

Dick Schaff Math Superbowl XLVI
Level 5 Huddle: Secondary Math III – 2019

- 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 for x in the following equation: $e^{6x} = 2019$.

- a) $x = \frac{\ln(2019)}{6}$ b) $x = \frac{6}{\ln(2019)}$ c) $x = \frac{\ln(6)}{2019}$ d) $x = \frac{2019}{\ln(6)}$ e) N.O.T.

2. The graph of which equation is an ellipse?

- a) $3x^2 + 4 = 3y^2$ b) $6x + 7y = 9$
c) $xy = 19$ d) $9x^2 + 4y^2 = 49$ e) N.O.T.

3. Megan deposited \$6000 into a savings account that annually earns 3% interest, compounded continuously. Which of the following expressions represents the amount of money in Megan's account after 7 years?

- a) $\$6000e^{7(3)}$ b) $\$6000e^{0.07(0.03)}$ c) $\$6000(2)^{0.03(7)}$ d) $\$6000(2)^{3(7)}$ e) N.O.T.

4. Which of the following trigonometric functions has a period of $\pi/4$ and an amplitude of 8?

- a) $y = -8\sin(8x)$ b) $y = 8\sin\left(\frac{1}{2}x\right)$
c) $y = -8\sin(2x)$ d) $y = 4\sin(8x)$ e) N.O.T.

5. Let $f(x) = x^2$. Which of the following is equivalent to $\frac{f(4+h) - f(4)}{h}$?

- a) $\frac{h^2 - 16}{h}$ b) h c) 1 d) $8 + h$ e) N.O.T.

6. For normally distributed data, which of the following describes the meaning of a z-score of -0.9 for a given observation?

- a) The data set has a median of 0.9.
b) The data set has a mean of 0.9.
c) The observation is 0.9 standard deviations above the mean.
d) The observation is 0.9 standard deviations below the mean.
e) N.O.T.

7. For which value of x is the expression $\frac{\cos(x)}{1 + 2\sin(x)}$ undefined?
- a) $x = 120^\circ$ b) $x = 180^\circ$ c) $x = 225^\circ$ d) $x = 270^\circ$ e) N.O.T.
8. If $f(x) = \sqrt[3]{x^3 + 1}$, what is the value of $f^{-1}(4)$?
- a) $\sqrt[3]{63}$ b) $\sqrt[3]{65}$ c) $\sqrt[3]{73}$ d) 5 e) N.O.T.
9. Which of the following is not true about the function $g(x) = -x + 8$?
- a) The graph of $g(x)$ can be obtained by shifting the graph of $f(x) = -x$ up by 8 units.
b) The graph of $g(x)$ can be obtained by shifting the graph of $f(x) = -x$ to the right by 2 units and up by 6 units.
c) The graph of $g(x)$ can be obtained by shifting the graph of $f(x) = -x$ to the right by 8 units.
d) The graph of $g(x)$ can be obtained by shifting the graph of $f(x) = -x$ to the left by 4 units and up by 12 units.
e) N.O.T.
10. What is the diameter of a circle that has an area of $49\pi \text{ cm}^2$?
- a) 7 cm b) 3.5 cm c) 24.5 cm d) 14 cm e) N.O.T.
11. Which of the following geometric shapes cannot be a cross-section obtained by the intersection of a plane and a right circular cylinder with finite height?
- a) Circle b) Parabola c) Ellipse d) Rectangle e) N.O.T.
12. Which of the following must be true about a function $f(x)$ and its inverse $f^{-1}(x)$?
- a) If f is an increasing function, then f^{-1} must be a decreasing function.
b) If f has an x -intercept at $(3, 0)$, then f^{-1} has a y -intercept at $(0, -3)$.
c) If f has domain $[0, 5]$, then f^{-1} has range $[-5, 0]$.
d) The graphs of f and f^{-1} can never intersect.
e) N.O.T.
13. The line with equation $y = 7$ is graphed on the same xy -plane as the circle with center $(4, 5)$ and radius 3. What are the x -coordinates of the points of intersection of the line and the circle?
- a) $x = 4 \pm \sqrt{7}$ b) $x = 1, 7$ c) $x = 2, 8$ d) $x = 4 \pm \sqrt{5}$ e) N.O.T.
14. Determine all solutions of $2\log_5(x) = 3\log_5(4)$.
- a) $x = \pm 8$ b) $x = 6$ c) $x = 8$ d) $x = 32$ e) N.O.T.

19. Simplify as far as possible: $\frac{4x^2 - 100}{x^2 + x - 6} \div \frac{20 - 4x}{2x^2 - 9x + 10}$

a) $\frac{(2x - 5)(x + 5)}{x - 2}$

b) $\frac{(5 - 2x)(x + 5)}{x + 3}$

c) $\frac{(2x - 5)(x - 5)}{x - 3}$

d) $\frac{(5 - 2x)(x - 5)}{4(x - 2)}$

e) N.O.T.

20. The equation $x^2 + y^2 - 4x + 2y = 0$ represents the graph of a circle with what properties?

a) Center at the point $(2, -1)$ and radius $\sqrt{5}$.

b) Center at the point $(2, -1)$ and radius 5.

c) Center at the point $(-2, 1)$ and radius $\sqrt{5}$.

d) Center at the point $(-2, 1)$ and radius 5.

e) N.O.T.

21. A principal wants to survey 150 students to determine which electives to offer during the next school year. There are 1,800 students in the school. Which procedure could the principal use to select a sample using a systematic random sample?

a) Obtain a list of students. Start with the eighth student, and select every twelfth student until 150 students have been selected.

b) Select the first 150 students who enter the school at the start of a school day.

c) Choose the fifth student that enters the cafeteria for lunch, and then select every third student who enters the cafeteria until 150 students have been selected.

d) Place students' names on slips of paper and select 150 slips.

e) N.O.T.

22. Which statement is true about the roots of a quadratic equation $ax^2 + bx + c$, $a \neq 0$?

a) The sum of the roots is always a real number.

b) The sum of the roots is always a rational number.

c) There are always two roots that are not equal to each other.

d) There is always one positive root and one negative root.

e) N.O.T.

23. A student put the tip of her pencil on the outer edge of a graph of the unit circle at the point $(0, -1)$. She moved her pencil tip along the edge of the circle, moving counterclockwise through an angle of $\frac{4\pi}{3}$ radians. At what angle of the unit circle did the student's pencil tip stop?

a) $\frac{7\pi}{6}$

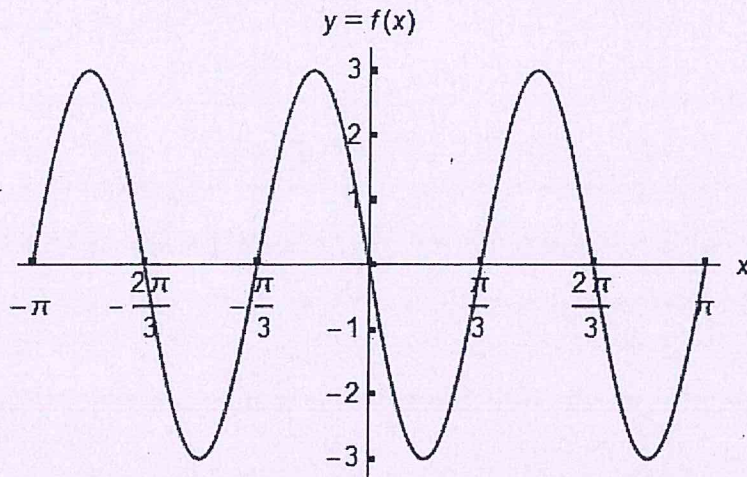
b) $\frac{5\pi}{3}$

c) $\frac{\pi}{3}$

d) $\frac{5\pi}{6}$

e) N.O.T.

24. Determine the equation for the function shown in the graph below.



a) $y = 3 \sin\left(\frac{2\pi}{3}x\right)$

b) $y = 3 \cos\left(\frac{2\pi}{3}x\right)$

c) $y = -3 \sin(3x)$

d) $y = -3 \cos(3x)$

e) N.O.T.

25. If $x - 2$ is a factor of $x^3 + kx^2 + 12x - 8$, then what must be the value of k ?

a) -6

b) -3

c) 2

d) 3

e) N.O.T.

26. Find the solution set of the inequality $-2x^2 + 3x + 5 > 0$.

a) $\{x \mid -1 < x < 2.5\}$

b) $\{x \mid -2.5 < x < 1\}$

c) $\{x \mid x < -1 \text{ or } x > 2.5\}$

d) $\{x \mid x < -2.5 \text{ or } x > 1\}$

e) N.O.T.

27. Which of the following is equivalent to $\log(a^2 - b^2)$?

a) $\log(a^2) - \log(b^2)$

b) $\log\left(\frac{a^2}{b^2}\right)$

c) $\log\left(\frac{a+b}{a-b}\right)$

d) $\log(a+b) + \log(a-b)$

e) N.O.T.

28. Which of the following statements is true about the symmetry of the function $f(x) = \frac{x^5}{1+x^3}$?

a) It is an odd function.

b) It is neither an even nor an odd function.

c) It is both an odd and even function.

d) It is an even function.

e) N.O.T.