

Dick Schaff Math Superbowl XLIII
Level 3: Secondary Math I Blitz – 2016

- Directions:** (1) Select the most correct answer for each question and mark it on your answer form.
(2) No calculators of any sort are allowed.
(3) Note that N.O.T. means “None of these.”

1. Solve the following equation for t : $\frac{3}{4}t + 8 = \frac{1}{3}t - 7$
a) -36 b) $-\frac{15}{2}$ c) 12 d) -15 e) N.O.T.

2. Which ordered pair is not in the solution set of $y \geq 2x + 1$?
a) $(1, 4)$ b) $(1, 6)$ c) $(0, 2)$ d) $(2, 5)$ e) N.O.T.

3. A circle has its center at $(6, 7)$ and goes through the point $(2, 4)$. A second circle is known to have one-fourth of the area of the first circle. What is the radius of the second circle?
a) 1 unit b) 1.25 units c) 2 units d) 2.5 units e) N.O.T.

4. Which equation represents a line that is parallel to the line given by $y = \frac{4}{3}x + 7$?
a) $y = \frac{3}{4}x + 9$ b) $y = -\frac{4}{3}x + 9$ c) $y = \frac{4}{3}x + 9$ d) $y = -\frac{3}{4}x + 9$ e) N.O.T.

5. Which equation represents a line that is perpendicular to the line given by $y = \frac{4}{3}x + 7$?
a) $y = \frac{3}{4}x + 9$ b) $y = -\frac{4}{3}x + 9$ c) $y = \frac{4}{3}x + 9$ d) $y = -\frac{3}{4}x + 9$ e) N.O.T.

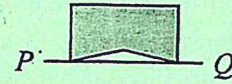
6. In a cup, there are 6 quarters, 5 dimes, 4 nickels, and 10 pennies. If one coin is selected from the cup at random, what is the probability that the coin has the letter “n” in its name?
a) $\frac{14}{25}$ b) $\frac{2}{4}$ c) $\frac{4}{25}$ d) $\frac{14}{11}$ e) N.O.T.

7. A sequence is defined recursively with $f(1) = 4$, $f(n) = f(n - 1) + 3n$. What is the value of $f(5)$?
a) 46 b) 33 c) 24 d) 16 e) N.O.T.

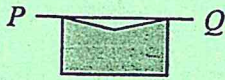
8. Which ordered pair is not in the solution set of $y > -\frac{1}{2}x + 5$ and $y \leq 3x - 2$?
a) $(5, 3)$ b) $(2, 4)$ c) $(3, 4)$ d) $(4, 4)$ e) N.O.T.

9. Which of the following correlation coefficients represents the strongest linear relationship?
a) 0.78 b) 0.29 c) -0.10 d) -0.89 e) N.O.T.

14. Which of the following figures is obtained when the shaded region shown in the figure is reflected about the line segment PQ ?



a)



b)



c)



d)



e) N.O.T.

15. Below is a set of points in the xy -plane.

$$\{(2, 5), (-8, 5), (3, 7), (2, 10), (4, 12)\}$$

Which of the following statements is true?

a) This is a function.

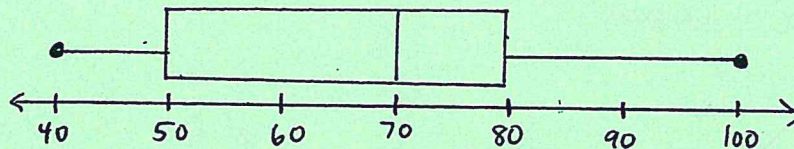
b) It cannot be determined if this is a function.

c) This is not a function because two values of x are associated with the same y -value.

d) This is not a function because two values of y are associated with the same x -value.

e) N.O.T.

16. For the box plot shown below, which statement is false?



a) The IQR is 30.

b) The median score is 70.

c) The third quartile is 80.

d) The range is 60.

e) N.O.T.

17. Juan hiked a trail. After hiking 60% of the length of the trail, he had 8 km left to go. What is the length of the trail?

a) 28 km

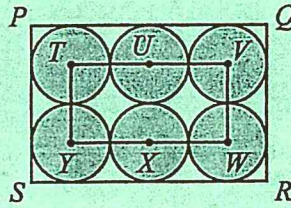
b) $13\frac{1}{3}$ km

c) 11.2 km

d) 20 km

e) N.O.T.

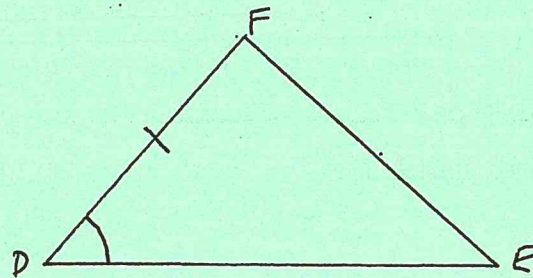
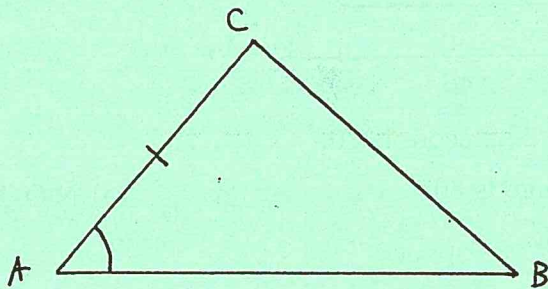
18. In the diagram shown, six identical circles touch the edges of the rectangle $PQRS$, and each circle touches the adjacent circles. The centers $T, V, W,$ and Y of four of these circles form a rectangle, as shown, and the remaining centers U and X lie on this rectangle. If the perimeter of rectangle $TVWY$ is 60 inches, what is the area of $PQRS$?



- a) 600 in^2 b) 1200 in^2 c) 150 in^2 d) 900 in^2 e) N.O.T.
19. The operation ∇ is defined by $x \nabla y = x^2 - y^2$. For example, $3 \nabla 2 = 3^2 - 2^2 = 5$. If $x > 0$ and $x \nabla 6 = 45$, the value of x is
- a) 39 b) 3 c) 9 d) 81 e) N.O.T.
20. Heather has an equal number of dimes and nickels, and no other coins. Her coins have a total value of \$1.50. How many nickels does Heather have?
- a) 4 b) 12 c) 5 d) 10 e) N.O.T.
21. A table of values of a function $y = f(x)$ is given below. If this function is linear, what is the value of $f(8)$?

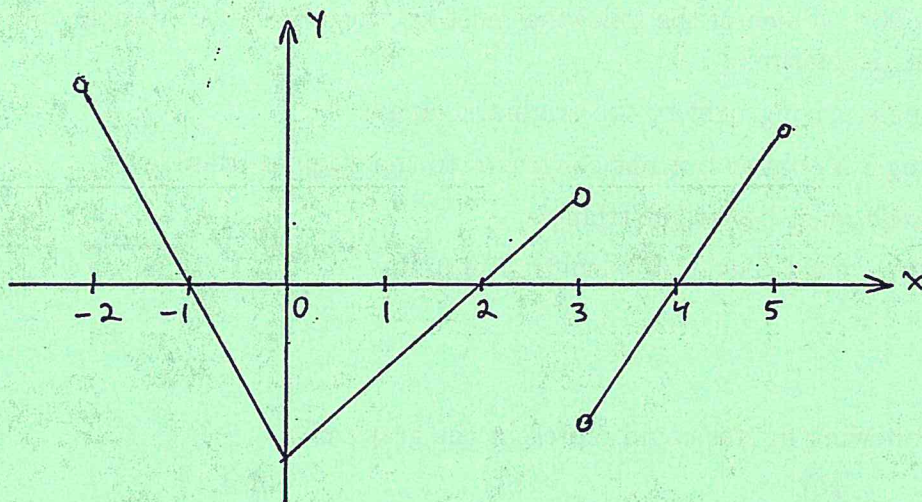
x	-1	1	4	7
$f(x)$	12	7	-0.5	-8

- a) -22 b) -10.5 c) -9 d) -14 e) N.O.T.
22. In the figure below, $\overline{AC} \cong \overline{DF}$, and $\angle A \cong \angle D$. Which additional information would be enough to prove that $\triangle ABC \cong \triangle DEF$?



- a) $\overline{AB} \cong \overline{DE}$ b) $\overline{AB} \cong \overline{BC}$ c) $\overline{BC} \cong \overline{EF}$ d) $\overline{BC} \cong \overline{DE}$ e) N.O.T.

23. A function is graphed in the figure below. Over what interval(s) is the function decreasing?



- a) $(-1, 2)$ only
 b) $(-1, 2)$ and $(3, 4)$
 c) $(0, 3)$ only
 d) $(-2, 0)$ only
 e) N.O.T.

24. Solve the following inequality: $|3x - 7| \leq 12$.

- a) $x \leq \frac{19}{3}$
 b) $-\frac{5}{3} \leq x \leq \frac{19}{3}$
 c) $-\frac{19}{3} \leq x \leq \frac{5}{3}$
 d) $x \leq \frac{5}{3}$
 e) N.O.T.

25. Which of the following triples of numbers could represent the lengths of sides of a triangle?

- a) 2, 2, 5
 b) 1, 4, 6
 c) 3, 3, 6
 d) 3, 7, 11
 e) N.O.T.

26. Which of the following functions represents the sequence 2, 5, 8, 11, 14, 17, ...?

- a) $f(n) = 2 + 3n$, for $n \geq 1$
 b) $f(n) = 2 + 3^n$, for $n \geq 1$
 c) $f(n) = -1 + 3n$, for $n \geq 1$
 d) $f(n) = -1 + 3^n$ for $n \geq 1$
 e) N.O.T.

27. The table below lists the number of people attending the first five games of a high school football team last year. If the attendance for the second game was increased by 30, what effect would this have on the values of the mean and median?

Game	1	2	3	4	5
Attendance	308	122	287	290	345

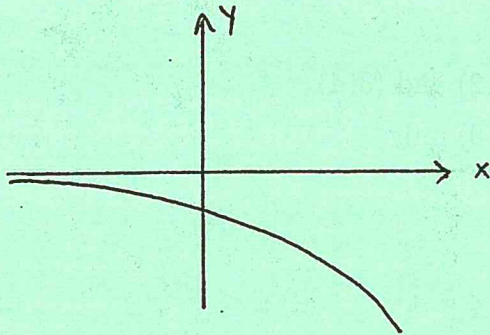
- a) Both the mean and the median would increase.
 b) The mean would decrease, but the median would increase.
 c) The mean would decrease, but the median would not change.
 d) The mean would increase, but the median would decrease.
 e) N.O.T.

28. A triangle on the coordinate plane is reflected across the x -axis, translated 6 units vertically, and rotated by 90° . Which of the following must be true about the triangle obtained after this sequence of transformations?

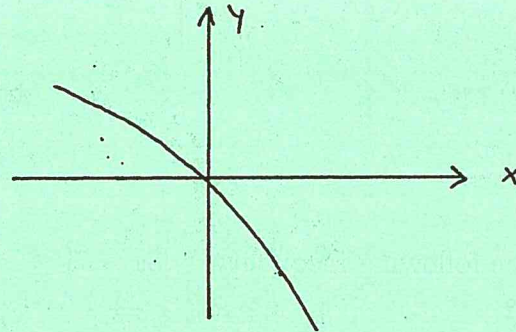
- a) The new triangle is congruent to the original triangle.
- b) The new triangle is similar but not congruent to the original triangle.
- c) The new triangle must be a right triangle.
- d) The new triangle must have a side length of 6 units.
- e) N.O.T.

29. Which of the following figures could represent the graph of $y = -3^x$?

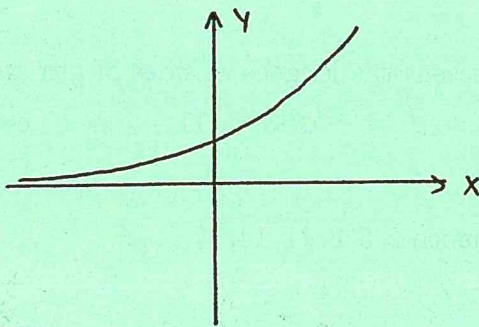
a)



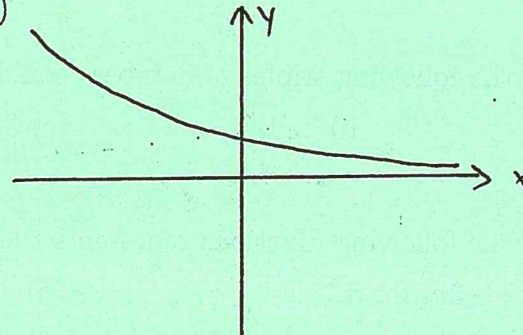
b)



c)



d)



e) N.O.T.

30. Consider the graph of a function $y = f(x)$. How is the graph of $y = f(x - 7)$ related to the graph of $f(x)$?

- a) The graph of $f(x - 7)$ is found by shifting the graph of $f(x)$ up 7 units.
- b) The graph of $f(x - 7)$ is found by shifting the graph of $f(x)$ down 7 units.
- c) The graph of $f(x - 7)$ is found by shifting the graph of $f(x)$ to the left by 7 units.
- d) The graph of $f(x - 7)$ is found by shifting the graph of $f(x)$ to the right by 7 units.
- e) N.O.T.

31. Solve the following system of equations:
$$\begin{cases} x + 2y = 8 \\ 5x - 2y = 4 \end{cases}$$

a) (2, 3)

b) (2, -3)

c) (3, -2)

d) (-3, 2)

e) N.O.T.

32. Solve $A = \frac{1}{3}(x + y + z)$ for z .

a) $z = 3(A - x - y)$

b) $z = \frac{A}{3} - x - y$

c) $z = \frac{A-x-y}{3}$

d) $z = 3A - x - y$

e) N.O.T.

33. Which of the following methods cannot be used to prove that two triangles are congruent?

a) Prove all three sets of corresponding sides are congruent.

b) Prove all three sets of corresponding angles are congruent.

c) Prove that two sides and an included angle of one triangle are congruent to two sides and an included angle of the other triangle.

d) Prove that two angles and an included side of one triangle are congruent to two angles and an included side of the other triangle.

e) N.O.T.

34. If a function P is the profit made by an auto dealership after selling n cars, which of the following would be an appropriate domain for this function?

a) All real numbers

b) Any integer

c) Any positive integer

d) Any negative integer

e) N.O.T.

35. Solve $2^x = \frac{1}{64}$ for x .

a) $x = -3$

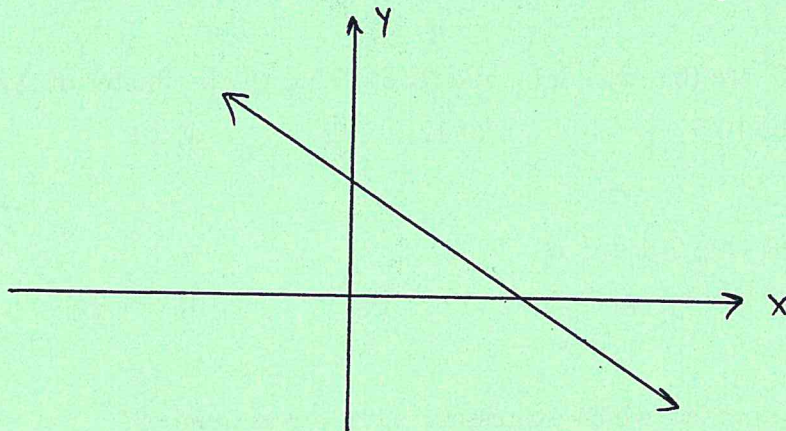
b) $x = -6$

c) $x = 3$

d) $x = 6$

e) N.O.T.

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



a) $y = 3x + 7$

b) $y = -4x - 6$

c) $y = 5x - 2$

d) $y = -10x$

e) N.O.T.

37. Which of the following collections of numbers has a mode of 4?

a) 1, 2, 3, 4

b) 2, 3, 5, 6

c) 1, 4, 4, 5, 7

d) 0, 2, 4, 6, 8

e) N.O.T.

Questions 38, 39, and 40 use the following information: A company purchases a new photocopier. The value y of the copier x years after purchase is given by the linear equation $y = 8000 - 2000x$.

38. What does the slope -2000 represent in this situation?

- a) The original purchase price of the copier.
- b) The amount by which the value of the copier changes each year.
- c) The value of the copier after 1 year.
- d) The value of the copier after 5 years.
- e) N.O.T.

39. What does the coordinate 8000 in the y -intercept represent in this situation?

- a) The original purchase price of the copier.
- b) The amount by which the value of the copier changes each year.
- c) The value of the copier after 1 year.
- d) The value of the copier after 5 years.
- e) N.O.T.

40. In how many years will the copier have no value?

- a) 0 years
- b) 1 year
- c) 2 years
- d) 3 years
- e) N.O.T.

41. The vertices of $\triangle ABC$ are $(0, -2)$, $(3, 1)$, and $(0, 5)$. Find the area of $\triangle ABC$.

- a) 21
- b) 10.5
- c) $12 + 3\sqrt{2}$
- d) 10
- e) N.O.T.

42. The vertices of $\triangle ABC$ are $(0, -2)$, $(3, 1)$, and $(0, 5)$. Find the perimeter of $\triangle ABC$.

- a) 21
- b) 10.5
- c) $12 + 3\sqrt{2}$
- d) 10
- e) N.O.T.

43. An equation equivalent to $\frac{1}{a} + \frac{1}{b} = \frac{1}{c}$ is

- a) $c = a + b$
- b) $c = b - a$
- c) $c = \frac{ab}{a+b}$
- d) $c = \frac{a+b}{a-b}$
- e) N.O.T.

44. If x is a negative real number, which expression is not a real number?

- a) $-x$
- b) $\frac{0}{x}$
- c) $\sqrt{-x}$
- d) $\frac{-x}{0}$
- e) N.O.T.

45. The expression $1 - \frac{1}{1+\sqrt{3}} + \frac{1}{1-\sqrt{3}}$ is equal to

- a) $1 - \sqrt{3}$
- b) 1
- c) $\sqrt{3}$
- d) $1 + \sqrt{3}$
- e) N.O.T.