < x < 7$ d. All Reals e. NOTA

7. Find the product of the slope and y-intercept of the line: 5x = 9y + 27.

a. $-\frac{5}{3}$ b. $-\frac{5}{27}$ c. $\frac{5}{3}$ d. 45 e. NOTA

8. The graph of the line 4x + 3y = 12 does not contain any points in which quadrant?

a. I b. II c. III d. IV e. NOTA

9. If the following three equations have the same solution, find the value of A + B.

$5(3x - A) = 35;$ $2x + 7 - 3x = 10 + 4x - 2;$ $7 + 2x + 3(x + 4) = B$

a. 6 b. 8 c. 10. d. 12 e. NOTA

10. If $x + y = k$ and $x - y = \frac{1}{k}$, then assuming that $k \neq 0$ what does $x^2 - y^2$ equal?

a. k b. $k^2 - k$ c. 1 d. $\frac{1}{k^2}$ e. NOTA

11. Find the sum of the greatest common factor and the least common multiple of the following three polynomials:

$x^2 - 9$; $x^2 - 7x + 12$; $4x^2 - 11x - 3$

a. $4x^3 - 27x^2 + 42x + 15$ b. $4x^3 + 24x^2 - 16x + 36$

c. $4x^4 - 15x^3 + 32x^2 - 134x - 39$ d. $4x^4 - 15x^3 - 40x^2 + 136x + 33$

e. NOTA

12. One boat travels 6 km/h slower than another. While one boat travels 85 km, the other travels 115 km in the same amount of time. Find the sum of their speeds.

a. 40 b. 42 c. 45 d. 48 e. NOTA

13. If the following polynomial is simplified and arranged in ascending order which term would be written last?
$3y(2y - 4) - 5(6 - 4y + y^2)$

a. y^2 b. -30 c. $11y^2$ d. $7y^2$ e. NOTA

14. How many of the following polynomials have 2x + 3y as a factor?

$4x^2 - 9y^2,$ $2x^2 + 10x + 3xy + 15y,$ $2x^2 + 3y^2,$ $12xz + 18yz$

a. 0 b. 1 c. 2 d. 3 e. NOTA

15. A 50-ft wire is cut into three pieces. The second piece is three times as long as the first piece. The third piece is four times as long as the second piece. How long is the third piece?

a. 30 ft b. 37.5 ft c. 38.7 ft d. 41.5 ft e. NOTA

16. Solve: $6(m+5)-7m=10-5(m-1)+2$.

a. $-\frac{13}{4}$ b. $-\frac{1}{2}$ c. $\frac{1}{2}$ d. $\frac{8}{3}$ e. NOTA

17. Simplify: $-\Big(-\big(x+3-(x-3)+5\big)\Big)$.

a. -11 b. -1 c. 5 d. 11 e. NOTA

18. Suppose $f(x)=4x$ and $g(x)=-3x^2$, find $f\big(g(-2)\big)$.

a. -192 b. -96 c. -48 d. 48 e. NOTA

19. Solve the proportion: $\frac{4-3x}{x+5}=\frac{9x}{8-3x}$

a. $\frac{32}{81}$ b. $\frac{32}{57}$ c. $\frac{32}{9}$ d. 32 e. NOTA

20. Let A = the set of integers between 3 and 8 inclusive and let B = the prime numbers less than 25 and let C = the set of even whole numbers greater than 15. Find $(A \cup B) \cap C$.

a. $\{3,5,7\}$ b. $\{19,\ 23\}$ c. $\{16,18,20,\ldots\}$ d. $\emptyset$ e. NOTA

21. Find the sum of the elements in the range of the function $f(m)=m^3+1$ when the domain is the set of integers greater than -3 and less than 3.

a. 0 b. 7 c. 10 d. 79 e. NOTA

22. A and B are two sets where the following conditions are true. B has 12 elements. A ∩ B has 5 elements and A ∪ B has 40 elements. How many elements are in A?

a. 18 b. 23 c. 28 d. 33 e. NOTA

23. If $2x+3y=k$ and $x+2y=m$, then $\frac{8x+13y}{2}=?$

a. $\frac{3k+2m}{2}$ b. $\frac{5k-3m}{2}$ c. $2km$ d. $\frac{3k+5m}{2}$ e. NOTA

24. Find the equation of the line that has the same y-intercept as 2x – 5y = 30 and has the same x-intercept as y = 4x – 8.

a. 4x – 5y = 30 b. y = 4x – 6 c. y = 3x – 6 d. 2x – 4y = 30 e. NOTA

25. A line contains the points (3, 5k) and (-2, 3k). It is perpendicular to the line y = 3x + 8. Find the value of k.

a. $-\frac{5}{6}$ b. $\frac{5}{6}$ c. $\frac{3}{2}$ d. $\frac{15}{2}$ e. NOTA

26. Find the sum of the solutions: $\big||x-5|-8\big| = 3$.

a. 4 b. 10 c. 16 d. 20 e. NOTA

27. Solve: $|2x+5| \geq 1 \ and \ |x-7| \leq 3$.

a. $-3 \leq x \leq 10$ b. $x \leq -3 \ or \ x \geq 10$ c. $x \leq -2 \ or \ x \geq -4$ d. $4 \leq x \leq 10$ e. NOTA

28. If the mean of 5 numbers is between 17 and 24, then the sum of the 5 numbers could be any one of the following except _____.

a. 75 b. 90 c. 100 d. 115 e. NOTA

29. How many of the following illustrate using the distributive property?

i. $(5w+8)k = 5w+8k$ ii. $6x(x^2-5) = 6x^3-30x$ iii. $8(3+6n) = 8(6n+3)$

iv. $(9r^2+7r)\cdot 5+3 = 5(9r^2+7r)+3$ v. $(x^2y^3)^5 = x^{10}y^{15}$

a. 1 b. 2 c. 3 d. 4 e. NOTA

30. Mackenzie and her friends are planning a trip to a paintball park. There are two plans to buy paintballs and both include lunch. Plan 1 has 800 paintballs for $36 and Plan 2 has 300 paintballs for $16. What would be the cost of 400 paintballs and lunch?

a. 18 b. 20 c. 28 d. 32 e. NOTA

1. 13% of 67 is equivalent to which of the following?

A: 11% of 72 C: 57% of 15 E: NOTA
B: 33% of 23 D: 67% of 13

2. The expression $\frac{(2^{x-y})(4^{x+y})}{8^{x-y}}$ can be rewritten as:

A: 2^{4y} B: 2^{2y} C: 2^{6x+2y} D: 2^{6x-2y} E: NOTA

3. Which of the following is a factor of $8x^2 + x - 9$

A: $8x - 9$ B: $8x + 9$ C: $x + 1$ D: $2x - 3$ E: NOTA

4. The sum of two polynomials is $3x^3 + x - 6$. If one of the polynomials is $2x - 2x^2 - 2$, then what is the other polynomial expression?

A: $3x^2 - x + 4$ C: $5x^2 - x - 4$ E: NOTA
B: $x^2 - 2x + 4$ D: $3x^3 + 2x^2 + x - 4$

5. $y = (x - 3)^2 + 1$. What is the value of y when $x = 1$?

A: -3 B: 3 C: 4 D: 5 E: NOTA

6. The Savage household consists of three children: Phil, Frank, and Ken. The three boys must complete their Algebra 1 homework. Phil can complete the homework in 30 minutes. Frank can complete the homework in 20 minutes. Ken can complete the homework in 10 minutes. To complete the homework faster, Phil and Frank decide to work together. Ken decides to give Phil and Frank a one-minute head start. Assuming they have been assigned the same homework, who finishes first and by how many minutes?

A: Phil and Frank by 1 min C: Ken by 1 min E: NOTA
B: Phil and Frank by 2 min D: Ken by 2 min

7. A newly created function is defined such that a∮b = $\frac{2^a}{3^b}$. If a = 3 and a∮b = 72, then what is b?

A: -2 B: $-\frac{1}{2}$ C: $\frac{1}{2}$ D: 2 E: NOTA

8. $x^2 - a$ can be factored into $(x - b)(x + b)$. Given that a and b are whole numbers, then how many possible values of $a + b$ exist such that $a + b \leq 50$?

A: 5 B: 6 C: 7 D: 12 E: NOTA

9. Simplify the following: $\dfrac{\frac{1}{3}\left(\frac{1}{1+\frac{1}{7}}\right)}{\frac{1}{4}\left(\frac{1}{1+\frac{1}{5}}\right)}$

A: $\frac{7}{5}$ B: $\frac{5}{7}$ C: $\frac{21}{20}$ D: $\frac{20}{21}$ E: NOTA

10. Vinnie scores an average of 81.0 on his first 3 quizzes in Algebra 1. Vinnie then averages a 97.0 on the next 5 quizzes. What is Vinnie's overall average grade for all 8 quizzes (all quizzes are weighted equally)?

A: 89 B: 90 C: 91 D: 93 E: NOTA

11. Lou swims against a current and travels at a speed of 2 mph. If Lou swam three times as fast, he would have a speed of 6 mph against the current. How long, in minutes, would it take Lou to swim half of a mile in still water?

A: 10 min B: 15 min C: 20 min D: 30 min E: NOTA

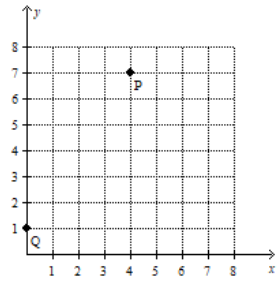
12. What value of x satisfies the equation $2 + 6(2x - 7) = 11 - 2(7 - 2x) - 3(-2x + 7)$?

A: 18 B: 16 C: 9 D: 8 E: NOTA

13. Which of the following expressions is not equivalent to the others?

A: $a + d(b - c)$ C: $d(b - c) + a$ E: NOTA
B: $a + bd - cd.$ D: $a + d(-c + b)$

Please use the following information to answer questions 14 to 16:
P has the coordinates (4,7) and Q has the coordinates (0,1) as shown in the diagram below



14. Point S lies on $\overleftrightarrow{PQ}$. Given that point S has an abscissa value of 2, then what is the ordinate value of S?

A: $\frac{2}{3}$ B: $\frac{3}{2}$ C: 2 D: 4 E: NOTA

15. What is the area of the triangle formed by $\overleftrightarrow{PQ}$ and the lines x = 4 and y = 1?

A: 12 B: 16 C: 20 D: 24 E: NOTA

16. $\overleftrightarrow{PM}$ has an x-intercept of a. What is the slope of $\overleftrightarrow{PM}$ in terms of a?

A: $\frac{a-7}{4}$ B: $\frac{7}{a-4}$ C: $\frac{7-a}{4}$ D: $\frac{7}{4-a}$ E: NOTA

17. Which of the following is equivalent to the expression $4^{3^{2^1}}$

A: 2^{18} B: 4^{12} C: 6^8 D: 12^2 E: NOTA

18. Which of the following functions does not have any coordinates in Quadrant II?

A: $y = -\frac{1}{3}x - 4$ C: $y = 0$ E: NOTA
B: $y = x + 2$ D: $y = |x|$

19. The sum of two positive numbers is 17. The sum of their squares is 169. What is the square of the difference of the two numbers?

A: 119 B: 81 C: 49 D: 9 E: NOTA

20. Al has exactly six coins in his pocket, consisting of nickels, dimes, or quarters. The total value of coins in his pocket is exactly \$0.60. How many different combinations of coins could Al have had in his pocket?

A: 2 B: 3 C: 5 D: 7 E: NOTA

21. What is the sum of all possible values of x and y such that

$2x + 4y = 12$
$5x + 10y = 28$

A: 16 B: 9 C: 7 D: 6 E: NOTA

22. $f(x) = -5x + 12$ and $g(x) = 4x - 7$. What value of x satisfies the equation, $f(x) = 2g(x)$?

A: 1 B: 2 C: 3 D: 4 E: NOTA

23. In two years, Tony will be twice as old as Vince. Three years ago, Tony was three times as old as Vince. How many years ago was Tony eleven times as old as Vince?

A: 4 B: 7 C: 11 D: 12 E: NOTA

24. If $|x| = 7$ and $|y| = 8$, then what is the least possible value of $x - y$?

A: -15 B: -1 C: 1 D: 15 E: NOTA

25. The equation of line 1 is $ax + by = c$. Line 2 is perpendicular to line 1 through the coordinate $(c, 0)$. What is the y-intercept of line 2 in terms of a, b, and c?

A: $\frac{ac}{b}$ B: $\frac{bc}{a}$ C: $\frac{-ac}{b}$ D: $\frac{-bc}{a}$ E: NOTA

26. $(12 + 2)(15 - 1) + 3 \times 2^3 \div 6 - 18 =$

A: 182 B: 194 C: 196 D: 214 E: NOTA

27. Two airplanes are scheduled to depart at 7 PM (EST). Plane A is flying from Los Angeles to New York, and Plane B is flying from New York to Los Angeles (approx. 2500 miles). Plane A has a speed of 175 mph, while Plane B has a speed of 225 mph. For the flights assume no air resistance, no wind, and no rotation of the earth. At what time do the planes pass each other (in EST)?

A: 12:15 AM B: 12:15 PM C: 2:15 AM D: 1:15 AM E: NOTA

28. Triangular numbers are defined such that the nth number in the sequence is the sum of the first n positive integers up to and including n. What is the 4th triangular number?

A: 4 B: 6 C: 10 D: 15 E: NOTA

29. a is defined as a natural number, b is defined as a whole number, and c is defined an integer. Which of the following expressions could NEVER yield an undefined value?

A: $\frac{a}{b-c}$ B: $\frac{b-c}{a}$ C: $\frac{a-b}{c}$ D: $\frac{c}{a-b}$ E: NOTA

30. A quadratic expression $x^2 + ax + b$ is factorable over the integers. If both a and b are positive prime numbers, then how many possible values of a exist?

A: 0 B: 1 C: 2 D: ∞ E: NOTA

What is the slope of the line $y = \frac{3}{8}x$?

1.

(A) $\frac{3}{8}$ (B) -3 (C) 1 (D) 3 (E) NOTA

2. Khondaker, the knight in shining armor for Asians and aliens everywhere, can fight bad guys at a constant rate of 10 bad guys per minute. At this rate, how many bad guys can he fight in 3600 seconds?

(A) 6 (B) 60 (C) 600 (D) 36000 (E) NOTA

3. Solve for x: $x + 3 = 4x - 9$.

(A) 4 (B) 6 (C) 9 (D) 12 (E) NOTA

4. What is the slope of the line $2y - 9 = 3x + 1$?

(A) $-\frac{2}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) 3 (E) NOTA

5. Find the area of the region bounded by the line $x = 1$, $y = 1$, the y-axis, and the x-axis.

(A) $\frac{1}{2}$ (B) 1 (C) $\frac{3}{2}$ (D) 2 (E) NOTA

6. How many negative integral solutions does $|2x + 3| \leq 5$ have?

(A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA

7. Viet, the crazy crimpy rock climber, decides turn gravity off for a day, so he can climb more easily. This angers Dean, the manager of a local climbing gym, so Dean increases the cost of Viet's monthly climbing membership by 50%. Given that Viet originally paid \$36.20, how much is Viet's new monthly membership?

(A) \$18.10 (B) \$27.15 (C) \$54.30 (D) \$72.40 (E) NOTA

8. $f(x) = x^2 - 5x + 6$ can be factored into the form $a(x - b)(x - c)$. Find abc.

(A) 2 (B) 3 (C) 5 (D) 6 (E) NOTA

9. Which of the following is a subset of the whole numbers?

(A) Real Numbers (B) Natural Numbers
(C) Integers (D) Rational Numbers (E) NOTA

10. Simplify using only positive exponents: $\left(\frac{x^{-3}y}{z^3}\right)\left(\frac{z^{-2}y^2}{x^4}\right)^2$.

(A) $\frac{y^3}{x^8z^5}$ (B) $\frac{y^4}{x^{11}z^7}$ (C) $\frac{y^5}{x^{11}z^7}$ (D) $\frac{y^5}{x^{10}z^7}$ (E) NOTA

11. Find the sum of the real solutions of $|x+2|=4$.

(A) -1 (B) 1 (C) 2 (D) 3 (E) NOTA

12. What is the sum of the solutions of $2x^2+3x+1=0$.

(A) $-3/2$ (B) $3/2$ (C) $2/3$ (D) $-2/3$ (E) NOTA

13. How many times does the graph of $y=x^2+4x+10$ intersect the x-axis?

(A) 3 (B) 2 (C) 1 (D) 0 (E) NOTA

14. Joe can spin a sign at a rate of 5 revolution per minute. How many revolutions can Joe spin the sign during 10 minutes, assuming he keeps a constant rate as previously described.

(A) 34 (B) 45 (C) 50 (D) 55 (E) NOTA

15. If $y=4x+3$ and $y=x+3$ intersect at (a,b), find ab.

(A) 0 (B) 1 (C) 4 (D) 5 (E) NOTA

16. Twice the square of a natural number is equal to the cube of the natural number. What is the natural number?

(A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA

17. $f(n)=4n^2+4n+1$. Find $f(5)$.

(A) 100 (B) 121 (C) 122 (D) 119 (E) NOTA

18. How many positive odd integers less than 99 are there?

(A) 49 (B) 50 (C) 51 (D) 52 (E) NOTA

20. Which of the following must be true for two lines $ay = bx + c$ and $dx = ey + f$ to be parallel?

(A) $b = e$ (B) $b = d$ (C) $\frac{b}{a} = -\frac{d}{e}$ (D) $\frac{b}{a} = \frac{e}{d}$ (E) NOTA

21. Let $a + b + c + d = 75$ for $a, b, c, d \in \mathbb{Z}$ such that the same value is obtained when 4 is added to a, 4 is subtracted from b, 4 is multiplied by c, and d is divided by 4 (i.e. $4+a = b-4 = 4c = d/4$). Find $\frac{ad}{bc}$.

(A) 8 (B) 16 (C) 24 (D) 48 (E) NOTA

22. In Inaville, there are 1000 houses. On average, there are 5 people living in each home in Inaville. How many people live in Inaville?

(A) 1000 (B) 3000 (C) 4500 (D) 5000 (E) NOTA

23. Mr. Scofield believes that the class of 2012 is the "perfect class". Find the sum of the unique prime factors of 2012.

(A) 500 (B) 503 (C) 505 (D) 507 (E) NOTA

For the next two questions: Consider a train that starts at a train station in Maoville and heads to Calculusville. The train travels at a constant rate of 25mph and the cities are 100 miles apart. Note that the train's path from Maoville to Calculusville forms a straight line.

24. How long does it take the train to reach Calculusville (in hours)?

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

25. How far in feet had the train traveled in 4 hours?

(A) 26400 (B) 528000 (C) 5280 (D) 1054000 (E) NOTA

26. Thomas, the pokemon master, wants to give his pokemon cards away to all of his friends. If he wants to give each friend 25 cards, then he is 10 cards short. If he wants to give each friend 20 cards, then he is left with 25 cards. How many friends does he have?

(A) 8 (B) 9 (C) 6 (D) 7 (E) NOTA

27. A school has 1000 students. 600 students take BC Calculus. 200 students take Physics C. 100 students take both BC Calculus and Physics C. How many students take neither BC Calculus nor Physics C?

(A) 500 (B) 200 (C) 300 (D) 700 (E) NOTA

28. Nick has 1L of a solution that contains 40 % alcohol. How much water, in liters, must Nick add to his 1L solution to make a solution that contains 10 % alcohol?

(A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA

29. Helen and Julie have to paint a wall. Julie can paint the wall in four hours working alone and Helen can paint the wall in two hours working alone. Find the number of hours it would take Helen and Julie to paint one wall given that they work at the constant rates described above.

(A) $\frac{4}{3}$ (B) $\frac{3}{4}$ (C) $\frac{2}{3}$ (D) $\frac{3}{2}$ (E) NOTA

30. Evaluate four times the quantity three plus four.

(A) 21 (B) 16 (C) 28 (D) 32 (E) NOTA

1) If k is an integer, which of the following MUST be an integer?

A) $k^k + k + \sqrt{k}$ B) $1 + k + \sqrt{k}$ C) $k + 2^k$ D) $k \times k - 1 + \frac{k-1}{k}$ E) NOTA

2) If k is real, which of the following must be true?

A) $|k - 1| > 1$ C) $3^{2k^2+1} + 1 > 0$ E) NOTA

B) $1^{k+3} > 1$ D) $\frac{2}{k} + \frac{k}{2} = \frac{4+k^2}{2k}$

3) Which of the following is <u>closest</u> to the value of $\frac{2(0.4)^2 + \frac{17}{25}}{2 + \pi - \sqrt{\frac{64}{16}}}$?

A) 0 B) $0.\overline{3}$ C) 0.5 D) 1 E) NOTA

4) Twice a number plus a second number is fourteen. The first number minus eleven times the second is equal to the opposite of three times thirty-six. What is the second number divided by the first?

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

5) Which of the following is NOT a solution of $2x^4 - 3x^3 - 12x^2 + 7x + 6 = 0$?

A) $x = 2$ B) $x = 1$ C) $x = 3$ D) $x = -\frac{1}{2}$ E) NOTA

6) If $f(x) = 2x^2 - 1$, what is $f(x - 1)$ evaluated at $x = 3$?

A) 5 B) $\frac{16}{3}$ C) $\frac{33}{6}$ D) 7 E) NOTA

7) What is the result when $a^2b^2c^7$ is divided by a^3bc^3?

A) abc B) $\frac{a}{bc^4}$ C) $a^5b^3c^{10}$ D) $\frac{bc^4}{a}$ E) NOTA

8) How many of the following statements are always true?

I. The Real numbers are closed over multiplication.

II. There is an infinite number of prime numbers.

III. The rational numbers are closed over division.

IV. All rational numbers can be expressed as the root of a polynomial with real coefficients.

A) 4 B) 3 C) 2 D) 1 E) NOTA

9) The equation $|x^2 + x - 6| = 6$ has four solutions. What is the sum of all four solutions?

A) -2 B) -1 C) 0 D) 1 E) NOTA

10) A jug contains a mixture of 1 part mayonnaise and 3 parts buttermilk. If Jason adds 1 gallon of water, the mixture is now 15% mayonnaise and 45% buttermilk (and 100% not tasty at all). What was the original volume of the mayonnaise and buttermilk mixture before Jason added the water?

A) 1 gallon C) 1.875 gallons E) NOTA

B) 1.5 gallons D) 2.0675 gallons

11) A made-up country that doesn't exist only uses coins in denominations of 2, 7, and 11. What is the smallest amount of money that a citizen of this fictional country can make with these three coins that is divisible by the value of all three kinds of coins?

A) 14 B) 22 C) 77 D) 154 E) NOTA

12) Given that $f(x) = 2x^2 - 7x + 3$, find the values of c that make $f(c) = 0$.

A) 0.5, 3 B) –1.5, 1 C) –0.5, –3 D) –0.5, 2 E) NOTA

For questions 13-14, use the following information:
In economics, supply of a product can be modeled by a linear function with positive slope called $S(x)$ and demand for that product can be modeled by a linear function with negative slope called $D(x)$. For these functions, the x −axis is units of product and the y −axis is US Dollars.

13) If $S(x)$ and $D(x)$ are both plotted on the same coordinate plane, then the point at which they intersect is called "the market price of the product." Call that point P_0. If the supply and demand functions for a sack of potatoes are $S(x) = 0.25x - 2$ and $D(x) = -0.5x + 7$, respectively, what is P_0 of a sack of potatoes?

A) \$12 B) \$9 C) \$7 D) \$1 E) NOTA

14) Suddenly, the demand for potatoes increases rapidly. In terms of the graph of $D(x)$, this corresponds to a shift to the right. If this sudden increase in demand for potatoes causes the y −intercept of $D(x)$ from the previous question to increase by a factor of 1.75, find the new market price P_0 of a sack of potatoes and round to the nearest dollar.

A) \$4 B) \$16 C) \$19 D) \$20 E) NOTA

15) The equation $x^3 - 9x^2 - 26x = 0$ has three solutions. If the solutions are a, b, and c, compute the product abc.

A) 9×26 B) $9 + 26$ C) $\frac{9}{26}$ D) 0 E) NOTA

16) What is the largest number x that makes the following equation true?

$$x^2 - 7x + 8 = -2$$

A) 2 B) 2, 5 C) 5 D) 10 E) NOTA

17) Given that $f(x) = 3x - x^2$ and $g(x) = 2 - 3x$, compute $f\big(g(1)\big) - g\big(f(1)\big)$.

A) –4 B) – 3 C) –1 D) 0 E) NOTA

18) A bookshelf contains four books: an Almanac, a Bestiary, a Cookbook, and a Dictionary. It is known that the Almanac and the Dictionary together weigh 3187g, the Bestiary and the Cookbook together weigh 2118g, and the Almanac and the Cookbook together weigh 1729g. Find the sum of the weight of the Bestiary and the Dictionary.

A) 3847g B) 3576g C) 2798g D) 1738g E) NOTA

19) Find the equation of the line with x–intercept –3 and y–intercept 7.

A) $3x - 7y = -21$ B) $7x - 3y = 21$ C) $-3x + 7y = -21$ D) $7x - 3y = -21$. E) NOTA

20) The lines P and Q cross at a point in the first quadrant. The lines R and S intersect at a point in the third quadrant. Which of the following is NOT a possible location where the midpoint of these intersections lies?

A) Quadrant 1 B) Quadrant 4 C) On one axis D) The Origin E) NOTA

21) The zeroes of $f(x) = 5x^2 - 43x - 70$ are c_1 and c_2. Compute $|c_1 - c_2| + 1$.

A) 9.4 B) 10.4 C) 11.4 D) 12.4 E) NOTA

22) Consider the set $S = \left\{0.98, \ \frac{99}{101}, \ \sqrt{0.98 * 1.02}, \ \sqrt{10} - 2\right\}$. What is the largest element of set S?

A) 0.98 B) $\frac{99}{101}$ C) $\sqrt{0.98 * 1.02}$ D) $\sqrt{10} - 2$ E) NOTA

23) The number 23 is very special. Which of the following is NOT a property of the number 23?

A) 23 is the smallest odd prime that is NOT a twin prime (differs from another prime by 2).

B) The number of positive primes less than 23 is equal to the square root of 64.

C) 23 is the only prime less than 50 whose second digit is exactly one more than its first digit.

D) 23 is the only two-digit prime less than 50 where the sum of the digits is itself prime.

E) NOTA

24) The number 24 is also very special. Which of the following is NOT a property of the number 24?

A) One of the factors of 24 is the first perfect number (a number that is equal to the sum of its proper divisors).

B) 24 is expressible as the factorial of a positive integer, which is: n! = n(n-1)(n-2)…(2)(1).

C) The product of the digits of 24 is a factor of 24, a power of 2, AND one less than a power of 3.

D) Subtracting 1 from each of its divisors (except 1 and 2) yields a prime number.

E) NOTA

25) Solve for x: $\sqrt{x+92}-\sqrt{x-92}=4$. HINT: There is only one solution!

A) 533 B) 529 C) 484 D) 441 E) NOTA

26) How many positive numbers less than 501 are divisible by 3 or 4, but <u>not</u> both?

A) 291 B) 250 C) 209 D) 166 E) NOTA

27) Townsend likes to write CSN math tests, but he always runs out of ideas near the end. When this happens, he likes to make up new math and force the students taking this test to learn it. The function gcf(a, b) is defined as the Greatest Common Factor that a and b share. Townsend came up with the new operation defined by $m \boxminus n = m \times n \div \text{gcf}(m, n) + 1$. Compute $5 \boxminus (7 \boxminus 9)$.

A) 320 B) 321 C) 334 D) 335 E) NOTA

28) If $g(x)=\frac{x^{12}+31}{1+31^x}$, which of the following is equivalent to $g(x)+g(-x)$?

A) $x^{12}+31$ B) $\frac{x^{12}+31}{1+31^x}$ C) $\frac{1}{1+31^x}$ D) $\frac{1+31^x}{x^{12}+31}$ E) NOTA

29) What is the largest integer x that satisfies the compound inequality $\sqrt{2}<x<\sqrt{781}$?

A) 2 B) 7 C) 22 D) 27 E) NOTA

30) Finally! You made it to the end of the test. To celebrate, I'll throw an easy problem at you! What is $\left(\sqrt{16}\right)\times\left(\sqrt{9}\right)\times\left(\sqrt{121}\right)$?

A) 121 B) 132 C) 144 D) 288 E) NOTA