Dick Schaff Math Superbowl 2018
Level 4: Secondary Math II Blitz

Directions: 1. Select the most correct answer for each questions and mark it on you answer form.

2. No calculators of any sort are allowed.

3. Note that N.O.T. means "None of these."

1. Factor completely: (x^2-4x+4).

a) $x=2,2$ b) $(x-2)^2$ c) $(x+2)^2$ d) x^2+y^2 e) N.O.T.

2. Simplify: $\sqrt{x}\sqrt{1+\frac{1}{x}}$.

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

3. Multiply and simplify: $(2a-3)(2a+3)$.

a) $2a-3$ b) $2a^2$ c) $4a^2-9$ d) -9 e) N.O.T.

4. Let $f(x)=\sqrt{-x}$, where x is a real number. Find $f(-4)$.

a) 2 b) $2i$ c) 16 d) ± 2 e) N.O.T.

5. A circle has a diameter of 2π. Find the circumference.

a) $2\pi^2$ b) 16π c) 32π d) 2π e) N.O.T.

6. What is the last digit of π?

a) 3 b) 1 c) 4 d) 6 e) N.O.T.

7. Find the y-intercept of $-y-(x+2)^2=7$.

a) (0,11) b) (−7,0) c) (0,−7) d) (−7,0) e) N.O.T.

8. What is the simplified form of $\frac{x}{2}+\frac{x}{3}+\frac{x}{4}+\frac{x}{5}$?

a) $\frac{x}{120}$ b) $\frac{5x}{4}$ c) $\frac{70x}{60}$ d) $\frac{77x}{60}$ e) N.O.T.

9. Factor completely: t^4-1.

a) $(t-1)(t+1)$ b) $t^2(t-1)(t+1)$ c) $t=\pm 1$. d) $(t-1)^2(t+1)$ e) N.O.T.

10. Solve: $\ln(x)+\ln(2)=4$.

a) $\frac{e^2}{4}$ b) $\frac{e^4}{2}$ c) $e^x=4$ d) 2 e) N.O.T.

11. What is the value of $1+\cfrac{1}{1+\cfrac{1}{1+\frac{1}{2}}}$?

a) $\frac{5}{4}$ b) $\frac{8}{5}$ c) $\frac{3}{2}$ d) $\frac{8}{3}$ e) N.O.T.

12. The reciprocal of -100 is:

a) $\frac{100}{1}$ b) $\frac{-1}{100}$ c) $\frac{1}{50}$ d) $\frac{1}{100}$ e) N.O.T.

13. Find the degree of the following polynomial: $4^2x^2y^3(wz)^2$.

a) 17 b) 16 c) 7 d) 9 e) N.O.T.

14. A train leaves Danville Union and travels north at 75 km/h. Two hours later, an express train leaves on a parallel track and travels north at 125 km/h. How far from the station will they meet?

a) 225 km b) 325 km c) 357 km d) 375 km e) N.O.T.

15. Find the midpoint of the segment with $\left(\frac{-4}{5},\frac{-2}{3}\right)$ *and* $\left(\frac{1}{8},\frac{3}{4}\right)$.

a) $\left(\frac{27}{80},\frac{25}{7}\right)$. b) $\left(-\frac{27}{80},\frac{1}{24}\right)$. c) $\left(-\frac{80}{27},\frac{1}{24}\right)$. d) $\left(\frac{1}{24},\frac{-27}{80}\right)$. e) N.O.T.

16. The simplified form of $\frac{x^{-1}}{y^{-1}}-\frac{y^{-1}}{x^{-1}}$.

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

17. The system $\begin{cases} x^2+y^2=1 \\ x-y=9 \end{cases}$ has

a) 4 solutions b) 3 solutions c) 2 solutions d) no solutions e) N.O.T.

18. For $x>0$, $e^{16\ln(x)}=$

a) e^{16} b) $\ln(x)$ c) x^{16} d) $16x$ e) N.O.T.

19. Divide and simplify: $\frac{-2+9i}{1-3i}$.

a) $\frac{-29}{10}+\frac{3}{10}i$ b) $\frac{3}{10}+\frac{29}{10}i$ c) $\frac{10}{3}+\frac{10}{29}i$ d) $-2-9i$ e) N.O.T.

20. Find all x-intercepts of $y=x^{\frac{1}{2}}-x^{\frac{1}{4}}-6$.

a) (0, 9) b) (−81, 0) c) (0, 81) d) (81, 0) e) N.O.T.

21. The vertices of ΔABC are (−15,0), (1,12), and (10,0). Find the perimeter.

a) 50 b) 60 c) 100 d) 132 e) N.O.T.

22. How is the graph of $y = 10 \cdot f(x)$ constructed from the graph of a function $y = f(x)$?

a) Vertical stretch by a factor of 10

b) Vertical shrink by a factor of 10

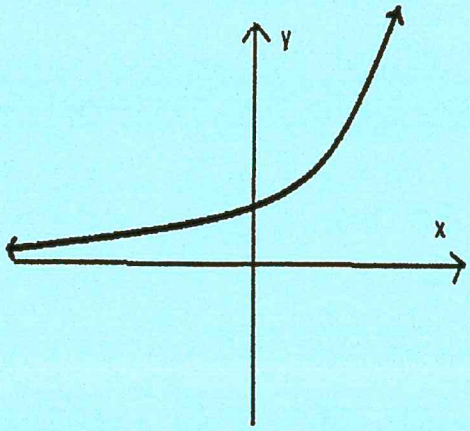
c) Horizontal stretch by a factor of 10

d) Horizontal shrink by a factor of 10

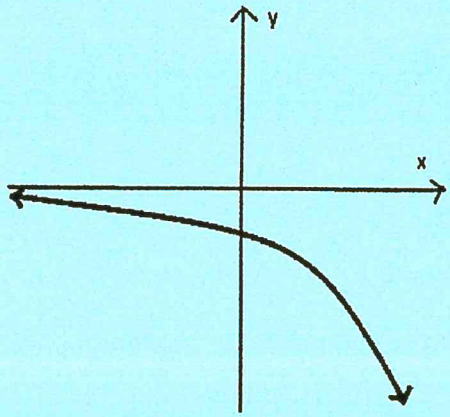
e) N.O.T.

23. Which of these figures could represent the graph of $y = 15^{-x}$?

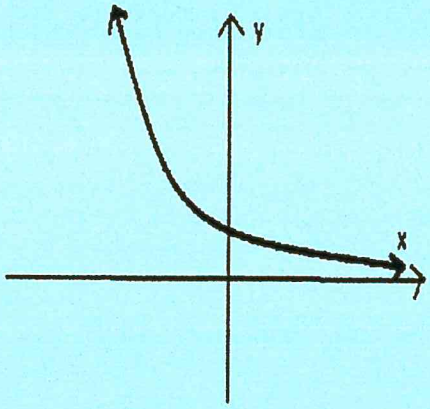
a)



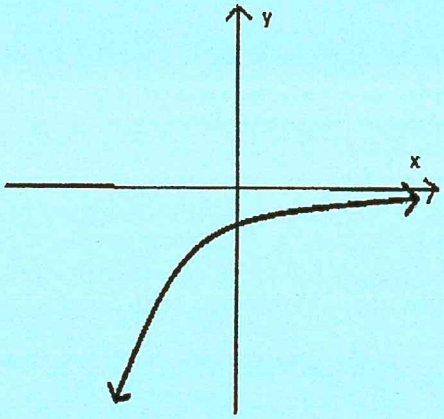
b)



c)



d)



e) N.O.T.

24. A triangle on the coordinate plane is rotated 90°, translated 3 units horizontally, then reflected about the y-axis. Which if the following must be true about the triangle obtained after this sequence of transformations?

a) The new triangle must have a side length of 3.

b) The new triangle must be a right triangle.

c) The new triangle is similar, but not congruent to the original triangle.

d) The new triangle is congruent to the original triangle.

e) N.O.T.

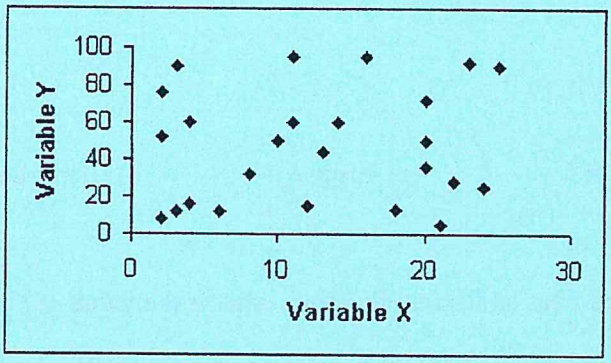
25. Solve the following equation: $|x-4|=|4-x|$.

a) 4 b) 0 c) No solution d) All real numbers e) N.O.T.

26. The absolute value of a complex number $a+bi$ is its distance from the origin. Using the distance formula we have $|a+bi|=\sqrt{a^2+b^2}$. Find the absolute value of $|-3+i|$.

a) -3 b) 10 c) 10 d) $\sqrt{10}$ e) N.O.T.

27. Which statement is true about the data shown in the scatter plot below?



a) There is no correlation between the two sets of data.

b) There is a positive correlation between the two sets of data.

c) There is a negative correlation between the two sets of data.

d) The correlation between the data is both positive and negative.

e) N.O.T.

28. Find the vertex of the following function: $g(x)=2x^2-20x-3$.

a) $(0,-9)$ b) $(5,-53)$ c) $(-5,23)$ d) $(-53,5)$ e) N.O.T.

29. Simplify: $\log_4(16)$

a) 16 b) 10^4 c) 4^{10} d) 2 e) N.O.T.

30. If $i = \sqrt{-1}$, then what is the value of i^{2018}?

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

31. The diameter of a circle is also

a) a radius b) an arc c) a chord d) a line e) N.O.T.

32. Find the radius of the following circle: $x^2 + y^2 + 8x - 2y + 15 = 0$.

a) 1 b) 2 c) $\sqrt{2}$ d) 4 e) N.O.T.

33. The graph of $\frac{x^2}{25} - \frac{y^2}{9} = 1$ is a

a) Parabola b) Chord c) Ellipse d) Hyperbola e) N.O.T.

34. If $f(3) = 7, f(7) = 12$, and f has an inverse function, what is the value of $f^{-1}(7)$?

a) 12 b) 7 c) 3 d) 21 e) N.O.T.

35. Simplify: $\left(\left(\left(x^{16}\right)^{\frac{1}{4}}\right)^2\right)^{\frac{1}{2}}$

a) x b) x^8 c) x^{32} d) x^4 e) N.O.T.

36. If two lines are graphed and we determine that they are perpendicular, then which of the following must be true?

a) The equations of the lines will have a common solution of $(-1, -1)$.

b) The lines will have slopes which are negative reciprocals.

c) The lines will have slopes which are negative.

d) The equations of the lines will have an infinite number of common solutions.

e) N.O.T.

37) If the line passing through the points $(a, 3a)$ and $(2, 7)$ has a slope of -1, the value of a is

a) $\frac{9}{4}$ b) 0 c) 6 d) $-\frac{9}{4}$ e) N.O.T.

38. The solution of $(x-3)(x+2) \leq 0$ is:

a) $[-2, 3]$ b) $[3, -2]$ c) 3 d) -2 e) N.O.T.

39. The value of the determinant $\begin{vmatrix} 2 & -2 & 2 \\ 3 & -3 & 3 \\ 4 & -4 & 4 \end{vmatrix}$ is

a) 9 b) -9 c) 3 d) 0 e) N.O.T.

40. The solution to the logarithmic equation $\ln(\ln(x)) = 0$ is:

a) e b) 0 c) e^{-1} d) $e^{\ln(x)}$ e) N.O.T.

41. Find the total sum of $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \cdots$

a) $\frac{2}{3}$ b) $\frac{3}{2}$ c) $\frac{5}{3}$ d) $\frac{3}{5}$ e) N.O.T.

42. If $C(n,r) = \frac{n!}{r!(n-r)!} = \binom{n}{r}$, then $\binom{6}{2} =$

a) 30 b) 15 c) 45 d) 54 e) N.O.T.

43. Next semester you are planning to take three courses-math, English, and humanities. Based on time blocks and highly recommended professors, there are 8 sections of math, 5 of English, and 4 of humanities that you find suitable. Assuming no scheduling conflicts, how many different three-course schedules are possible?

a) 120 b) 130 c) 220 d) 160 e) N.O.T.

44. Find the mode of the following data: 23, 24, 27, 18, 19, 27

a) 23 b) 19 c) 23.5 d) 27 e) N.O.T.

45. The number of floors of each building in a particular city is recorded. Select the correct stem-and-leaf plot of the data.

Number of Floors																			
24	38	46	16	28	31	12	27	32	49	33	12	38	34	48	22	36	29	47	41
49	30	21	17	40	13	32	15	31	21	13	16	43	33	30	25	28	29	13	11

a) **Number of Floors**

Key: 1 | 1 *means* 11

Stems	Leaves
1	1 2 3 5 6 7
2	1 2 4 5 7 8 9
3	0 1 2 3 4 6 8
4	0 1 3 6 7 8 9

b) **Number of Floors**

Key: 1 | 1 *means* 11

Stems	Leaves
1	11 12 12 13 13 13 15 16 16 17
2	21 21 22 24 25 27 28 28 29 29
3	30 30 31 31 32 32 33 33 34 36 38
4	40 41 43 46 47 48 49 49

c) **Number of Floors**

Key: 1 | 1 *means* 11

Stems	Leaves
1	1 2 2 3 3 3 5 6 6 7
2	1 1 2 4 5 7 8 8 9 9
3	0 0 1 1 2 2 3 3 4 6 8 8
4	0 1 3 6 7 8 9 9

d) **Number of Floors**

Key: 1 | 1 *means* 11

Stems	Leaves
1	11 12 13 15 16 17
2	21 22 24 25 27 28 29
3	30 31 32 33 34 36 38
4	30 31 33 36 37 38 39

e) N.O.T.