Dick Schaff Math Superbowl XLV
Level 4 Huddle: Secondary Math II – 2018

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. If a and b are real numbers and $(a+b)+5i = 9+ai$, what is the value of b?

   a) 9 b) 8 c) 5 d) 4 e) N.O.T.

2. What is the rate of change of $f(t) = t^3 - 2t + 7$ over the t-interval $[1, 4]$?

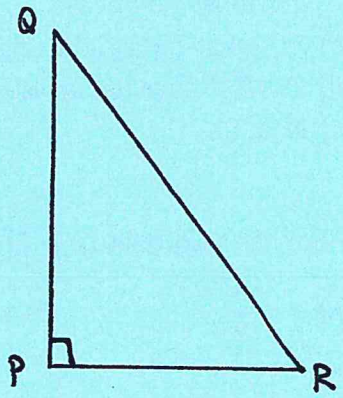
   a) 19 b) $\frac{74}{3}$ c) 21 d) $\frac{64}{3}$ e) N.O.T.

3. A number n is increased by 8. If the cube root of that result equals -0.5, what is the value of n?

   a) -7.5 b) -7.875 c) -8.5 d) -8.125 e) N.O.T.

4. In the figure shown to the right, if $\frac{PQ}{QR} = \frac{2}{3}$, what is the value of $\tan(\theta)$?

   a) $\frac{3}{\sqrt{5}}$ b) $\frac{\sqrt{5}}{2}$
   c) $\frac{2}{\sqrt{5}}$ d) $\frac{\sqrt{5}}{3}$ e) N.O.T.



5. A parallelogram has side lengths 19 cm and 24 cm. Which of the following could not be the length of one of the diagonals of the parallelogram?

   a) 19 cm b) 14 cm c) 46 cm d) 35 cm e) N.O.T.

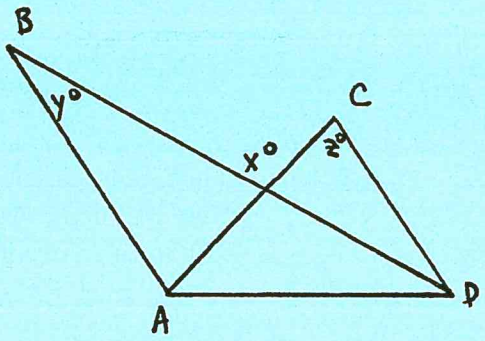
6. A game has two spinners, each of which are independent from each other. For the first spinner, the probability of landing on blue is $\frac{4}{5}$. For the second spinner, the probability of landing on blue is $\frac{1}{7}$. What is the probability that the first spinner lands on blue and the second spinner does <u>not</u> land on blue?

   a) $\frac{1}{35}$ b) $\frac{4}{35}$ c) $\frac{33}{35}$ d) $\frac{11}{35}$ e) N.O.T.

7. What is the range of the function $f(x) = -3(x+4)^2 - 1$?

   a) $[-4, -1]$ b) $(-\infty, -1]$ c) $[1, \infty)$ d) $[-3, 1]$ e) N.O.T.

8. In the figure shown to the right, $\overline{AB}$ is parallel to $\overline{CD}$. What is the value of x° in terms of y° and z°?



a) $180^\circ - y^\circ - z^\circ$ b) $180^\circ + y^\circ - z^\circ$ c) $2y^\circ + z^\circ$
d) $y^\circ + z^\circ$ e) N.O.T.

9. If $i = \sqrt{-1}$, simplify $\dfrac{2+4i}{-3+i}$.

a) $\dfrac{1-7i}{4}$ b) $\dfrac{6+10i}{9}$ c) $\dfrac{6-10i}{5}$ d) $\dfrac{-1-7i}{5}$ e) N.O.T.

10. If $\sin(\theta) = 0.28$, then what is the value of $\cos(90^\circ - \theta)$?

a) 0.28 b) 0.72 c) -0.28 d) -0.72 e) N.O.T.

11. In ΔABC, $\angle A$ and $\angle B$ are both acute. Which of the following statements must be true?

a) $\angle C$ must also be acute.
b) $\angle C$ must be obtuse.
c) $\angle C$ must be a right angle.
d) ΔABC must be an isosceles triangle.
e) N.O.T.

12. For the parabola $(x-7)^2 = 10(y+3)$, what is the equation of the directrix?

a) $x = \dfrac{9}{2}$ b) $x = \dfrac{19}{2}$ c) $y = -\dfrac{11}{2}$ d) $y = \dfrac{1}{2}$ e) N.O.T.

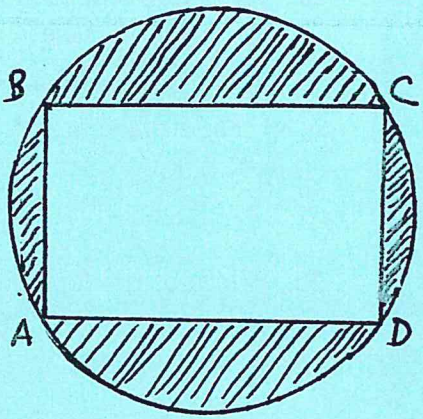
13. When two parallel lines are cut by a transversal, what is false about the angles that are formed?

a) Pairs of alternate exterior angles are congruent.
b) Pairs of alternate interior angles are supplementary.
c) Pairs of corresponding angles are congruent.
d) Interior angles on the same side of the transversal are supplementary.
e) N.O.T.

14. Simplify as much as possible: $(18x^2 - 4x + 7) - (5x^2 + 6x + 1) + (3x + 2)(11x - 5)$

a) $46x^2 + 9x - 4$ b) $13x^2 + 4x + 3$
c) $13x^2 + 16x + 5$ d) $46x^2 + 2x - 4$ e) N.O.T.

15. Rectangle $ABCD$ is inscribed in the circle shown to the right. If the length of side $\overline{AB}$ is 5 and the length of side $\overline{BC}$ is 12, what is the area of the shaded region?



a) $\frac{13\pi}{2} - 60$ b) $\frac{169\pi}{2} - 60$

c) $\frac{13\pi}{4} + 60$ d) $\frac{169\pi}{4} - 60$ e) N.O.T.

16. Consider the following table of values of a function f:

x	0	2	4	8	16
$f(x)$	18	17	16	14	10

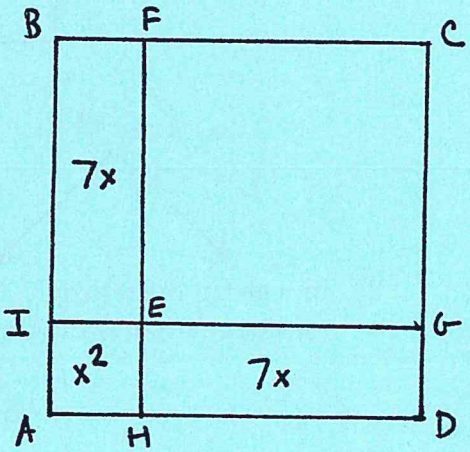
Which of the following best describes the type of function represented by this data?

a) Linear b) Quadratic c) Exponential d) Constant e) N.O.T.

17. In a coordinate plane, the vertices of a given triangle are located at $(\sqrt{2}, 0)$, $(2, \sqrt{10})$, and $(5, 0)$. What is the area of this triangle?

a) $\frac{\sqrt{10}(5-\sqrt{2})}{2}$ b) $\frac{3\sqrt{10}}{2}$ c) $\frac{\sqrt{10}-5\sqrt{2}}{2}$ d) $\frac{5\sqrt{10}}{2}$ e) N.O.T.

18. The figure shows a square region $ABCD$ divided into four rectangular regions, three of which have areas $7x$, $7x$, and x^2, as in the figure. The regions $AIEH$ and $CGEF$ are squares, and the area of $ABCD$ is 64. What is the area of $CGEF$?



a) 14 b) 7

c) 49 d) 28 e) N.O.T.

19. Before 1990, telephone area codes consisted of a digit from 2 to 9, followed by either a 0 or 1, and then followed by a third digit. If such an area code is selected at random, what is the probability that the area code starts and ends with an odd number?

a) $\frac{11}{160}$ b) $\frac{1}{20}$ c) $\frac{1}{2}$ d) $\frac{11}{20}$ e) N.O.T.

20. What is the midpoint of the line segment with endpoints (7.2, 5.4) and (−1, 12)?

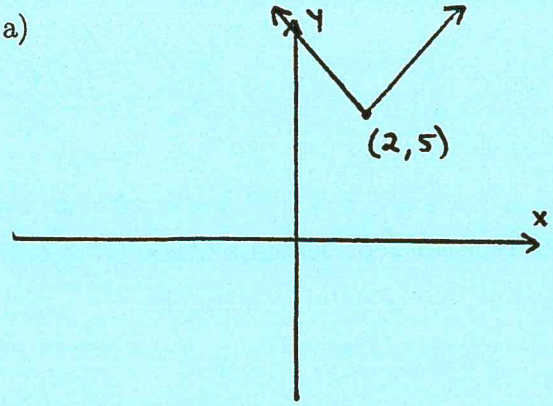
a) (3.1, 8.7) b) (6.2, 17.4) c) (6.7, 11.4) d) (4.1, 9) e) N.O.T.

21. The lengths of each side of a rectangular solid is doubled. By how much does the surface area of the solid increase?

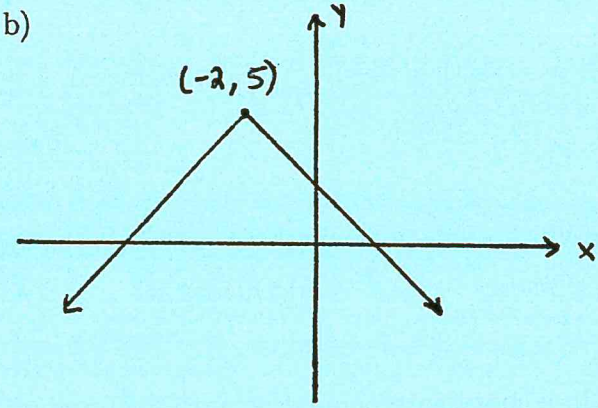
a) The surface area is doubled.
b) The surface area is tripled.
c) The surface area is multiplied by 4.
d) The surface area is multiplied by 8.
e) N.O.T.

22. Which of the following could represent the graph of $y = -|x + 2| + 5$?

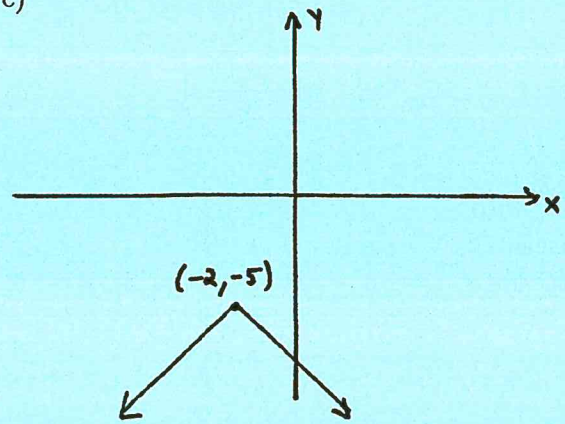
a)



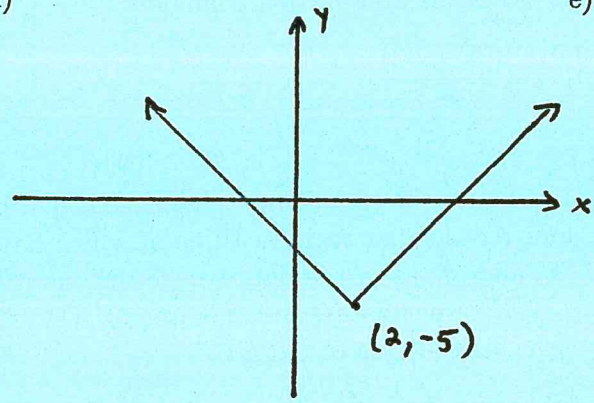
b)



c)



d)



e) N.O.T.

23. In a group of 10 people, 60% have brown eyes. Two people are to be selected from this group at random. What is the probability that neither person selected will have brown eyes?

a) $\frac{3}{25}$
b) $\frac{2}{15}$
c) $\frac{1}{3}$
d) $\frac{1}{5}$
e) N.O.T.

24. If $\sin(\theta) = 0.4$ and θ is a second-quadrant angle, what is the value of $\cos(\theta)$?

a) $-\sqrt{0.6}$
b) $-\sqrt{0.84}$
c) $\sqrt{0.6}$
d) $\sqrt{0.84}$
e) N.O.T.

25. The sum of two roots of a quadratic equation is 5 and their product is -6. Which of the following could be the quadratic equation?

a) $x^2 - 5x + 6 = 0$
b) $x^2 - 6x + 5 = 0$
c) $x^2 - 6x - 5 = 0$
d) $x^2 - 5x - 6 = 0$
e) N.O.T.

26. What is the radius of a circle given by the equation $x^2 + 4x + y^2 - 10y = -1$?

a) 3 b) 1 c) $2\sqrt{7}$ d) $\sqrt{30}$ e) N.O.T.

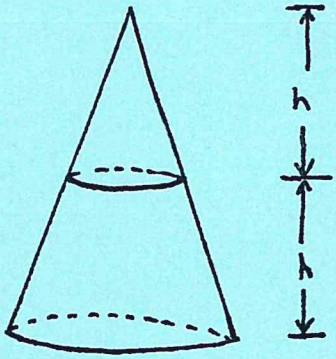
27. Which of the following is a trinomial with degree 8?

a) $5x^2 + 8y^7 - x^3$ b) $3x^3 + 8$
c) $x^5y^3 - 3x^7$ d) $12x^8 + 19x^{10} - 3x^4$ e) N.O.T.

28. Factor $x^4 - 81$ as far as possible.

a) $(x^2 - 9)(x^2 + 9)$ b) $(x - 9)(x + 9)(x - 3)(x + 3)$
c) $(x - 3)(x + 3)(x - 3i)(x + 3i)$ d) $(x - 9)(x + 9)(x - 9i)(x + 9i)$ e) N.O.T.

29. The right circular cone (shown to the right) is sliced horizontally to form two pieces, each of which has the same height. What is the ratio of the radius of the base of the top piece to the radius of the larger base of the bottom piece?



a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{6}$
d) $\frac{1}{7}$ e) N.O.T.

30. Refer to the sliced cone in Problem 29. What is the ratio of the volume of the top piece to the volume of the bottom piece?

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{6}$ d) $\frac{1}{7}$ e) N.O.T.