

Dick Schaff Math Superbowl XLIV
Level 4 Blitz: 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. If the side lengths of a cube are tripled, then by what factor does the volume of the cube increase?
a) 27 b) 9 c) 3 d) 1 e) N.O.T.

2. What is the midpoint of a line segment with endpoints $(-5, 2)$ and $(-6, 10)$?
a) $(-5.5, 6)$ b) $(0.5, 6)$ c) $(5.5, 6)$ d) $(-11, 12)$ e) N.O.T.

3. Which of the following is a binomial with degree 7?
a) $x^6 + 12x^5y^2 + 7$ b) $18x^3 + 20x^4$ c) $-5x^3y^2z^2 + 8x^4$ d) $17y^7 + 11z^{10}$ e) N.O.T.

4. Which equation describes the graph of $y = x^2$ after a translation three units to the right and 2 units up?
a) $y + 2 = (x - 3)^2$ b) $y - 2 = (x - 3)^2$
c) $y + 2 = (x + 3)^2$ d) $y - 2 = (x + 3)^2$ e) N.O.T.

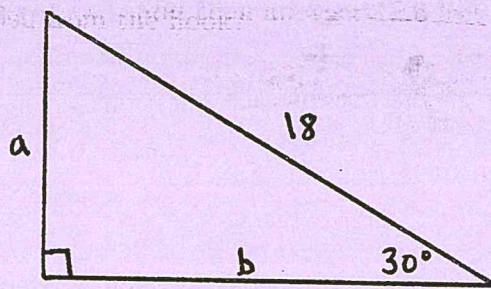
5. Simplify as much as possible: $(x - 7)(5x^2 + 12x - 4)$
a) $5x^3 - 35x^2 - 84x - 11$ b) $5x^2 + 13x - 11$
c) $5x^3 - 23x^2 - 88x + 28$ d) $35x^2 - 83x + 28$ e) N.O.T.

6. If $i = \sqrt{-1}$, then what is the value of i^{2017} ?
a) 1 b) -1 c) $-i$ d) 2017 e) N.O.T.

7. A drawer contains 4 blue socks, 5 red socks, and 6 green socks. You draw two socks from the drawer, one at a time, without replacement. What is the probability that the second sock is blue and the first sock is green?
a) $\frac{8}{75}$ b) $\frac{8}{35}$ c) $\frac{4}{15}$ d) $\frac{4}{35}$ e) N.O.T.

8. What is the average rate of change of $f(x) = 3x^2 - x + 2$ over the x -interval $[1, 3]$?
a) 22 b) $\frac{26}{3}$ c) 15 d) 11 e) N.O.T.

9. Find the values of a and b in the triangle shown below.



a) $a = 9\sqrt{3}$, $b = 9$

c) $a = 9\sqrt{2}$, $b = 9\sqrt{2}$

b) $a = 18$, $b = 9\sqrt{3}$

d) $a = 9$, $b = 9\sqrt{3}$

e) N.O.T.

10. Factor $x^4 - 16$ as far as possible.

a) $(x + 2)(x - 2)(x + 2i)(x - 2i)$

c) $(x + 2)(x - 2)(x - 4)(x + 4)$

b) $(x + 4)(x - 4)(x + 4i)(x - 4i)$

d) $(x^2 + 4)(x^2 - 4)$

e) N.O.T.

11. What is the radius of the circle given by the equation $x^2 - 6x + y^2 + 8y = 3$?

a) $\sqrt{3}$

b) 5

c) $\sqrt{19}$

d) $3\sqrt{3}$

e) N.O.T.

12. The lengths of two sides of a triangle are 3 inches and 7 inches. Which of the following could be the length of the third side?

a) 4 inches

b) 3 inches

c) 10 inches

d) 9 inches

e) N.O.T.

13. When two parallel lines are cut by a transversal, what must be true about a pair of alternate interior angles?

a) The angles must be obtuse.

b) The angles must be acute.

c) The angles must be congruent.

d) The angles must be supplementary.

e) N.O.T.

14. The axis of symmetry of a parabola is $x = 6$, and one point on the parabola is $(3, 8)$. Which of the following must be another point on the parabola?

a) $(-3, 8)$

b) $(3, 4)$

c) $(0, 0)$

d) $(12, 8)$

e) N.O.T.

15. Which of the following statements about parallelograms is always true?

a) All four angles are acute angles.

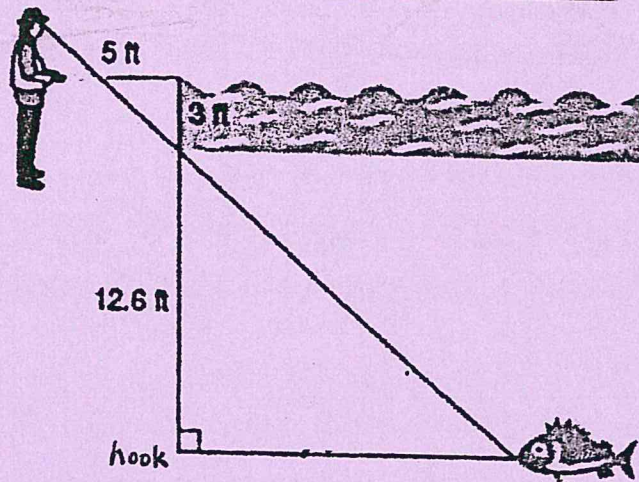
b) Opposite angles are always congruent.

c) The diagonals of a parallelogram are always congruent.

d) Opposite angles are always complementary angles.

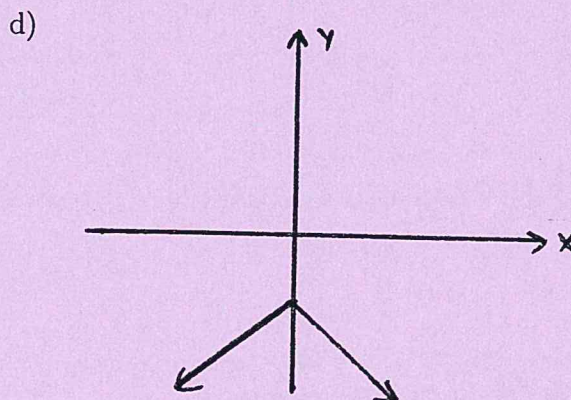
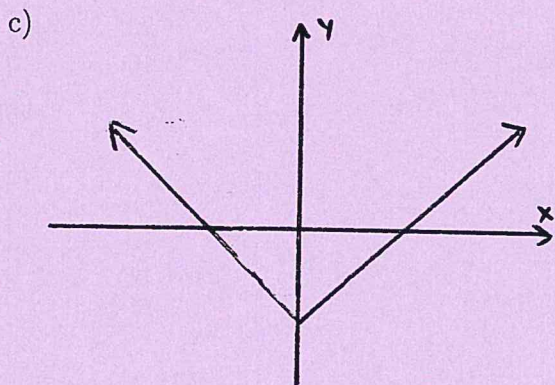
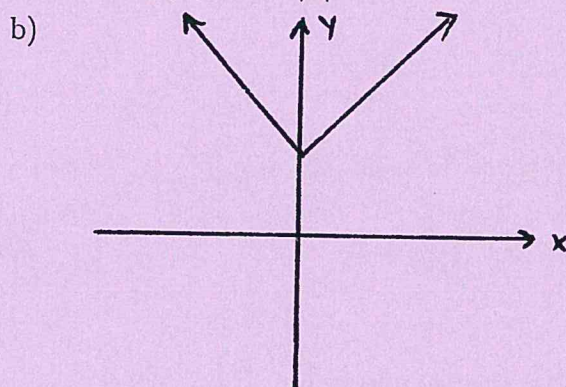
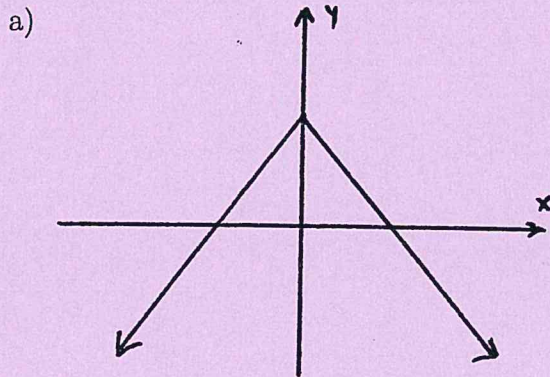
e) N.O.T.

16. Victoria holds a 5-foot long fishing pole. The fishing line extends 3 feet to the water's surface and then another 12.6 feet to a hook. How far is the fish from the hook?



- a) 14.6 feet b) 21 feet c) 24.6 feet d) 27 feet e) N.O.T.

17. Which of the following could represent the graph of $f(x) = 3 - |x|$?



e) N.O.T.

18. In an experiment, three marbles are simultaneously selected from a bag of five distinct marbles. If S is the sample space for this experiment, how many different outcomes are in S ?

- a) 3 b) 5 c) 8 d) 10 e) N.O.T.

19. For $x, y > 0$, simplify $\left(\frac{x^2y^{1/3}}{16x^{1/4}y}\right)^{1/2}$ so that only positive exponents occur.

a) $\frac{x^{7/8}}{4y^{2/3}}$

b) $\frac{x^{7/4}}{16y^{1/3}}$

c) $\frac{x^{7/4}}{16y^{2/3}}$

d) $\frac{x^{7/8}}{4y^{1/3}}$

e) N.O.T.

20. Which of the following is the inverse of $f(x) = 12\sqrt[3]{x}$?

a) $g(x) = 12x^3$

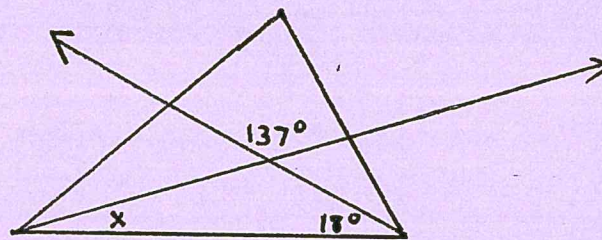
b) $g(x) = \left(\frac{x}{12}\right)^3$

c) $g(x) = \frac{x^3}{12}$

d) $g(x) = (x - 12)^3$

e) N.O.T.

21. Solve for x in the figure shown.



a) 18°

b) 24°

c) 37°

d) 119°

e) N.O.T.

22. Which of these functions has a y -intercept of $(0, 1)$?

a) $f(x) = x^2 + 2x + 7$

b) $f(x) = 7x^2 + 3x + 1$

c) $f(x) = 7(x - 1)(x + 5)$

d) $f(x) = 3x(x - 7)$

e) N.O.T.

23. The solution to the inequality $\frac{x + 1}{x - 5} \geq 0$ is

a) $[-1, 5)$

b) $(-\infty, 5)$

c) $[-1, 5) \cup (5, \infty)$

d) $(-\infty, -1] \cup (5, \infty)$

e) N.O.T.

24. Which of the following is the vertex of the function $f(x) = -x^2 + 6x$?

a) $(3, 9)$

b) $(0, 0)$

c) $(3, 0)$

d) $(4, 2)$

e) N.O.T.

25. In the equation $x^2 + 7x = 24$, what number must be added to both sides to complete the square on the left side of the equation?

a) 49

b) $-\frac{7}{2}$

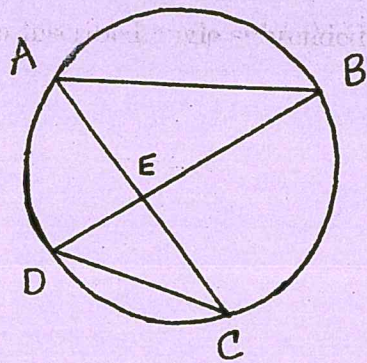
c) $\frac{49}{4}$

d) $\frac{7}{2}$

e) N.O.T.

26. What is the largest coefficient in the expression $45x^{22} + 18z^{97}$?
- a) 45 b) 63 c) 97 d) 18 e) N.O.T.
27. Which of the following information is sufficient to show that $\triangle ABC$ is congruent to $\triangle XYZ$?
- a) $\angle B \cong \angle Y$, $\overline{AB} \cong \overline{YX}$, and $\overline{AC} \cong \overline{XZ}$.
b) $\overline{AB} \cong \overline{YZ}$, $\angle A \cong \angle X$, and $\overline{AC} \cong \overline{YX}$.
c) $\angle A \cong \angle X$, $\angle C \cong \angle Z$, and $\overline{AC} \cong \overline{XZ}$.
d) $\angle A \cong \angle X$, $\angle B \cong \angle Y$, and $\angle C \cong \angle Z$.
e) N.O.T.
28. If $x = 4 - 7i$ is a root of a quadratic equation in x , what must be another root of this equation?
- a) $x = 4$ b) $x = -4 - 7i$ c) $x = 7i$ d) $x = -4 + 7i$ e) N.O.T.
29. A circle has diameter 6π . What is the area of this circle?
- a) $6\pi^2$ b) $9\pi^3$ c) $36\pi^3$ d) $12\pi^2$ e) N.O.T.
30. A fair purple six-sided die (sides labeled 1 to 6) and a fair brown eight-sided die (sides labeled 1 to 8) are rolled simultaneously. What is the probability that the number rolled on the purple die is less than 3 and the number rolled on the brown die is a 7?
- a) $\frac{3}{14}$ b) $\frac{1}{16}$ c) $\frac{1}{24}$ d) $\frac{7}{24}$ e) N.O.T.
31. Determine the solution set of $|5x + 2| > 1$.
- a) $\left(-\infty, -\frac{1}{5}\right) \cup \left(\frac{3}{5}, \infty\right)$ b) $\left(-\frac{3}{5}, -\frac{1}{5}\right)$
c) $\left(-\infty, -\frac{3}{5}\right) \cup \left(-\frac{1}{5}, \infty\right)$ d) $\left(-\infty, -\frac{3}{5}\right) \cup \left(\frac{1}{5}, \infty\right)$ e) N.O.T.
32. Determine which of the following is an intersection point of the line $y = 4x + 12$ with the parabola $y = x^2 + 7$.
- a) (1, 16) b) (-5, 32) c) (-5, -8) d) (-1, 8) e) N.O.T.
33. What is the range of the function given by $f(x) = 4(x - 2)^2 - 6$?
- a) $(-\infty, -6)$ b) $[6, \infty)$ c) $(-\infty, 6)$ d) $(-6, 2)$ e) N.O.T.

For Questions 34 - 36, refer to the diagram below.



Given:

$$m \widehat{AB} = 108^\circ$$

$$m \widehat{BC} = 60^\circ$$

$$m \widehat{CD} = 88^\circ$$

34. What is the measure of $\angle BAE$?

a) 30°

b) 60°

c) 120°

d) 108°

e) N.O.T.

35. What is the measure of arc \widehat{AD} ?

a) 60°

b) 104°

c) 108°

d) 120°

e) N.O.T.

36. What is the measure of $\angle BEC$?

a) 30°

b) 52°

c) 60°

d) 82°

e) N.O.T.

37. Determine the equation of the parabola with focus at $(3, 2)$ and directrix $y = 6$.

a) $8(x - 3) = (y - 4)^2$

b) $2(x - 3) = (y - 6)^2$

c) $(x - 3)^2 = 2(y - 2)$

d) $(x - 3)^2 = -8(y - 4)$

e) N.O.T.

38. For two events A and B , suppose the probability of A occurring is 0.3, and the probability of B occurring is 0.5. If the probability of at least one of the events A or B occurring is 0.65, what is the probability that both events will occur simultaneously?

a) 0.8

b) 0.3

c) 0.15

d) 0

e) N.O.T.

39. Determine the solution set of $(3x + 2)(x - 1) = x(5x + 4)$.

a) $\left\{-\frac{1}{2}, -2\right\}$

b) $\left\{-\frac{2}{3}, \frac{1}{2}\right\}$

c) $\left\{\frac{-5 \pm \sqrt{41}}{4}\right\}$

d) $\left\{\frac{5 \pm \sqrt{41}}{4}\right\}$

e) N.O.T.

40. Which of the following is equivalent to $\frac{1}{1-i}$?

a) $1+i$

b) $\frac{1+i}{2}$

c) $1-i$

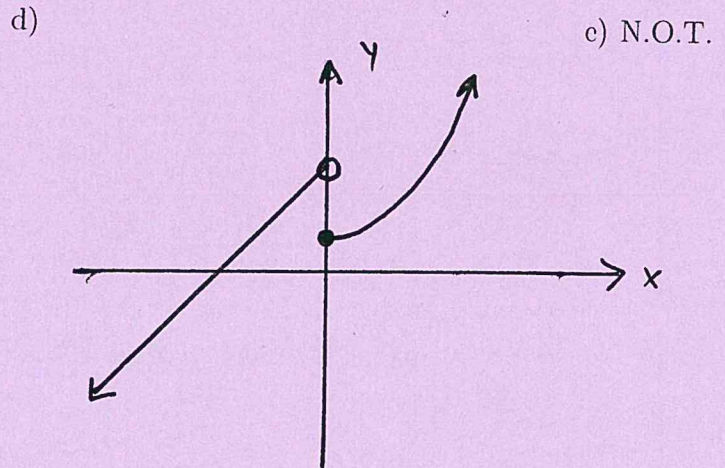
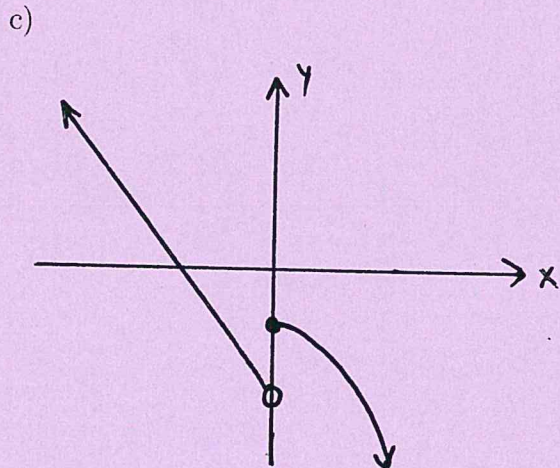
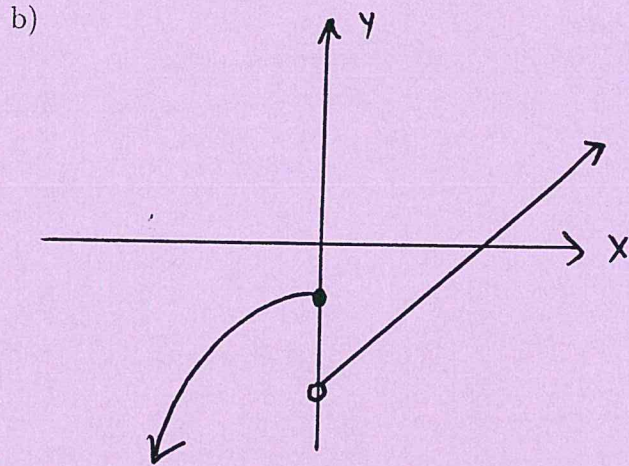
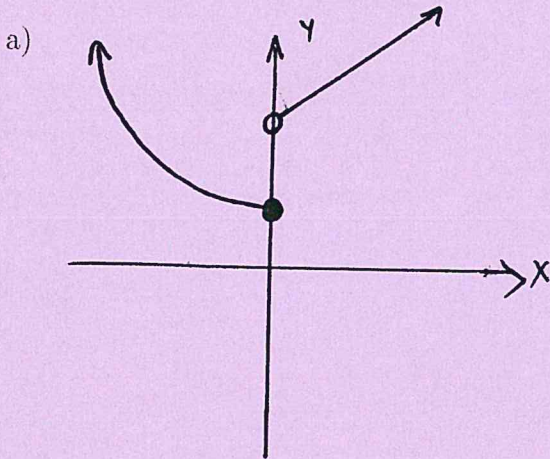
d) $\frac{1-i}{2}$

e) N.O.T.

41. Which of the following is true about central angles in a circle?

- a) A central angle must be an acute angle.
- b) A central angle is twice the measure of an inscribed angle subtended by the same arc.
- c) A central angle is half the measure of an inscribed angle subtended by the same arc.
- d) A central angle must be a right angle.
- e) N.O.T.

42. Determine which of the following could be the graph of $\begin{cases} y = x + 5 & \text{if } x < 0, \\ y = x^2 + 2 & \text{if } x \geq 0. \end{cases}$



e) N.O.T.

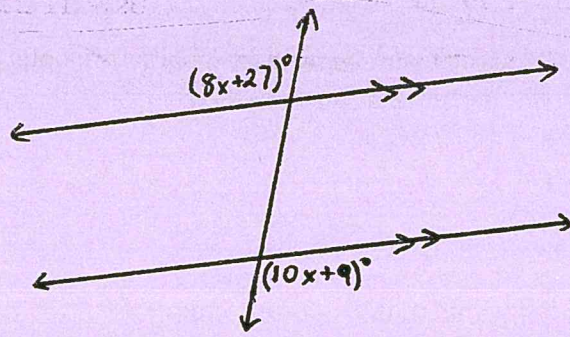
43. The volume of the larger of two similar cones is 64 times the volume of the smaller cone. What is the ratio of the lateral area of the larger cone to the lateral area of the smaller cone?

- a) 4 : 1
- b) 8 : 1
- c) 32 : 1
- d) 64 : 1
- e) N.O.T.

44. Compute all zeros of the function $f(x) = 3x^2 - 7x - 20$.

- a) $\{-20\}$
- b) $\left\{-\frac{5}{3}, 4\right\}$
- c) $\left\{\frac{5}{3}, -4\right\}$
- d) $\{20\}$
- e) N.O.T.

45. What is the measure of the angle marked $(8x + 27)^\circ$ in the figure below?



a) 100°

b) 109°

c) 99°

d) 89°

e) N.O.T.