

Dick Schaff Math Superbowl XLIV
Level 4 Huddle: Secondary Math II – 2017

- 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. The x -coordinate of the x -intercept of $y = 2(x - 4)^2 - 18$ is
a) -1 b) 0 c) 7 d) -18 e) N.O.T.
2. Suppose $\triangle PQR$ is an isosceles triangle with $PQ \cong QR$. If the measure of $\angle P$ is one-third the measure of $\angle Q$, then what is the measure of $\angle R$?
a) 45° b) 30° c) 36° d) 108° e) N.O.T.
3. Which of these ordered pairs is a solution for the system of equations $\begin{cases} y = 0.5x + 1 \\ y = x^2 - 4x + 3 \end{cases}$?
a) $\left(\frac{1}{2}, 4\right)$ b) $(4, 3)$ c) $(-4, -1)$ d) $(-4, 3)$ e) N.O.T.
4. Determine the coordinates of the center of the circle $x^2 + y^2 + 14x - 6y + 54 = 0$.
a) $(-7, 3)$ b) $(14, -6)$ c) $(49, 36)$ d) $(0, 0)$ e) N.O.T.
5. Determine the radius of the center of the circle $x^2 + y^2 + 14x - 6y + 54 = 0$.
a) 1 b) 4 c) 8 d) 54 e) N.O.T.

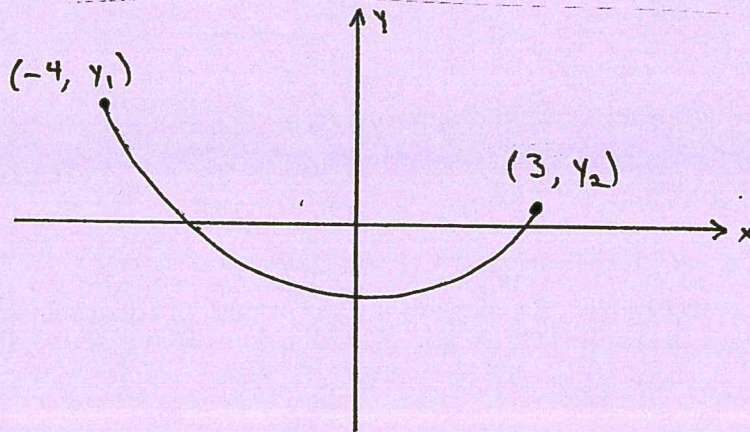
For Questions 6 and 7, the letters $A, B, C, D, E, F, G, H, I, J,$ and K are written on separate pieces of paper and placed in a jar. Two letters are randomly drawn without replacement.

6. What is the probability that both letters chosen are vowels?
a) $\frac{6}{121}$ b) $\frac{3}{11}$ c) $\frac{9}{110}$ d) $\frac{3}{55}$ e) N.O.T.
7. How many of the two-letter combinations drawn from the jar will contain the letter G ?
a) 20 b) 22 c) 18 d) 21 e) N.O.T.
8. What is the volume of a 4-inch tall pyramid with a square base (side length of 6 inches)?
a) 48 in^3 b) 60 in^3 c) 72 in^3 d) 84 in^3 e) N.O.T.

9. In $\triangle ABC$, $\angle A$ is obtuse. Which of the following statements must be true about the sum of the measures of $\angle B$ and $\angle C$?

- a) $m\angle B + m\angle C < 90^\circ$.
- b) $m\angle B + m\angle C = 90^\circ$.
- c) $90^\circ < m\angle B + m\angle C < 180^\circ$.
- d) $m\angle B + m\angle C = 180^\circ$.
- e) N.O.T.

10. The graph of f is given below. What can be said about the average rate of change of f from $x = -4$ to $x = 3$?



- a) The average rate of change is positive.
- b) The average rate of change is negative.
- c) The average rate of change is zero.
- d) Nothing can be said about the average rate of change.
- e) N.O.T.

11. If the side lengths of a cube are doubled, by what factor does the surface area of the cube increase?

- a) 1
- b) 2
- c) 3
- d) 8
- e) N.O.T.

12. Starting with the graph of $y = f(x)$, which of the following would represent the graph obtained by horizontally stretching f by a factor of 3 and shifting the resulting graph down 4 units?

- a) $y = f(3x) + 4$
- b) $y = 3f(x) - 4$
- c) $y = \frac{1}{3}f(x) + 4$
- d) $y = f\left(\frac{1}{3}x\right) - 4$
- e) N.O.T.

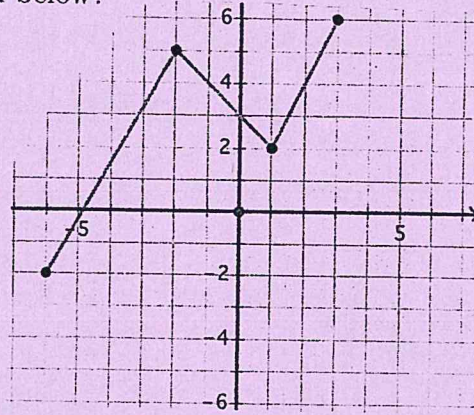
13. Which of the following lines do not intersect the graph of $y = 5(x - 1)^2 - 4$?

- a) $x = 7$
- b) $x = -7$
- c) $y = -2$
- d) $y = -6$
- e) N.O.T.

14. Andrea has a math test at the end of the week. The probability that she studies and passes her math test is $\frac{17}{20}$. Suppose the probability that Andrea studies for the test is $\frac{15}{16}$. What is the probability that Andrea passes her math test, given that she has studied?

- a) $\frac{255}{320}$ b) $\frac{68}{75}$ c) $\frac{7}{80}$ d) $\frac{17}{25}$ e) N.O.T.

15. What is the range of function graphed below?



- a) $[-6, 3]$ b) $[-6, 6]$ c) $[-2, 6]$ d) $[-2, 2]$ e) N.O.T.

16. Harry owns a motorcycle. The current value of the motorcycle is \$6,000. Each year, the motorcycle loses 4% of its value. Which of these represents the value in dollars of the motorcycle in three years?

- a) $6000 - 4(3)$ b) $6000 - 0.04(3)$ c) $6000(0.04)^3$ d) $6000(4)^3$ e) N.O.T.

17. Simplify $81^{3/4}$ as much as possible.

- a) 27 b) 243 c) 9 d) 3 e) N.O.T.

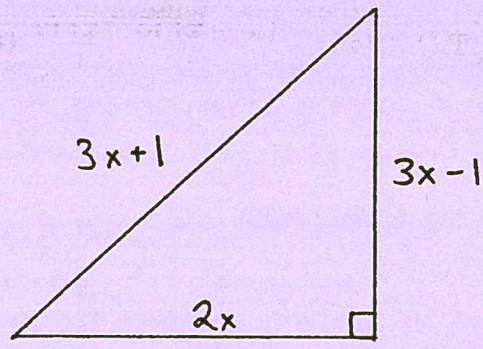
18. Find the solution set of $|x^2 + 7x - 3| = 15$.

- a) $\left\{ \frac{-7 \pm \sqrt{61}}{2} \right\}$ b) $\{-9, -4, -3, 2\}$ c) $\left\{ \frac{-7 \pm \sqrt{37}}{2} \right\}$ d) $\{-2, 3, 4, 9\}$ e) N.O.T.

19. Suppose I purchase 40 stamps. Some of these are 44-cent stamps, while the rest are 20-cent stamps. Suppose x represents the number of 44-cent stamps purchased, and y is the number of 20-cent stamps I bought. If I spend \$16.40 for all 40 stamps, which of the following systems of equations could be used to determine the number of each type of stamp I bought?

- a) $\begin{cases} 44x + 20y = 40 \\ x + y = 16.40 \end{cases}$ b) $\begin{cases} 44x + 20y = 1640 \\ x + y = 40 \end{cases}$ c) N.O.T.
- c) $\begin{cases} 44x + 20y = 40 \\ x + y = 1640 \end{cases}$ d) $\begin{cases} 44x + 20y = 16.40 \\ x + y = 40 \end{cases}$

20. Determine the value of x in the diagram below.



- a) $\frac{3}{2}$ b) $\frac{2}{3}$ c) 3 d) 2 e) N.O.T.

21. If $i = \sqrt{-1}$, simplify $\frac{3-i}{4+5i}$.

- a) $\frac{7-19i}{41}$ b) $\frac{7+19i}{9}$ c) $\frac{17-4i}{41}$ d) $\frac{17+4i}{9}$ e) N.O.T.

22. What is the maximum value of $f(x) = -3x^2 + 6x - 4$?

- a) -3 b) -4 c) 4 d) 1 e) N.O.T.

23. If $x = -7 + 4i$ is a root of a quadratic function $f(x) = ax^2 + bx + c$, what is a second root of f ?

- a) There is not enough information to find another root.
b) $x = 7 - 4i$
c) $x = -7 - 4i$
d) $x = 7 + 4i$
e) N.O.T.

24. Given $i = \sqrt{-1}$, consider all of the numbers $i, i^2, i^3, \dots, i^{2017}$. How many of these numbers are equal to 1?

- a) 502 b) 504 c) 506 d) 508 e) N.O.T.

25. In $\triangle ABC$, let P be the midpoint of AB , and let Q be the midpoint of BC . Which of these statements is not true?

- a) PQ is parallel to AC .
b) The length of PQ is half of the length of AC .
c) $\triangle ABC$ is similar to $\triangle PBQ$.
d) $BP \cong BQ$
e) N.O.T.

26. Factor $x^2 + 25$.

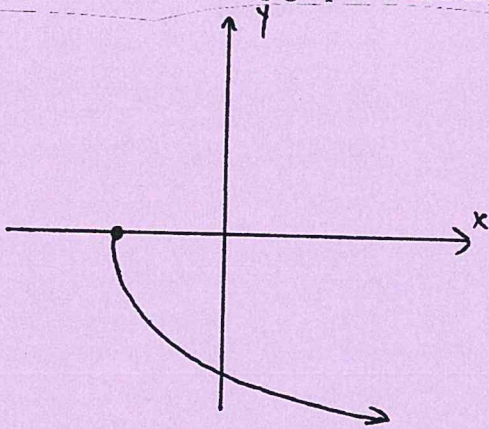
- a) $(x + 5)(x - 5)$
c) $(x - 5i)(x - 5i)$

- b) $(x + 5)(x + 5)$
d) $(x + 5i)(x + 5i)$

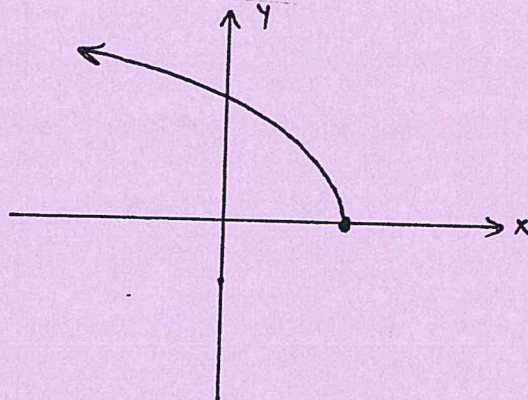
e) N.O.T.

27. Which of the following graphs could represent the function $f(x) = -\sqrt{x - 9}$?

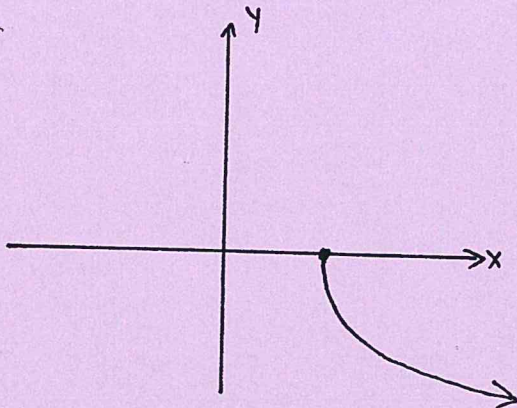
a)



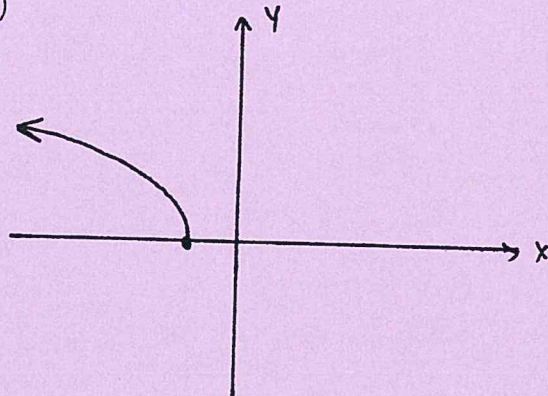
b)



c)



d)



e) N.O.T.

28. If $f(x) = x + 2$ and $g(x) = |x| + 5$, what is the value of $f(g(-2))$?

a) 0

b) -1

c) 5

d) 9

e) N.O.T.

29. Thomas borrowed \$1,000 from his parents to buy a car so he could drive to work. He made a deal to pay them back by making weekly payments. His first payment will be \$3, and each payment will be \$4 more than the previous payment. If n represents the number of payments he has made, which of the following expressions describes how much Thomas still owes his parents while he is still in debt with them?

a) $3 + 4n$ dollars

b) $3 + 4(n - 1)$ dollars

c) $1000 - (3 + 4n)$ dollars

d) $1000 - (3 + 4(n - 1))$ dollars

e) N.O.T.

30. Simplify as much as possible: $(13y^2 - 2y + 9) - (8y^2 - 12y + 1) + (3y - 4)(6y + 5)$.

a) $23y^2 + y - 12$

b) $23y^2 - 23y - 10$

c) $23y^2 + 10y + 8$

d) $39y^2 - 23y - 10$

e) N.O.T.

