THIRTY-EIGHTH ANNUAL MATHEMATICS CONTEST
sponsored by
THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

ALGEBRA I 1994

Prepared by the Mathematics Dept.,
Nashville State Technical Institute
Coordinated by Elaine Richards and
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Scoring formula: 4R - W + 40

Edited by: Larry Bouldin , Roane State
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DIRECTIONS:

Do not open this booklet until you are told to do so.

This is a test of your competence in high school mathematics. For each problem, determine the best answer, and indicate your choice by making a heavy black mark in the proper place on the separate answer sheet provided. You must use a pencil with a soft lead (No. 2 lead or softer).

This test has been constructed so that most of you are not expected to answer all the questions. Do your very best on the questions you feel you know how to work. You will be penalized for incorrect answers, so it is advisable not to do wild guessing.

If you should change your mind about an answer, be sure to erase completely. Do not mark more than one answer for any problem. Make no stray marks of any kind on your answer sheet. The answer sheets will not be returned to you. If you wish to have a record of your performance, mark your answers in this booklet also. You will be able to keep this booklet after the test is completed.

When told to do so, open your test booklet and begin. The working time for the entire test is 80 minutes. The use of calculators is prohibited.

NOTE: 1995 Contest date, April 4

Contributors to TMTA for Annual Mathematics Contest:

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1. In the system of equations $\begin{cases} 4x + 3y = 8 \\ x + y = 2 \end{cases}$ the value of x is:

a. 2 b. -1 c. -2 d. 0 e. $\frac{1}{2}$

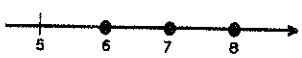
2. A nickel, penny, quarter. amd a silver dollar will be arranged in a row. In how many ways can this be done?

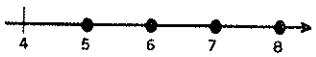
a. 131 b. 12 c. 4 d. 1 e. 24

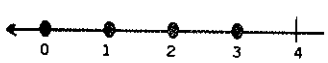
3. The graph of $x - 2 > 3$, Domain = {Integers}, is:

a. 

b. 

c. 

d. 

e. 

4. If the sum of three times a number and -5 is multiplied by 6, the answer is 42. Find the number.

a. -4 b. 2 ½ c. 8 d. 4 e. 24

5. Simplify: $\sqrt{5}\left[2\sqrt{5} - \sqrt{20}\right]$

a. $10 - 2\sqrt{15}$ b. 5 c. 0 d. $5 - 2\sqrt{15}$ e. $\sqrt{5}$

6. The equation of the line passing through the points (-3,2) and (0,-2) is:

a. $y = \frac{3}{4}x - 2$ b. $y = \frac{4}{3}x - 2$ c. $y = -\frac{4}{3}x - 2$

d. $y = -\frac{3}{4}x - 2$ e. $y = -\frac{3}{4}x + 2$

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

a. $x + y$ b. $\frac{xy}{x + y}$ c. 1 d. $\frac{x + y}{x^2y^2}$ e. $\frac{1}{x^2y^2}$

8. Let S = {1,2,3,4,5,6,7,8,9,10}. What is the probability that the number selected from this set is at least 4?

a. $\frac{7}{10}$ b. $\frac{3}{5}$ c. 0 d. 1 e. $\frac{2}{5}$

9. Let ⊙ be a binary operation over the set of positive integers such that $a \odot b = 2ab^2$. Find $a \odot (a \odot b)$.

a. $4a^3b^4$ b. $8a^3b^4$ c. $a^2 + ab$ d. $2ab$ e. $4a^2b^2$

10. Evaluate: $-(3^{-2}) \cdot -(-3)^0 \cdot 3^{-1}$

a. 18 b. $-\frac{1}{27}$ c. -27 d. 0 e. $\frac{1}{27}$

11. Expand: $(3x - 2)^3$

a. $27x^3 - 54x^2 + 36x - 8$ b. $27x^3 - 8$ c. $27x^3 + 54x^2 + 36x - 8$

d. $27x^3 + 54x^2 - 36x - 8$ e. $27x^3 + 8$

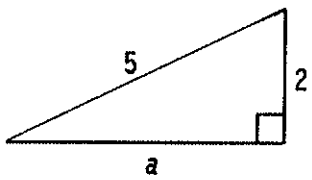
12. How many liters of a 65% acid solution should be added to 35 liters of a 12% acid solution to produce a 15% acid solution?

a. 1.2 b. 12 c. 2.4 d. 2.1 e. 2

13. The distance between the points (-2,3) and (4,5) is:

a. $2\sqrt{2}$ b. 8 c. $2\sqrt{11}$ d. $2\sqrt{10}$ e. 4

14. Find a:

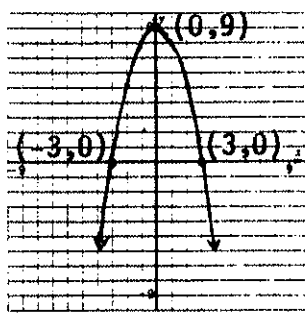


a. $\sqrt{29}$ b. 29 c. 3 d. $\sqrt{21}$ e. 21

15. The sum of three consecutive even integers is 174. The smallest of the three integers is:

a. 58 b. 60 c. 54 d. 56 e. 59

16. Which equation represents the graph of the parabola?



a. $y = x^2 + 9$ b. $y = x^2 - 9$

c. $y = 9 - x^2$ d. $y = x^2 + 9x$

e. $y = -x^2 - 9$

17. Solve for a in terms of g: $ga^2 - g^2a = g^3$

a. $a = \pm\frac{2}{g}$ b. $a = \pm g$ c. $a = \frac{g^2 \pm g^2\sqrt{5}}{2}$ d. $a = \frac{g \pm g\sqrt{5}}{2}$ e. $\varnothing$

18. Solve for x: $2|3x - 6| = 6$

a. 3 only b. 1 or 3 c. -1 only d. -3 or 0 e. 1 or 0

19. The equation of the line with slope -3 and passing through the point (-2,4) is:

a. $y = -3x + 4$ b. $y = -3x - 10$ c. $y = -3x - 2$

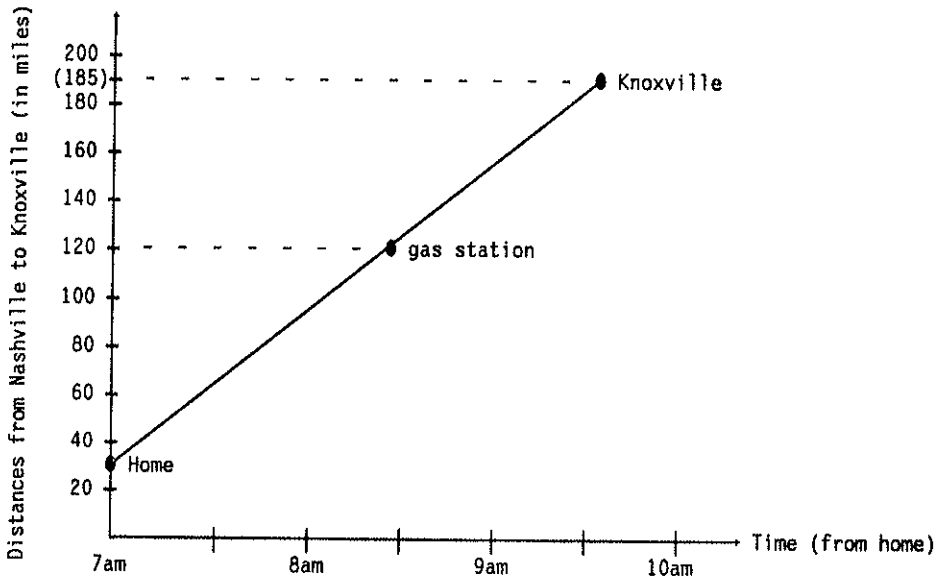
d. $y = -3x + 2$ e. $y = 3x + 2$

20. A customer received a 24% discount on the new stereo yet still had to pay $912. What was the <u>original price</u> of the stereo?

a. $3800 b. $888 c. $1200 d. $836 e. $1888

21. According to the chart below, how far (in miles) is it from home to Knoxville?

Trip from Home to Knoxville



a. 185 mi b. 150 mi c. 180 mi d. 65 mi e. 155 mi

22. Solve for a: $-\frac{3}{a+3} = \frac{7}{a^2-9} + \frac{5}{3-a}$

a. $-\frac{17}{2}$ b. $-\frac{2}{17}$ c. $-\frac{13}{8}$ d. no solution e. $-\frac{8}{13}$

23. Factor completely: $a^2 - (a+b)^2$

a. $(a-b)(a+b)$ b. $(a-2b)(a+2b)$ c. $(a-b)(a-b)$

d. $-b(2a+b)$ e. $b(a+b)$

24. The domain of the function $y = \frac{2}{x-1}$ is:

a. All real numbers b. $\{x|x \neq 2\}$ c. $\{x|x \neq -1\}$

d. $\{x|x \neq 0\}$ e. $\{x|x \neq 1\}$

25. Let $f(x) = \frac{x}{2} + x^2$ and let $g(x) = x^{-1}$. Find $f(g(-4))$.

a. $-\frac{1}{16}$ b. $-\frac{1}{12}$ c. $-\frac{7}{16}$ d. $\frac{1}{8}$ e. $-\frac{3}{16}$

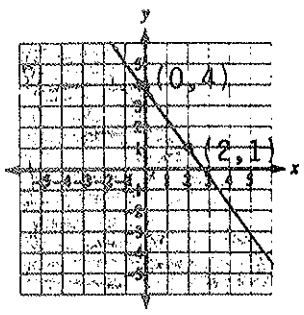
26. A child has \$8.50 in quarters and dimes. The child has 15 more dimes than quarters. How many quarters does the child have?

a. 5 b. 20 c. 10 d. 35 e. 2

27. Find the next term in this sequence: 8, 11, 18, 29, 44

a. 62 b. 59 c. 63 d. 61 e. 60

28. The shaded area represents which of the following?



a. $y \geq -\frac{3}{2}x + 4$ b. $y < -\frac{2}{3}x + 4$

c. $y \leq -\frac{3}{2}x + 4$ d. $y = -\frac{3}{2}x + 4$

e. $y < -\frac{3}{2}x + 4$

29. In the system of equations $\begin{cases} y = 2x - 3 \\ 3x - y = -4, \end{cases}$ the value of y is:

a. -5 b. 1 c. -7 d. -3 e. -17

30. A train leaves a station and travels at 45 miles per hour. Three hours later a second train leaves the same station and travels at 75 miles per hour. How many hours will it take the second train to catch the first train?

a. $3\frac{1}{2}$ hours b. $7\frac{1}{2}$ hours c. $4\frac{1}{2}$ hours d. $5\frac{1}{2}$ hours e. $1\frac{4}{5}$ hours

31. The slope of a line perpendicular to the line $y = -\frac{3}{5}x + 2$ is:

a. $-\frac{3}{5}$ b. $-\frac{5}{3}$ c. $\frac{3}{5}$ d. $\frac{5}{3}$ e. $\frac{2}{5}$

32. Solve for x: $\frac{2x}{x+3} = \frac{4x-1}{2x-3}$

a. $-\frac{5}{3}$ b. $\frac{3}{5}$ c. $-\frac{17}{3}$ d. $\frac{3}{17}$ e. $\frac{17}{3}$

33. The slope of the line $2y + 5x = 7$ is:

a. $\frac{2}{5}$ b. $\frac{7}{2}$ c. $-\frac{5}{2}$ d. $-\frac{2}{7}$ e. -5

34. Simplify: $(-2\frac{1}{2})(2) - [6 \div (-\frac{1}{3})]$

a. -13 b. 13 c. -3 d. -7 e. -2

35. The length a spring stretches varies directly as the force applied. If a force of 7 pounds stretches a string 3 inches, how much force is necessary to stretch the same spring 5 inches?

a. $\frac{35}{3}$ b. 105 c. $\frac{15}{7}$ d. $\frac{21}{5}$ e. $\frac{35}{7}$

36. Solve for a: $-\sqrt{5a-1} = a - 3$

a. $a = 1$ and $a = 10$ b. $a = \frac{2}{5}$ c. $a = 1$ d. $a = 10$ e. $a = -10$ and $a = -1$

37. What is the remainder when $(2x^2 - 9x + 15)$ is divided by $(x - 6)$?

a. 9 b. -18 c. 18 d. 0 e. 33

38. Find the additive inverse of $-t^{-2}$.

a. $-t^2$ b. t^{-2} c. t^2 d. 0 e. $-\frac{1}{t^2}$

39. Write in scientific notation: 100×10^{-6}

a. 10×10^{-4} b. 1×10^{-4} c. 1×10^{4} d. 10×10^{-8} e. 1^{-4}

40. If r and s are positive integers, and $r < s$, which one of the following statements is <u>false</u>?

a. $\left(\frac{r}{s}\right)^2 > \frac{r}{s}$ b. $-r > -s$ c. $s^2 > r^2$ d. $rs > r$ e. $\frac{1}{\frac{r}{s}} > 1$