

**Math Superbowl XLVII**  
**Level 3: Secondary Math I Blitz**

**Directions:**

1. Select the most correct answer for each question and mark it on your answer form.
2. No Calculator of any sort are allowed.
3. Note that N.O.T. means "None of these."

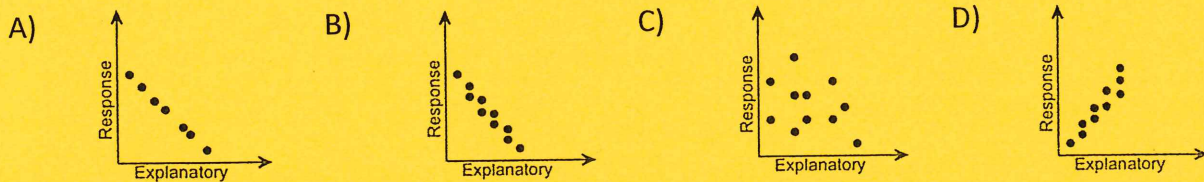
1) The data in the accompanying table represent the ages of the presidents of a country on their first days in office. Which of the following stem and leaf plots correctly displays this data?

42	48	51	52	54	56	57	61	65
43	49	51	54	55	56	57	61	68
45	49	51	54	55	56	58	62	69
46	50	51	54	55	57	60	64	
47	50	52	54	55	57	61	64	

- A) **President Ages**  
 4 | 567899  
 4 | 23  
 5 | 0011112244444  
 5 | 555566677778  
 6 | 0111244  
 6 | 589  
 Legend: 4 | 5 represents 45 years
- B) **President Ages**  
 4 | 23  
 4 | 567899  
 5 | 0011112244444  
 5 | 555566677778  
 6 | 0111244  
 6 | 589  
 Legend: 4 | 2 represents 42 years
- C) **President Ages**  
 4 | 23  
 4 | 567899  
 5 | 0011112244444  
 5 | 555566677778  
 6 | 01112445  
 6 | 89  
 Legend: 4 | 2 represents 42 years
- D) **President Ages**  
 4 | 23  
 4 | 567899  
 5 | 1001112244444  
 5 | 555566677778  
 6 | 0111244  
 6 | 589  
 Legend: 4 | 2 represents 42 years

E) N.O.T.

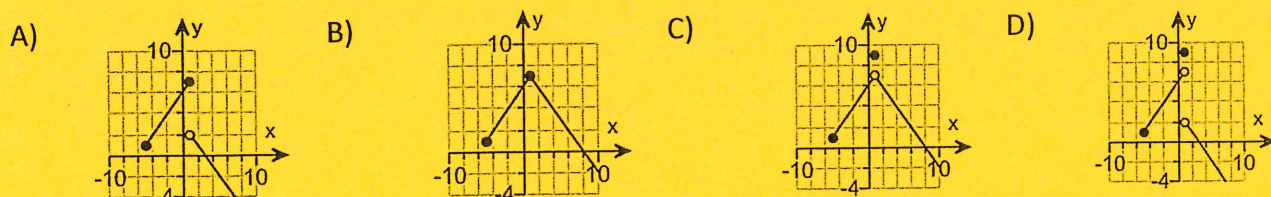
2) Which of the scatter diagrams could indicate a linear correlation coefficient of  $r = -0.025$ ?



E) N.O.T.

3) Which of the following graphs represent the function  $f$  given to the right?

$$f(x) = \begin{cases} x + 6 & \text{if } -5 \leq x < 1 \\ 9 & \text{if } x = 1 \\ -x + 3 & \text{if } x > 1 \end{cases}$$



E) N.O.T.

4) Solve the following inequality:  $|7t - 2| \leq 12$ .

- A)  $[-10/7, 2]$       B)  $(10/7, 2)$       C)  $[10/7, 2]$       D)  $(-10/7, 2)$       E) N.O.T.

5) Solve the following absolute value equation:  $\left| \frac{1}{7} - \frac{9}{14}x \right| + 1 = 6$ .

- A)  $x = -117/5, 1$       B)  $x = 17/2, -1$       C)  $x = 17/55, -1$       D)  $x = -17/3, -1$       E) N.O.T.

6) Find the distance between the points  $(-2, -3)$  and  $(-4, 4)$ .

- A)  $\sqrt{37}$       B)  $\sqrt{53}$       C)  $\sqrt{85}$       D)  $\sqrt{85}$       E) N.O.T.

7) Simplify the following as much as possible:  $\left(\frac{4}{7} + i\right)^2$

- A)  $(-33/49) + (8/7)i$       B)  $16/49 + i$       C)  $11/7$   
D)  $(22/49) + (11/7)i$       E) N.O.T.

8) Find the equation of the line that is perpendicular to the line  $-9x + y = -85$  and contains the point  $(9, -5)$ .

- A)  $x - 9y = -36$       B)  $x - (1/9)y = 36$       C)  $x + (1/9)y = 36$       D)  $x + 9y = -36$       E) N.O.T.

9) The midpoint of the line segment from  $P_1$  to  $P_2$  is  $(-5, 2)$ . If  $P_1 = (-1, 3)$ , what is  $P_2$ ?

- A)  $(9, -1)$       B)  $(-8, 1)$       C)  $(-9, 1)$       D)  $(8, 1)$       E) N.O.T.

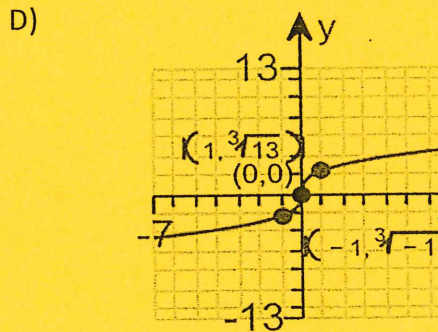
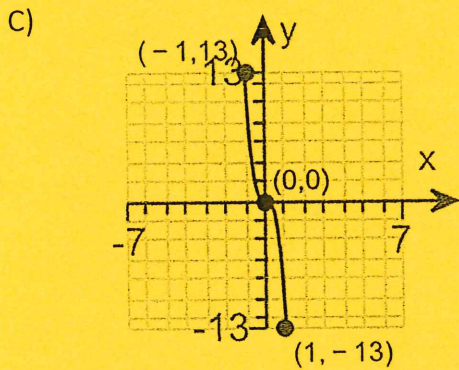
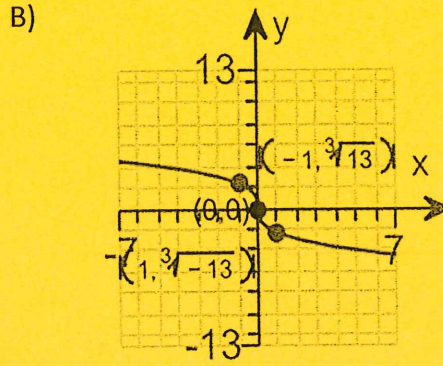
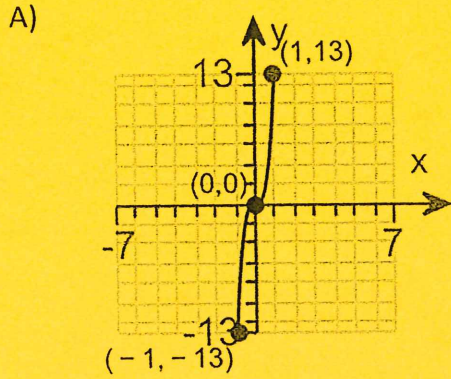
10) Solve the inequality  $\frac{1}{3}(x - 6) > x + 8$ .

- A)  $(-\infty, -15)$       B)  $[15, \infty)$       C)  $(-\infty, -15]$       D)  $(15, \infty)$       E) N.O.T.

11) If  $t(p) = \frac{4p-8}{p-A}$  and  $t(-2) = 2$ , what is the value of  $A$ ?

- A)  $3/2$       B)  $4$       C)  $-8$       D)  $6$       E) N.O.T.

12) Which of the following is the graph of  $f(x) = \sqrt[3]{13x}$ ?



E) N.O.T.

13) Which of the following is a solution of  $\sqrt{2x+3} - \sqrt{x+5} = 1$ ?

A) 3

B) 11

C) 7

D) 13

E) N.O.T.

14) Predict the general term  $a_n$  for the sequence given by  $-1, 2, 5, 8, 11, \dots$

A)  $a_n = 3n - 4$

B)  $a_n = -3n + 4$

C)  $a_n = 3n + 2$

D)  $a_n = -3n - 2$

E) N.O.T.

15) Shown is a side picture of a roof on a building.

What is the slope of this roof?

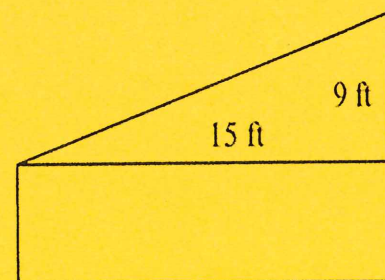
A)  $4/3$

B)  $5/3$

C)  $3/4$

D)  $3/5$

E) N.O.T.



16) Which of the following represents an equation that would be used to solve this problem:

"Luvenia can row 3 mph in still water. She takes as long to row 8 miles upstream as 20 miles downstream. If  $x$  is the speed of the current, how fast is the current?"

- A)  $\frac{8}{3-x} = \frac{20}{3+x}$       B)  $\frac{20}{3-x} = \frac{8}{3+x}$       C)  $\frac{8}{3+x} = \frac{20}{3-x}$       D)  $\frac{8}{3-x} = \frac{-20}{3+x}$       E) N.O.T.

17) How many liters of a 50% acid solution must be mixed with a 10% acid solution to get 280 L of a 40% acid solution?

- A) 309 L      B) 185 L      C) 210 L      D) 160 L      E) N.O.T.

18) Determine the number that will complete the square to solve  $x^2 + 3x - 10 = 0$  after the constant term has been written on the right side. (Do not solve the equation.)

- A) 3/10      B) 10/3      C) 4/9      D) 9/4      E) N.O.T.

19) Find the positive value of  $b$  so that the equation  $p^2 + bp + 16 = 0$  will have exactly one solution.

- A)  $b = 2$       B)  $b = 8$       C)  $b = 4$       D)  $b = 6$       E) N.O.T.

20) A club with 153 members is to choose three officers: president, vice-president, and secretary. If each office is to be held by one person and no person can hold more than one office, in how many ways can those offices be filled?

- A) 3,511,656      B) 3,581,577      C) 459      D) 456      E) N.O.T.

21) The vertices of  $\triangle ABC$  are  $(-15,0)$ ,  $(1,12)$ , and  $(10,0)$ . Find the perimeter.

- A) 50      B) 60      C) 100      D) 132      E) N.O.T.

22) The vertices of  $\triangle ABC$  are  $(-15,0)$ ,  $(1,12)$ , and  $(10,0)$ . Find the area.

- A) 50      B) 60      C) 100      D) 132      E) N.O.T.

23) An expression equivalent to  $\frac{a}{b} - \frac{1}{a} = \frac{c}{b}$  is:

- A)  $ac - bc = ac$       B)  $a^2 + b^2 = ac$       C)  $a = c - 1$       D)  $b = a^2 - ac$       E) N.O.T.

24) Simplify the expression  $8 + \frac{1}{\sqrt{3}-2} - \frac{1}{\sqrt{3}+2}$

A) 4

B) 8

C) 1

D) -2

E) N.O.T.

For problems 25, 26, and 27, use the following information: The average cost of health insurance per year,  $t$  years after 2008, for a family is given by:  $y = 700t + 12700$ .

25) What does the slope 700 represent in this situation?

A) The average cost of health insurance in 2008

B) The average cost of health insurance after 1 year

C) The price increase, per year, for health insurance after 2008

D) The average cost of insurance today

E) N.O.T.

26) What does the y-intercept 12700 represent in this situation?

A) The average cost of health insurance in 2008

B) The average cost of health insurance after 1 year

C) The price increase, per year, for health insurance after 2008

D) The average cost of insurance today

E) N.O.T.

27) In what year will the cost reach \$18,300 per year for a family?

A) 2020

B) 2016

C) 2050

D) 2010

E) N.O.T.

28) Which of the following collections of numbers has a median of 6?

A) 1, 6, 6, 5, 9

B) 7, 6, 5, 4

C) 2, 4, 6, 8

D) 1, 2, 10, 11, 11

E) N.O.T.

29) A line intersects the x and y-axes as shown below. Which of these is a possible equation of the line?

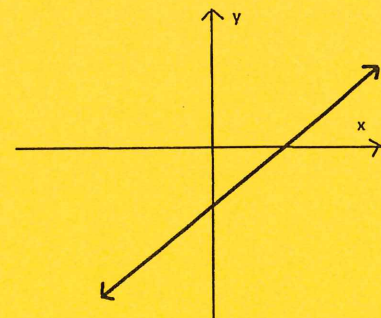
A)  $y = 2x + 4$

B)  $y = -5x$

C)  $y = 3x - 1$

D)  $y = -4x - 3$

E) N.O.T.



30) Solve:  $5^x = \frac{1}{\sqrt{5}}$

- A)  $x = -\frac{1}{2}$       B)  $x = -1$       C)  $x = \frac{1}{5}$       D)  $x = \frac{1}{2}$       E) N.O.T.

31) If a function  $V$  models the value of a certain work of art  $t$  days after it was auctioned, which of the following could be an appropriate domain for  $V$ ?

- A) All real numbers      B) All negative real numbers  
 C) Any integer      D) Any positive integer      E) N.O.T.

32) Solve for  $p$ :  $\frac{k}{p} = m + k$ .

- A)  $\frac{m+k}{k}$       B)  $\frac{k}{m+k}$       C)  $\frac{1}{m}$       D)  $m + 1$       E) N.O.T.

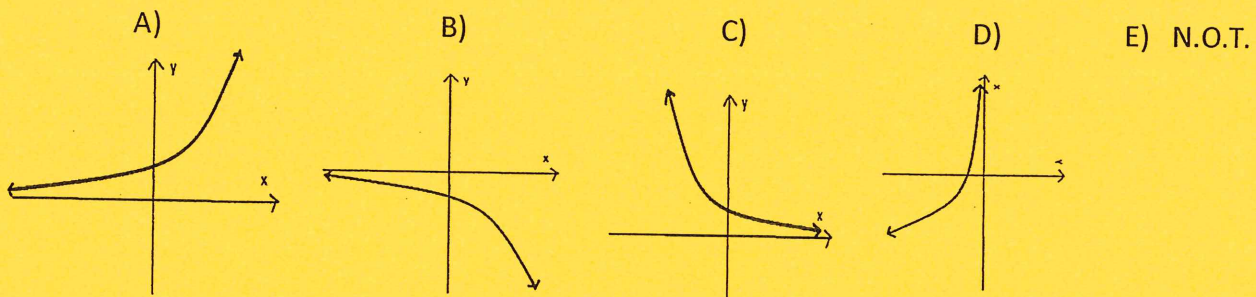
33) Solve the system of equations:  $\begin{cases} 3x + 4y = 4 \\ 2x - 3y = 14 \end{cases}$

- A) (4,2)      B) (-4,-2)      C) (4,-2)      D) (-4,2)      E) N.O.T.

34) Consider the graph of a function  $y = f(x)$ . Which of the following transformations is represented by the graph of  $y = 3 \cdot f(x)$ ?

- A) Vertical stretch by a factor of 3      B) Vertical shrink by a factor of 3  
 C) Horizontal stretch by a factor of 3      D) Horizontal shrink by a factor of 3  
 E) N.O.T.

35) Which of these figures could represent the graph of  $y = 5^{-x}$



36) A triangle on the coordinate plane is rotated  $90^\circ$ , translated 3 units horizontally, then reflected about the  $y$ -axis. Which of the following must be true about the triangle obtained after this sequence of transformations?

- A) The new triangle must have a side length of 3.
- B) The new triangle must be a right triangle.
- C) The new triangle is similar, but not congruent to the original triangle.
- D) The new triangle is congruent to the original triangle.
- E) N.O.T.

37) Which of the following functions represent the sequence: 0, 3, 8, 15, 24, 35, ...

- A)  $f(n) = 3n, n \geq 0$
- B)  $f(n) = 3n - 1, n \geq 1$
- C)  $f(n) = n^2 - 1, n \geq 1$
- D)  $f(n) = 3 - n^3, n \geq 0$
- E) N.O.T.

38) Solve the following inequality:  $|2x + 3| < -9$

- A)  $-6 \leq x \leq 3$
- B)  $-6 \leq x \leq 3$
- C)  $x < 3$
- D)  $x > -6$
- E) N.O.T.

39) A table of values of the function  $y = f(x)$  is given. If the function is linear, what is the value of  $f(2)$ ?

- A) 0
- B)  $-\frac{7}{3}$
- C) -2
- D) -1
- E) N.O.T.

$x$	-7	-4	5	10
$f(x)$	5	3	-3	$-\frac{19}{3}$

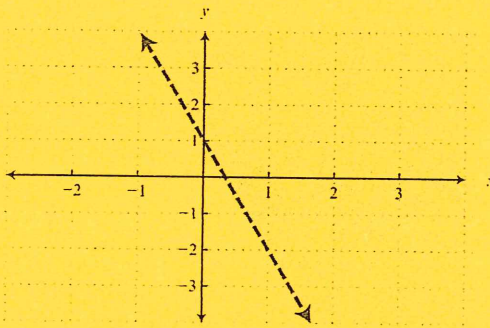
40) If  $x$  is an imaginary number, which of the following is a real number?

- A)  $\sqrt{x}$
- B)  $x^3$
- C)  $\sqrt{-x}$
- D)  $-x^2$
- E) N.O.T.

41) If the line passing through the points  $(a, 3a)$  and  $(2, 7)$  has a slope of -1, the value of  $a$  is

- A)  $\frac{9}{4}$
- B) 0
- C) 6
- D)  $-\frac{9}{4}$
- E) N.O.T.

42) Which inequality is shown in the graph below?



- A)  $x - y > 3$       B)  $y \leq -2x + 5$       C)  $y > -3x + 1$       D)  $y > -3x$       E) N.O.T.

43) If two lines are graphed and we determine that they are perpendicular, then which of the following must be true?

- A) The equations of the lines will have a common solution of  $(-1, -1)$ .  
B) The lines will have slopes which are negative reciprocals.  
C) The lines will have slopes which are negative.  
D) The equations of the lines will have an infinite number of common solutions.  
E) N.O.T.

44) Solve the following equation:  $|x - 3| = |3 - x|$ .

- A) 3      B) 7      C) No solution      D) All real numbers      E) N.O.T.

45) The absolute value of a complex number  $a + bi$  is its distance from the origin. Using the distance formula, we have  $|a + bi| = \sqrt{a^2 + b^2}$ . Find the absolute value of  $|-3 + i|$ .

- A) -3      B) 10      C) 4      D)  $\sqrt{10}$       E) N.O.T.