Dick Schaff Math Superbowl XLI
Level 2: Algebra I Blitz – 2014

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. What is the solution to $x \geq -5$ in interval notation?

   a) $(-5, \infty)$ b) $[-5, \infty)$ c) $(-\infty, -5)$ d) $(-\infty, -5]$ e) N.O.T.

2. What is the slope of any line that is perpendicular to the line given by $2x + 3y = 24$?

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

3. Exactly how many solutions does the system $\begin{cases} 2x + 5y = 7 \\ 10y = -4x + 14 \end{cases}$ possess?

   a) None b) One c) Two d) Three e) N.O.T.

4. Which of the following is equivalent to $\sqrt{75}$?

   a) $5\sqrt{3}$ b) $3\sqrt{5}$ c) $25\sqrt{3}$ d) $3\sqrt{25}$ e) N.O.T.

5. If $1 + 2 + 3 + 4 + 5 + 6 + \cdots + x = 300$, then what is the value of x?

   a) 24 b) 25 c) 29 d) 30 e) N.O.T.

6. Working together, Emily and Kendall can paint a fence in six hours. Kendall works twice as fast as Emily. How long would it take Emily to paint the fence alone?

   a) 18 hours b) 9 hours c) 6 hours d) 3 hours e) N.O.T.

7. What is the solution set of $2x^2 - 9x - 35 = 0$?

   a) $\{-\frac{2}{5}, 7\}$ b) $\{-\frac{2}{5}, -7\}$ c) $\{-\frac{5}{2}, 7\}$ d) $\{-\frac{5}{2}, -7\}$ e) N.O.T.

8. Express $(9.5 \times 10^7)(7 \times 10^9)$ in scientific notation.

   a) 66.5×10^{16} b) 66.5×10^{63} c) 6.65×10^{17} d) 6.65×10^{64} e) N.O.T.

9. Simplify $(-7x - 5x^4 + 5) - (-7x^4 - 5 - 9x)$.

   a) $2x^4 + 2x + 8$ b) $-14x^4 - 10x + 10$
   c) $-14x^4 + 10x + 10$ d) $2x^4 + 2x + 10$ e) N.O.T.

10. What is the solution set of $6x^2 = 18x$?

a) $\{3\}$ b) $\{-3\}$ c) $\{0, -3\}$ d) $\{0, -3, 3\}$ e) N.O.T.

11. What is the slope of the line passing through the points $(8, 2)$ and $(3, -5)$?

a) $\frac{5}{7}$ b) $-\frac{3}{5}$ c) $-\frac{5}{3}$ d) $\frac{7}{5}$ e) N.O.T.

12. Three numbers which are in a ratio of $3 : 5 : 7$ add up to 75. What is the average of these three numbers?

a) 20 b) 25 c) 30 d) 35 e) N.O.T.

13. Which of the following is the same as $\sqrt{x^2}$?

a) x b) $-x$ c) $|x|$ d) $-|x|$ e) N.O.T.

14. If $\frac{x-3}{x+2} = 5$, then the value of x is

a) $-\frac{4}{13}$ b) $-\frac{13}{4}$ c) $-\frac{3}{2}$ d) $-\frac{10}{3}$ e) N.O.T.

15. For the system of inequalities given by $\begin{cases} x - y > 3 \\ x + 2y < 6, \end{cases}$ which of the following points lies in the solution set?

a) $(7, 1)$ b) $(3, 4)$ c) $(-2, 2)$ d) $(4, -2)$ e) N.O.T.

16. A bicyclist rode up a hillside to the top at a speed of 10 miles per hour and, without stopping, came back down at a speed of 20 miles per hour. What is the average speed for the round trip?

a) $12\frac{1}{2}$ mph b) $13\frac{1}{3}$ mph c) $14\frac{1}{2}$ mph d) 15 mph e) N.O.T.

17. The fraction $\frac{h^2-7h}{7-h}$ reduces to

a) $h - 1$ b) h c) $h - 7$ d) $h + 7$ e) N.O.T.

18. Simplify the following: $(x^8)^{-3}(x^{-7})^{-4}$

a) x^4 b) x^{-4} c) x^{672} d) x^{-672} e) N.O.T.

19. The sum of the solutions for $|2x - 1| = 9$ is

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

20. The product of three consecutive integers is always

a) divisible by 4 b) divisible by 6 c) divisible by 8 d) divisible by 10 e) N.O.T.

21. A factor of the expression $x^3 - 4x^2 + x + 6$ is

a) $x + 3$ b) $x - 3$ c) $x - 1$ d) $x + 2$ e) N.O.T.

22. Jonathan has a total of 58 DVDs and CDs. If the number of CDs is two more than three times the number of DVDs, how many CDs does he have?

a) 42 b) 14 c) 44 d) 12 e) N.O.T.

23. The statement $a + (b + c) = (a + b) + c$ is an example of which property of addition?

a) Associative property b) Commutative property
c) Distributive property d) Additive inverse property e) N.O.T.

24. The distance between the points $(-2, 5)$ and $(9, 8)$ is

a) $\sqrt{14}$ b) $4\sqrt{7}$ c) $\sqrt{118}$ d) $\sqrt{130}$ e) N.O.T.

25. What percent of 80 is 144?

a) 1.8% b) 18% c) 108% d) 118% e) N.O.T.

26. The multiplicative inverse of $7\frac{3}{8}$ is

a) $-\frac{59}{8}$ b) $-7\frac{3}{8}$ c) $-\frac{8}{59}$ d) $\frac{59}{8}$ e) N.O.T.

27. If $a\#b = 4a + b$, then the value of $2\#(3\#2)$ is

a) 19 b) 13 c) 22 d) 46 e) N.O.T.

28. Julia completed 12 problems from her math homework, but she still had 60% of her assignment left to finish. How many problems were assigned for homework?

a) 120 b) 72 c) 30 d) 20 e) N.O.T.

29. Rationalize the denominator in $\frac{\sqrt{15}}{\sqrt{3}+\sqrt{15}}$.

a) $\frac{15-\sqrt{15}}{12}$ b) $\frac{\sqrt{14}-15}{12}$ c) $\frac{\sqrt{5}+5}{4}$ d) $\frac{-\sqrt{5}+5}{4}$ e) N.O.T.

30. A freight train leaves Modesto at 3 p.m. and travels 40 miles per hour. A passenger train leaves Modesto, traveling in the same direction, one hour later and passes the freight train 200 miles from Modesto. What is the speed of the passenger train?

a) 65 mph b) 60 mph c) 55 mph d) 50 mph e) N.O.T.

31. Provided that all variables are positive real numbers, solve $V = \frac{1}{3}\pi r^2 h$ for r.

a) $r = \sqrt{\frac{3V}{\pi h}}$ b) $r = \sqrt{\frac{Vh}{3\pi}}$ c) $r = \left(\frac{3V}{\pi h}\right)^2$ d) $r = \left(\frac{Vh}{3\pi}\right)^2$ e) N.O.T.

32. An equivalent form of $|\sqrt{3} - 3|$ is

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

33. If the length of a side of a cube is $3x + 4$, then the volume of the cube is

a) $9x + 12$ b) $27x^3 + 108x^2 + 144x + 64$
c) $27x^3 + 64$ d) $27x^3 + 12x^2 + 12x + 64$ e) N.O.T.

34. If $a \neq 0$, then an equation of the line that passes through the points $(0, 0)$ and $(-a, a)$ is

a) $ax - ay = 1$ b) $ax + ay = 1$ c) $y = a$ d) $x = -a$ e) N.O.T.

35. If two-thirds of a number is 10, then three-fifths of the number is

a) 15 b) 18 c) 30 d) 45 e) N.O.T.

36. A ladder leans against a vertical wall. The top of the ladder is 12 feet from the ground. The base of the ladder is 5 feet from the base of the wall. The length of the ladder is

a) 17 feet b) 13 feet c) 11 feet d) 15 feet e) N.O.T.

37. What value of c will make $x^2 + 10x + c$ a perfect square trinomial?

a) 5 b) 10 c) 20 d) 25 e) N.O.T.

38. The 150^{th} term of the arithmetic sequence $4, 7, 10, 13, \ldots$ is

a) 301 b) 304 c) 451 d) 454 e) N.O.T.

39. Simplify the expression $\dfrac{x^{-1} + y^{-1}}{x^{-1} - y^{-1}}$

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

40. Find the value of $-2^2[2-3(2-1^2)]-(3^2+2)(1-2^2)$

a) 170 b) 58 c) 37 d) -35 e) N.O.T.

41. What is the last digit of 3^{2014}?

a) 1 b) 3 c) 5 d) 7 e) N.O.T.

42. If $\frac{x}{y}=\frac{1}{3}$, and $\frac{w}{z}=\frac{3}{5}$, then the value of $\frac{2xw-yz}{3yz+xw}$ is

a) $-\frac{3}{16}$ b) $-\frac{12}{5}$ c) $\frac{7}{3}$ d) $\frac{9}{2}$ e) N.O.T.

43. Simplify $(12a^9+20a^6-4a^3)\div(4a^3)$

a) $3a^3+5a^2-a$ b) $12a^3+20a^2-4a$
c) $8a^6+16a^3-8$ d) $3a^6+5a^3-1$ e) N.O.T.

44. A boat can sail 24 miles with the current of a particular river in two hours. The return trip of 24 miles, now against the current, can be done in four hours. How fast is the river flowing?

a) 1.5 mph b) 3 mph c) 6 mph d) 9 mph e) N.O.T.

45. If $x<0$, then the value of $3-x^0$ is

a) 4 b) 3 c) 2 d) 1 e) N.O.T.