TWENTY-EIGHTH ANNUAL MATHEMATICS CONTEST
Sponsored by
THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

ALGEBRA I 1984

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Scoring Formula: 4R - W + 40

This test was prepared from a list of Algebra I questions submitted by the Kingsport University Center of East Tennessee State University.

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 there are listed 5 possible answers; one and only one is correct. You are to work each problem, determine the correct answer, and indicate your choice by making a heavy black mark in the correct 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 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 much 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 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 to page 2 and begin. When you have finished one page, go on to the next. The working time for the entire test is 80 minutes.

Contributors to TMTA for Annual Mathematics Contest:

1. The value of $\dfrac{3^{-1} - 4^{-1}}{3^{-1} + 4^{-1}}$

   a) $\dfrac{-1}{12}$

   b) $\dfrac{1}{7}$

   c) 1

   d) 7

   e) 12

2. The expression $\big((2x + 1)x - 3\big)x - 1$ equals

   a) $2x^3 - x^2 - 3x + 1$

   b) $2x^3 + x^2 - 3x + 1$

   c) $2x^3 + x^2 - 3x - 1$

   d) $2x^3 - x^2 - 3x - 1$

   e) $2x^3 + x^2 + 3x - 1$

3. Simplify $\left(x^2 y^{-3}\right)^{-1}$

   a) $x^{-2} y^3$

   b) $x^2 y^{-3}$

   c) $(xy)^5$

   d) xy

   e) y

4. What is the coefficient of x in the product $(4x + 3)(3x-4)$?

   a) -12

   b) -7

   c) 0

   d) 12

   e) 25

5. If the expression $6x^2 + x - 12$ is factored $(ax + b)(cx - d)$ where a, b, c and d are positive integers, then a =

   a) 1

   b) 2

   c) 3

   d) 6

   e) No such factorization is possible.

12. $\dfrac{9^{1/2}}{27^{2/3}} =$

  a) 1/9   d) 3

  b) 1/3   e) 9

  c) 1

13. Solve for x $\dfrac{12}{x + 2} = 3$.

  a) 1   d) 4

  b) 2   e) 5

  c) 3

14. The determinant $\begin{vmatrix} 1 & 2 \\ 3 & 7 \end{vmatrix}$ equals

  a) 1   d) 12

  b) 3   e) 13

  c) 7

15. If $x = \dfrac{1 - t}{1 + t}$, then $t =$

  a) $\dfrac{x + 1}{x - 1}$ d) $\dfrac{x - 1}{x + 1}$

  b) $\dfrac{1 + x}{1 - x}$ e) $\dfrac{1}{x}$

  c) $\dfrac{1 - x}{1 + x}$

16. Solve for x. $\dfrac{4}{x} - \dfrac{6}{x} = \dfrac{8}{x} - 5$

  a) -2   d) 2

  b) -1   e) 3

  c) 1

22. If s and t are the roots of $x^2 - 5x - 24 = 0$, then a value of
s - t is

a) 3   d) 11

b) 5   e) 24

c) 8

23. Let a be a non-zero real number. The two roots of
$x^2 - 4x - a^2 = 0$ are

a) Both positive   d) Need not exist

b) One positive and one negative
                          e) The answer depends on a.
c) Both negative

24. A rectangle has area 18 square meters and perimeter 18 meters.
A possible value for the base of the rectangle is

a) 1   d) 4

b) 2   e) 5

c) 3

25. When $x^3 + x^2 + x + 1$ is divided by x - 2, the remainder is

a) 0   d) 7

b) 1   e) 15

c) 3

26. If the operation ⊙ is defined for positive numbers by
$a \odot b = ab/(a + b)$, the operation is

a) Both associative and commutative

b) Associative but not commutative

c) Commutative but not associative

d) Neither commutative nor associative

33. If $2^{x + 2y} = 32$ and $2^{2x + 3y} = 256$, what is $2^{y - x}$?

   a) 1
   b) 2
   c) 4
   d) 8
   e) 16

34. The graph of the equation $x^2 - 2xy + y^2 = 1$ is best described as

   a) Circle
   b) Ellipse
   c) Straight line
   d) Two straight lines
   e) Hyperbola

35. If one pipe can fill a tub in 6 hours and another can fill the tub in 5 hours, how long will it take to fill the tub using both pipes?

   a) 11/30 hours
   b) 1 hour
   c) 30/11 hours
   d) 11 hours
   e) 30 hours

36. Driver A drives a certain distance in $1\frac{1}{2}$ hours, and driver B drives the same distance in 2 hours. The speed of driver A is 20 mph greater than the speed of driver B. What is the speed of driver A?

   a) 60 mph
   b) 70 mph
   c) 80 mph
   d) 90 mph
   e) 100 mph

37. Solution A contains 70% water and 30% acid. Solution B contains 30% water and 70% acid. How many liters of solution B must be mixed with 10 liters of solution A to produce a solution which is 60% water and 40% acid?

   a) .3
   b) .3333
   c) 3.333
   d) 10
   e) 33.33

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