Dick Schaff Math Superbowl XLIV
Level 5 Huddle: 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. Solve for x in the following equation: $e^{4x} = 2017$.

   a) $x = \dfrac{2017}{\ln(4)}$ b) $x = \dfrac{4}{\ln(2017)}$ c) $x = \dfrac{\ln(4)}{2017}$ d) $x = \dfrac{\ln(2017)}{4}$ e) N.O.T.

2. The graph of which equation is an ellipse?

   a) $2x^2 + 4 = 2y^2$ b) $7x + 3y = 9$
   c) $xy = 6$ d) $x^2 + 4y^2 = 25$ e) N.O.T.

3. Which of these is the fourth-degree term in the binomial expansion of $(x-2)^6$?

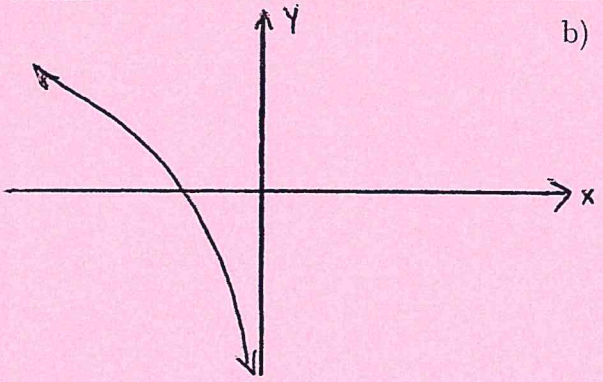
   a) $60x^4$ b) $-60x^4$ c) $12x^4$ d) $-12x^4$ e) N.O.T.

4. How many x-intercepts does the graph of $y = \cos(x)$ have?

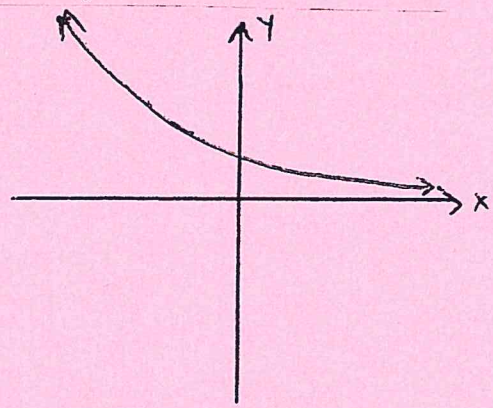
   a) None b) Infinitely many c) 1 d) 2 e) N.O.T.

5. Which graph could represent the inverse of the equation $y = 3^x$?

   a)



   b)



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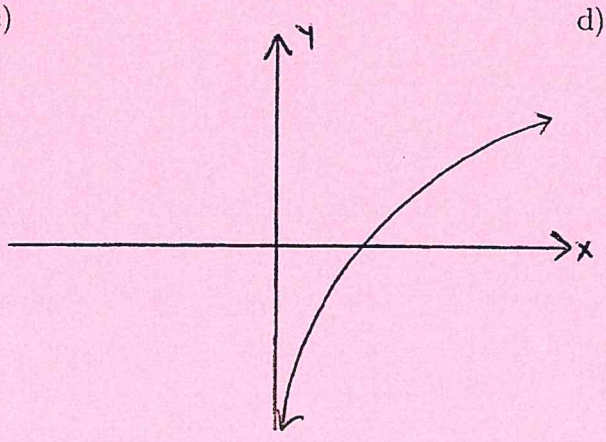
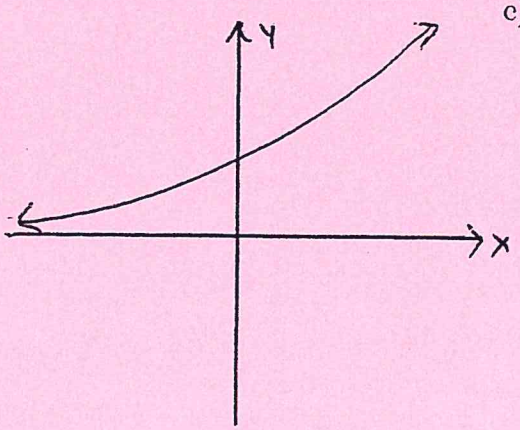


   d)



   e) N.O.T.

6. 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.

7. Angela deposited \$4000 into a savings account that annually earns 5% interest, compounded continuously. Which of the following expressions represents the amount of money in Angela's account after 4 years?

a) $\$4000e^{4(5)}$ b) $\$4000e^{0.04(0.05)}$ c) $\$4000(2)^{0.05(4)}$ d) $\$4000(2)^{5(4)}$ e) N.O.T.

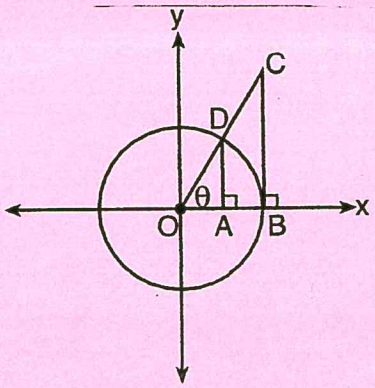
8. Which of the following trigonometric functions has a period of 4π and an amplitude of 8?

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.

9. 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.

10. The diagram below shows the unit circle with radius OD.



Which of the following line segments has a length equivalent to $\tan(\theta)$?

a) AD b) BC c) OA d) OB e) N.O.T.

11. Solve for x: $\sqrt{2x+7} - 5 = 0$.

a) $x = 9$ b) $x = \frac{11}{2}$ c) $x = 2$ d) $x = \frac{49}{2}$ e) N.O.T.

12. What is the period of the trigonometric function $y = 3\tan(4x - 5) + 6$?

a) $\frac{\pi}{6}$ b) $\frac{\pi}{5}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$ e) N.O.T.

13. In a circle, an arc of length 8π cm is intercepted by a central angle of $2\pi/3$ radians. What is the radius of the circle?

a) $\frac{3\pi}{16}$ cm b) $\frac{16\pi}{3}$ cm c) 12 cm d) 8 cm e) N.O.T.

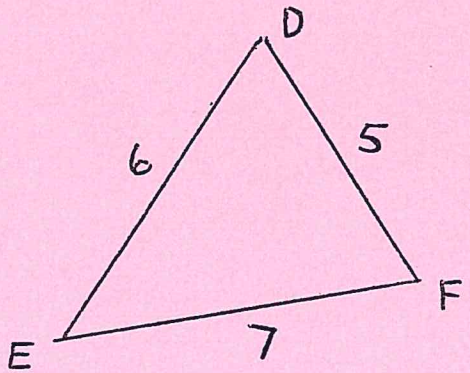
14. What is the remainder after $f(x) = x^3 - 7x - 6$ is divided by $x - 4$?

a) -42 b) -18 c) 86 d) 30 e) N.O.T.

15. A literacy group wants to determine whether high school students that participated in a recent national reading program had higher standardized test scores than high school students that did not participate in the program. Which would be the most appropriate method to accomplish this?

a) Observational study
b) Survey
c) Experiment
d) Sample
e) N.O.T.

16. Consider the triangle below. Which of the following statements is true about $\angle D$?



a) $\cos(D) = \frac{6}{7}$ b) $\sin(D) = \frac{6}{7}$ c) $\cos(D) = \frac{1}{5}$ d) $\sin(D) = -\frac{1}{5}$ e) N.O.T.

17. In the following distribution, identify the random variable and classify it as discrete or continuous.

The number of cars passing through an intersection between 5 and 6 p.m.

a) Number of cars; continuous random variable.
b) Intersection; discrete random variable.
c) Time interval; discrete random variable.
d) Time interval; continuous random variable.
e) N.O.T.

18. What is the domain of the real-valued function $f(x) = \dfrac{x+2}{x^2-25} + \sqrt{x+3}$?

a) $(-\infty, -5) \cup (-5, -3]$ b) $[-3, 5) \cup (5, \infty)$

c) $[-3, -2) \cup (-2, 5) \cup (5, \infty)$ d) $(-\infty, -5) \cup (-5, 5) \cup (5, \infty)$ e) N.O.T.

19. For normally distributed data, which of the following describes the mean of a z-score of -0.7 for a given observation?

a) The observation is 0.7 standard deviations above the mean.
b) The data set has a mean of 0.7.
c) The data set has a median of 0.7.
d) The observation is 0.7 standard deviations below the mean.
e) N.O.T.

20. Simplify the following expression: $\dfrac{x + \frac{x}{y}}{1 + \frac{1}{y}}$.

a) x b) $2x$ c) $\dfrac{x}{y}$ d) $x+1$ e) N.O.T.

21. If $0 \leq \theta < 2\pi$, for how many angles (in radians) does $\sin(\theta) = 0.3$?

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

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

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

c) $\dfrac{(2x-5)(x-5)}{x-3}$ d) $\dfrac{(5-2x)(x-5)}{4(x-2)}$ e) N.O.T.

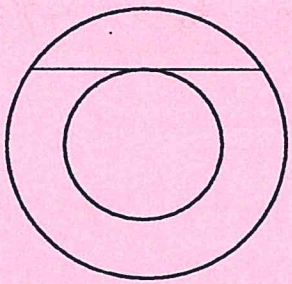
23. Let $f(x) = x^2$. Which of the following is equivalent to $\dfrac{f(x) - f(3)}{x-3}$?

a) $\dfrac{x^2-16}{x-3}$ b) $x-3$ c) x^2-16 d) $x+3$ e) N.O.T.

24. A nearby town has 1000 households. The number of people per household is normally distributed with a mean of 3.6 and a standard deviation of 0.2. Approximately how many households have between 3.2 and 3.8 people?

a) 815 households b) 680 households c) 340 households d) 950 households e) N.O.T.

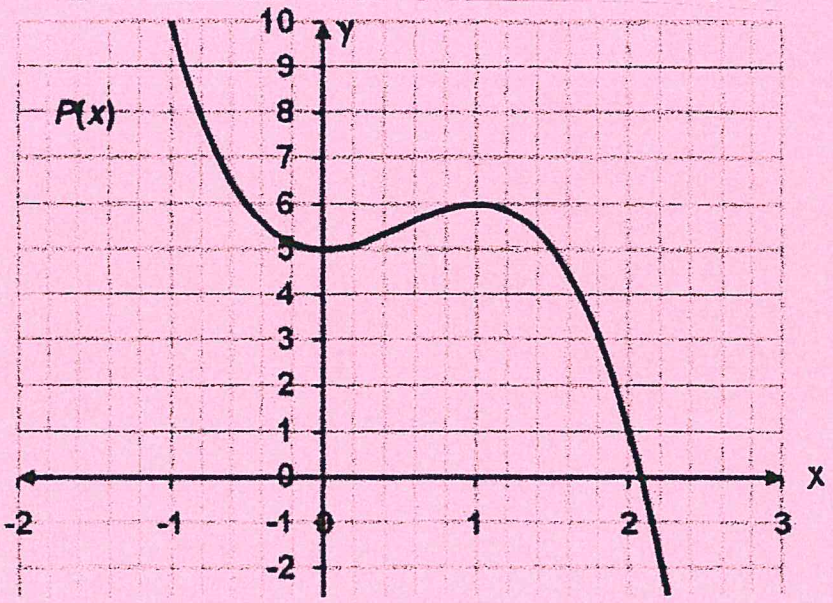
25. The radii of two concentric circles (shown below) are 5 units and 13 units.



What is the length of the chord shown in the figure?

a) 8 units b) 12 units c) 16 units d) 24 units e) N.O.T.

26. Which statement best describes the degree and leading coefficient of the polynomial whose graph is shown below?



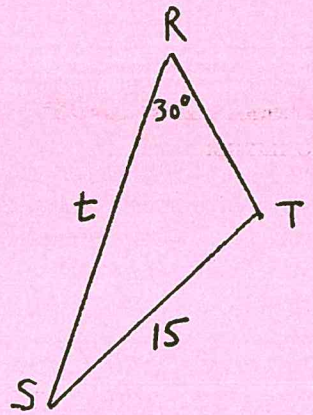
a) The polynomial is of odd degree with a positive leading coefficient.
b) The polynomial is of odd degree with a negative leading coefficient.
c) The polynomial is of even degree with a positive leading coefficient.
d) The polynomial is of even degree with a negative leading coefficient.
e) N.O.T.

27. Which of the following is the inverse function for $f(x) = \dfrac{3x+2}{x-1}$?

a) $f^{-1}(x) = \dfrac{x+3}{x-2}$ b) $f^{-1}(x) = \dfrac{x+2}{x-3}$

c) $f^{-1}(x) = \dfrac{x-1}{3x+2}$ d) $f^{-1}(x) = \dfrac{3x-1}{x+2}$ e) N.O.T.

28. Given ΔRST as shown to the right, suppose $\sin(T) = 1/5$. What is the length of t?



a) 6 b) 3

c) 18 d) $\frac{3}{2}$

e) N.O.T.

29. For which value of x is the expression $\dfrac{\sin(x)}{1+2\cos(x)}$ undefined?

a) $x = 60°$ b) $x = 120°$ c) $x = 180°$ d) $x = 300°$ e) N.O.T.

30. The expression $\log\left(\dfrac{b^3}{a}\right)$ is equivalent to:

a) $3(\log(b) - \log(a))$ b) $\log(3b) - \log(a)$

c) $\dfrac{\log(b)}{3} - \log(a)$ d) $\dfrac{3\log(b)}{\log(a)}$ e) N.O.T.