

Dick Schaff Math Superbowl XLIV
Level 5 Blitz: Secondary Math III – 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.”

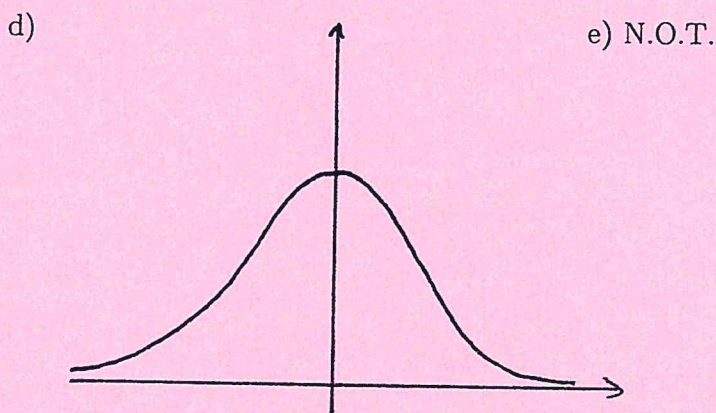
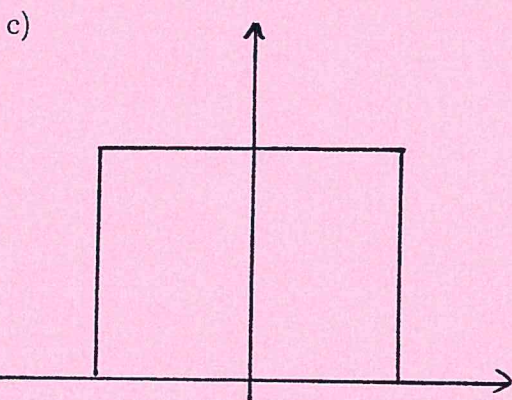
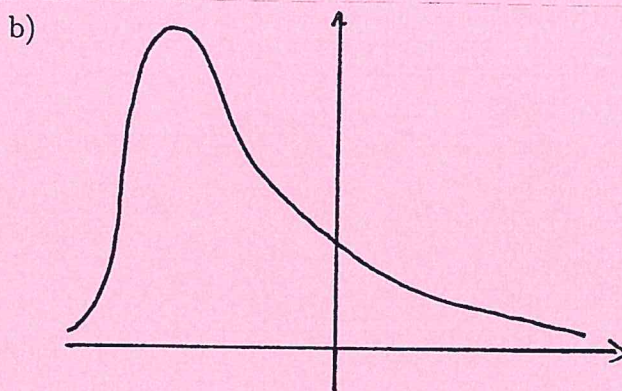
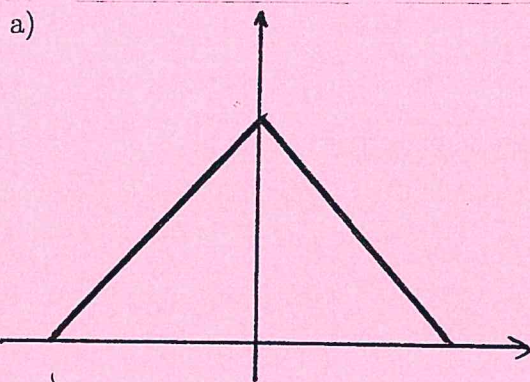
1. The remainder when $2x^3 + 3x^2 - 2x + 3$ is divided by $x + \frac{1}{2}$ is

- a) $\frac{3}{2}$ b) $\frac{9}{2}$ c) $\frac{1}{2}$ d) $\frac{-1}{2}$ e) N.O.T.

2. Which of the following geometric shapes cannot be a cross-section obtained by the intersection of a plane with a right circular cone?

- a) Parabola b) Hyperbola c) Circle d) A single point e) N.O.T.

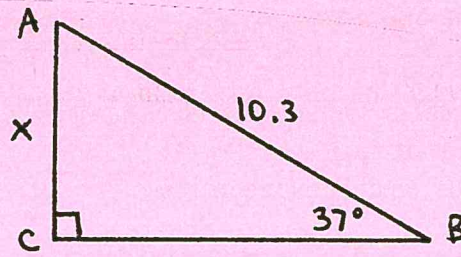
3. Which of the following graphs represents the normal distribution curve?



4. The domain of the function $f(x) = \frac{1}{\sqrt{x^2 - 2x - 24}}$ is:

- a) $(-\infty, \infty)$ b) $(-\infty, -4) \cup (6, \infty)$ c) N.O.T.
c) $(-\infty, -4] \cup [6, \infty)$ d) $(-4, 6)$

5. For the given triangle, determine the exact value of x .



- a) $x = 10.3 \cos(37^\circ)$ b) $x = 10.3 \sec(37^\circ)$
 c) $x = 10.3 \sin(37^\circ)$ d) $x = 10.3 \csc(37^\circ)$ e) N.O.T.

6. Which of the following polynomials has roots i , $-i$, 3 , and -2 ?

- a) $x^4 + x^3 - 5x^2 + x - 6$ b) $x^4 - x^3 - 5x^2 - x - 6$
 c) $x^4 - 2x^3 - 6x - 12$ d) $x^4 + x^3 + 5x^2 + x - 12$ e) N.O.T.

7. Simplify $\frac{x^{-1} + y^{-1}}{x^{-2} - y^{-2}}$.

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

8. A student reporter wants to know the percentage of college students at Stanislaus State that would be in favor of a small raise in student tuition to update the college facilities. Who would represent her population if she were to take a poll?

- a) All people in California.
 b) All adults in California.
 c) All students over 21 years old at Stanislaus State.
 d) A random sample of students at Stanislaus State.
 e) N.O.T.

9. If $f(x) = 2x^2 - x$, then $\frac{f(x+h) - f(x)}{h}$ is:

- a) $\frac{2x^2 + 4xh - h^2 - 2x}{h}$ b) $2x^2 + 4x + h - 2x$
 c) 1 d) $4x + 2h - 1$ e) N.O.T.

10. Find the solution set of the radical equation $\sqrt{3x+1} = 2x$.

- a) $\left\{1, -\frac{1}{4}\right\}$ b) $\{\pm 1\}$ c) $\{1\}$ d) $\{0, 1\}$ e) N.O.T.

20. Find the solution set of $|x^2 - 5x + 6| + 1 = 0$.

- a) $\{2, 3\}$ b) $\{1, 4\}$ c) $\{-2, -3\}$ d) $\left\{\frac{5 \pm 2i\sqrt{6}}{2}\right\}$ e) N.O.T.

21. In a set of test scores that are normally distributed, a test score of 76 is three standard deviations below the mean. A score of 88 is one standard deviation above the mean. What is the mean of the data?

- a) 79 b) 82 c) 84 d) 85 e) N.O.T.

22. Simplify as far as possible: $\left(\frac{y^2 + y}{3xy}\right) \left(\frac{3x + 3}{y^2 + 2y + 1}\right)$.

- a) $\frac{1}{y}$ b) $\frac{3}{y + 1}$ c) $\frac{3}{2y + 1}$ d) $\frac{1}{xy}$ e) N.O.T.

23. After sampling the weights of 40 high school football players, a mean of 181.5 pounds is obtained. A 90% confidence interval for the data is (158.4, 204.6). What is the margin of error?

- a) ± 13.2 b) ± 23.1 c) ± 27.4 d) ± 32.5 e) N.O.T.

For Questions 24 - 27, consider the rational function $f(x) = \frac{x^2 - 2x - 8}{x^2 + 3x - 10}$.

24. Which of the following is an x -intercept of f ?

- a) $(0, 0.8)$ b) $(0, -8)$ c) $(-4, 0)$ d) $(-2, 0)$ e) N.O.T.

25. Which of the following is a y -intercept of f ?

- a) $(0, 0.8)$ b) $(0, -8)$ c) $(-4, 0)$ d) $(-2, 0)$ e) N.O.T.

26. Which of the following is a vertical asymptote of f ?

- a) $x = 5$ b) $x = -2$ c) $y = 0.8$ d) $y = 1$ e) N.O.T.

27. Which of the following is a horizontal asymptote of f ?

- a) $x = 5$ b) $x = -2$ c) $y = 0.8$ d) $y = 1$ e) N.O.T.

28. If $27^{4x} = 9^{x+1}$, then what is the value of 3^x ?

- a) 243 b) 81 c) $3^{1/5}$ d) $\frac{1}{5}$ e) N.O.T.

29. Which of the following is the inverse function of $f(x) = 1.5^x + 4$?

a) $f^{-1}(x) = \frac{x - 4}{1.5}$

b) $f^{-1}(x) = \frac{\log(x) - 4}{1.5}$

c) $f^{-1}(x) = \frac{\log(x - 4)}{\log(1.5)}$

d) $f^{-1}(x) = \frac{4 - \log(x)}{\log(1.5)}$

e) N.O.T.

30. 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) Select the first 150 students who enter the school at the start of a school day.
- b) Obtain a list of students. Start with the eighth student, and select every twelfth student until 150 students have been selected.
- 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.

31. Which of the following most closely approximates how many degrees are in 1 radian?

- a) 60°
- b) 30°
- c) π°
- d) 90°
- e) N.O.T.

32. Solve for x in the following: $\frac{c}{x} + 1 = b$ and $b \neq 1$.

a) $\frac{c}{b-1}$

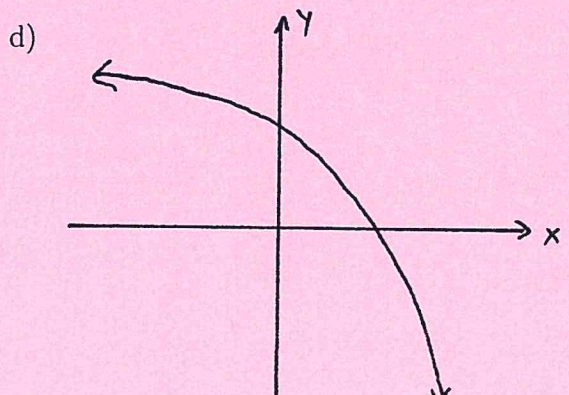
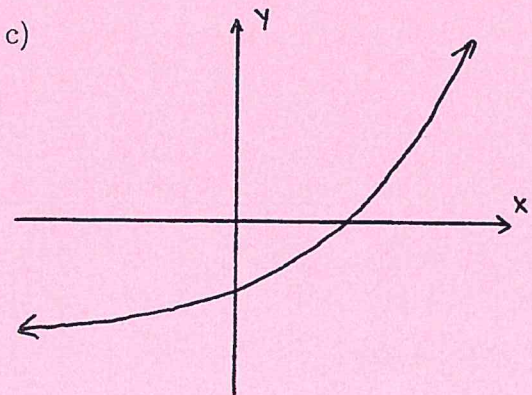
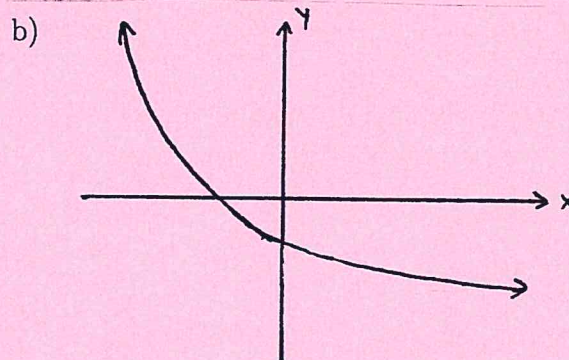
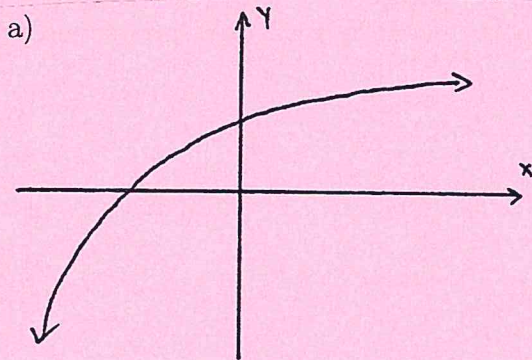
b) $\frac{c}{1-b}$

c) $\frac{c}{b+1}$

d) $\frac{c}{b} - c$

e) N.O.T.

33. Which of the following could be the graph of $f(x) = -5 + 2^{-x}$?



e) N.O.T.

34. Which of the following is the result of dividing $2x^2 - 5x - 1$ by $x - 3$?

a) $2x + 11 + \frac{32}{x - 3}$

b) $2x + 10 - \frac{31}{x - 3}$

c) $-2x - 1 - \frac{4}{x - 3}$

d) $2x + 1 + \frac{2}{x - 3}$

e) N.O.T.

35. Solve for y if $\log(y + 1) - \log(y + 2) = \log\left(\frac{1}{y}\right)$.

a) -1

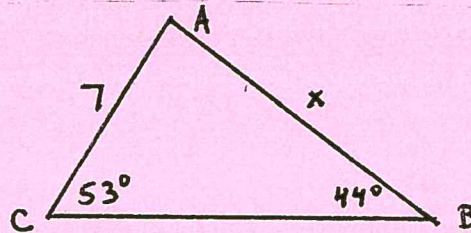
b) $\sqrt{2}$

c) 1

d) 2

e) N.O.T.

36. For the given triangle, determine the exact value of x .



a) $x = \frac{7 \sin(44^\circ)}{\sin(53^\circ)}$

b) $x = \frac{\sin(53^\circ)}{7 \sin(44^\circ)}$

c) $x = \frac{\sin(44^\circ)}{7 \sin(53^\circ)}$

d) $x = \frac{7 \sin(53^\circ)}{\sin(44^\circ)}$

e) N.O.T.

37. Which of the following statements is true about the symmetry of the function $f(x) = \frac{x^3}{1 + x^2}$?

a) It is an odd function.

b) It is an even function.

c) It is both odd and even function.

d) It is neither even nor odd.

e) N.O.T.

38. 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.

39. Convert 60° to radians.

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

b) $\frac{\pi}{4}$ radians

c) $\frac{\pi}{2}$ radians

d) π radians

e) N.O.T.

40. Data for a certain characteristic of a population is normally distributed, with a mean $\mu = 10$ and standard deviation $\sigma = 2$. Approximately what percentage of the population data should be between 6 and 14?

a) 34%

b) 68%

c) 95%

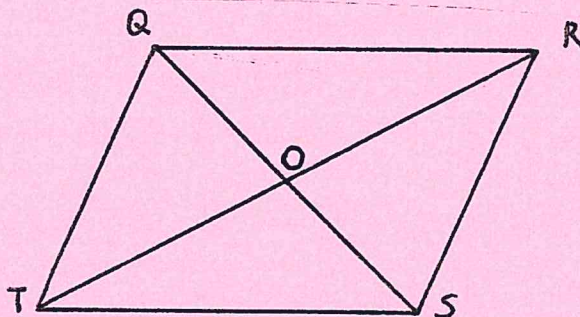
d) 99.7%

e) N.O.T.

41. Rewrite $3 \log(x) + \log(2) - \log(z) + 0.5 \log(y)$ as a single logarithm.

- a) $\log\left(\frac{3xy}{z}\right)$ b) $\log(5.5xyz)$ c) $\log\left(\frac{2x^3}{z\sqrt{y}}\right)$ d) $\log\left(\frac{2x^3\sqrt{y}}{z}\right)$ e) N.O.T.

42. For the parallelogram shown below, which of the following triangles must always be congruent to $\triangle QOT$?

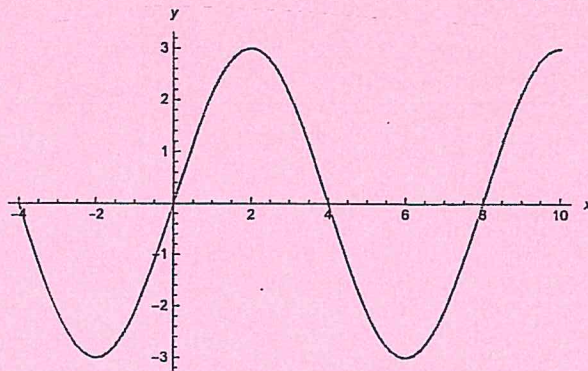


- a) Only $\triangle SOR$ b) $\triangle SOR$ and $\triangle SOT$ c) N.O.T.
 c) $\triangle QOR$ and $\triangle SOR$ d) $\triangle QOR$, $\triangle SOR$, and $\triangle SOT$

43. Determine the solution set of $8 - x^2 < 5$.

- a) $(-\infty, -\sqrt{3}) \cup (\sqrt{3}, \infty)$ b) $(-\infty, -9) \cup (9, \infty)$ c) N.O.T.
 c) $(-\sqrt{3}, \sqrt{3})$ d) $(-\sqrt{13}, \sqrt{13})$

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



- a) $y = 3 \cos(2x)$ b) $y = 3 \sin\left(\frac{\pi}{4}x\right)$ c) $y = 2 \sin\left(\frac{\pi}{3}x\right)$ d) $y = 3 \cos\left(\frac{\pi}{2}x\right)$ e) N.O.T.

45. If $f(x) = 2 - 5x$ and $g(x) = f(x) + f^{-1}(x)$, then what is the value of $g(3)$?

- a) $-\frac{138}{13}$ b) $-\frac{170}{13}$ c) 3 d) $-\frac{66}{5}$ e) N.O.T.

