

NINTH ANNUAL MATHEMATICS CONTEST

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THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

ALGEBRA I TEST

1965

Scoring Formula: $4R - W$.

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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 First-year Algebra. For each of the 40 problems there are listed 5 possible answers. You are to work each problem and determine which is the correct answer, and indicate your choice by making a heavy black mark in the correct place on the separate answer sheet provided. A sample follows:

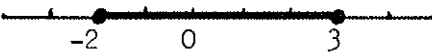
1. If $2x = 3$, then x equals:
- | | 1 | 2 | 3 | 4 | 5 |
|--------------------|---|---|---|---|---|
| (1) $2/3$; | | | | | |
| (2) 3 ; | | | | | |
| (3) 6 ; | | | | | |
| (4) $3/2$; | | | | | |
| (5) none of these. | | | | | |

The correct answer for the sample question is " $3/2$ ", which is answer (4); therefore, you should answer this question by making a heavy black mark under space 4 as indicated above.

If you should change your mind about an answer, be sure to erase completely. Avoid wild guessing, as wrong answers count against you. Do not mark more than one answer for any question. Make no stray marks of any kind on your answer sheet.

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 page. The working time for the entire test is 80 minutes.

1. Which of the following symbols does not represent a rational number?
 (1) $3/4$; (2) $0.333\dots$; (3) $\sqrt{3}$; (4) 1.732 ; (5) $3/2$.
2. Let S denote a set of elements and let \circ denote an operation. If for any two elements a and b in S , $a \circ b = b \circ a$, the operation is
 (1) associative; (2) closed; (3) commutative; (4) distributive;
 (5) none of these.
3. The solution set for the inequality $15 - \frac{2x}{3} > 21$ is
 (1) $\{x \mid x > -9\}$; (2) $\{x \mid x < -54\}$; (3) $\{x \mid x > 9\}$;
 (4) $\{x \mid x < -9\}$; (5) none of these.

4. The graph 

represents the solution set of

- (1) $x \leq 3$ and $x \geq 2$; (2) $x \leq -2$ and $x \geq 3$; (3) $x \geq -2$ and $x \leq 3$;
 (4) $x \geq -2$ and $x \geq 3$; (5) none of these.
5. The product of

$$\frac{3x^2 + 7x + 2}{4 - x^2} \quad \text{and} \quad \frac{3x^2 - 7x + 2}{1 - 9x^2} \quad \text{is}$$

- (1) 1; (2) -1; (3) $(x^2 - 4x + 4) / (9x^2 - 6x + 1)$;
 (4) $(9x^2 - 1) / (4 - x^2)$; (5) none of these.
6. The expression $\frac{x^2 + 7x - 8}{x^2 - 12x + 35}$ has no meaning if x is

- (1) 5 or 7; (2) -5 or -7; (3) 8 or 1; (4) -8 or -1; (5) 0.
7. What number added to 4 and to 6 produces two sums that have the ratio of 6:7?
 (1) -18; (2) 8; (3) 10; (4) 14; (5) none of these.
8. A mason can build a wall in 20 hours. His helper can do it in 30 hours. How long will it take them together if each works at his own rate?
 (1) 25 hours; (2) 7.5 hours; (3) 12 hours; (4) 12.5 hours; (5) none of these.

9. Which of the following pairs of linear functions have the same graph?
- (1) $\{(x,y) \mid x - y = 5\}$, $\{(x,y) \mid y = x + 5\}$;
 - (2) $\{(x,y) \mid y = 2x + 5\}$, $\{(x,y) \mid y = 2x\}$;
 - (3) $\{(x,y) \mid y = 2\}$, $\{(x,y) \mid x = 2\}$;
 - (4) $\{(x,y) \mid x - y = 5\}$, $\{(x,y) \mid y = x - 5\}$;
 - (5) none of these.
10. If $\sqrt{x-3} + 4 = 1$, then x is
- (1) 12 ; (2) -6 ; (3) 0 ; (4) 6 ; (5) none of these.
11. The roots of the equation $(x - 7)(x + 3) = 4$ are
- (1) 7 and -3 , (2) -7 and 3 , (3) 3 and 1 , (4) $2 + \sqrt{29}$ and $2 - \sqrt{29}$;
 - (5) none of these.
12. The solution set for the inequality $(x - 1)^2 \geq 4$ is
- (1) $\{x \mid x \geq 3\}$; (2) $\{x \mid x \geq 3 \text{ or } x \leq -1\}$; (3) $\{x \mid -1 \leq x \leq 3\}$;
 - (4) $\{x \mid x \geq 2 \text{ or } x \leq -2\}$; (5) none of these.
13. The hypotenuse of a right triangle is 25 feet long. The difference between the lengths of the other two sides is 5 feet. The lengths of the sides of the triangle are
- (1) 10 feet and 15 feet ; (2) 17.5 feet and 12.5 feet ; (3) 4 feet and 9 feet ;
 - (4) $\sqrt{15}$ feet and $\sqrt{15} + 5$ feet ; (5) 15 feet and 20 feet.
14. Jack takes 5 days more than Joe to do a job. Together they can finish in 6 days. Jack can do the job in
- (1) 11 days; (2) 15 days; (3) 7 days; (4) 8 days; (5) none of these.
15. The x -coordinates of the points of the graph of $y = x^2 + 2x - 3$ for $y = 0$ are
- (1) -3 and 1, (2) 3 and -1; (3) 3 and 1; (4) -3 and -1; (5) -3 and 2.
16. Which of the following pairs of numbers does not represent the coordinates of a point of the graph of the equation $3x + y = 6$?
- (1) (2,0) ; (2) (1,3) ; (3) (0,6) ; (4) (-1,9) ; (5) (-1,3).

17. The solution set for the system of equations $\begin{cases} 3x + y = 10, \\ 2x + y = 7, \end{cases}$
is

(1) $\{(3,1)\}$; (2) $\{(1,3)\}$; (3) $\{(-3, -1)\}$;
(4) $\{(-1, -3)\}$; (5) none of these.

18. The expression $x^2 + 9 - 6x$ may be written as

(1) $(x + 3)^2$; (2) $(x - 3)^2$; (3) $(x - 3)(x + 2)$;
(4) $(x + 3)(x - 2)$; (5) none of these.

19. The expression $\frac{\frac{x+y}{1} + \frac{1}{\frac{x}{1} + \frac{1}{y}}}$ is equivalent to

(1) 1; (2) $\frac{1}{xy}$; (3) xy ; (4) $x + y$; (5) none of these.

20. If y is inversely proportional to x and y is 45 when x is 5, then when x is 15, y is

(1) $3/5$; (2) $5/3$; (3) $1/15$; (4) 15; (5) none of these.

21. If $C = \frac{E}{R + \frac{r}{n}}$, then n is equal to

(1) $\frac{rC}{E + RC}$; (2) $\frac{rC}{E - RC}$; (3) $\frac{1}{E - RC}$; (4) $\frac{1}{E + RC}$; (5) none of these.

22. An equivalent expression for

$$25 - (x + y)^2 \text{ is}$$

(1) $[5 - (x + y)]^2$; (2) $(5 - x + y)^2$; (3) $(5 - x + y)(5 + x - y)$;
(4) $(5 - x - y)(5 + x + y)$; (5) none of these.

23. The fraction

$$\frac{\frac{6x}{y} - 7 - \frac{3y}{x}}{\frac{6}{y^2} + \frac{11}{xy} + \frac{3}{x^2}}$$

may be simplified and expressed as

(1) 1; (2) -1; (3) $(2x - 3y) \mid (2x + 3y)$; (4) $(3x + y) \mid (3x - y)$;
(5) none of these.

24. The size of a picture varies directly as the square of the distance of the projector from the screen. The area of the picture on a screen 30 feet from the projector is 30 square feet. The number of square feet in the area of the picture on a screen 6 feet nearer the projector is
- (1) 24 ; (2) $6/5$; (3) 6 ; (4) $\frac{96}{5}$; (5) none of these.
25. The expression $\frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$ is equivalent to
- (1) $1/4$; (2) $(\sqrt{5} - \sqrt{3})^2 / 2$; (3) 1 ; (4) -1 ; (5) none of these.
26. If $\frac{x}{2} - 1 > \frac{2x}{3}$, then the solution set is
- (1) $\{x \mid x > 6\}$; (2) $\{x \mid x < 6\}$; (3) $\{x \mid x > -6\}$;
 (4) $\{x \mid x < -6\}$; (5) none of these.
27. Alice is now two years older than Sue. Ten years ago the sum of their ages was 36. Alice's age in six years will be
- (1) 35 ; (2) 15 ; (3) 29 ; (4) 23 ; (5) none of these.
28. If $A = \{(x,y) \mid x - 3y = 10\}$ and $B = \{(x,y) \mid 2x - y = 5\}$ then $A \cap B$ is
- (1) $\{(4,2)\}$; (2) $\{(4,3)\}$; (3) $\{(-3,1)\}$; (4) $\{(3, -1)\}$; (5) $\{(1, -3)\}$.
29. For any real numbers a , b , and c , $(a + b) + c = a + (b + c)$. The above is a statement that addition of real numbers is
- (1) associative; (2) closed; (3) commutative; (4) distributive;
 (5) rational.
30. In a fraction the denominator is 4 greater than the numerator. If 24 is added to the numerator, the resulting fraction will be equal to the reciprocal of the original fraction. The fraction is
- (1) $\frac{5}{1}$; (2) $-\frac{7}{2}$; (3) $-\frac{1}{5}$; (4) $\frac{7}{2}$; (5) $\frac{1}{5}$.
31. In the expression $3x^5$, 5 is called the
- (1) coefficient; (2) exponent; (3) numerator; (4) reciprocal;
 (5) subscript.
32. The symbol $n(A)$ denotes the number of distinct elements in set A . If $n(A) = 9$, $n(B) = 8$, and $n(A \cap B) = 4$, then $n(A \cup B)$ is
- (1) 17 ; (2) 12 ; (3) 13 ; (4) 21 ; (5) 5 .

33. The coordinates of the point of intersection of the graphs of the equations
 $3x + 2y = 9$ and $y = 4x - 1$ are
 (1) (1,3) ; (2) (3,1) ; (3) (-1, -3) ; (4) (-3, -1) ; (5) none of these.
34. The product of $(4x - 3y)$ and $(7x + 3y)$ is
 (1) $11x$; (2) $28x^2 - 9y^2$; (3) $3x + 6y$; (4) $-3x - 6y$; (5) none of these.
35. For any sets A, B, and C, if $A = B$ and $B = C$, then $A = C$. The above is a statement that set equality is
 (1) commutative; (2) distributive; (3) reflexive; (4) symmetric;
 (5) transitive.
36. If the point with coordinates (3,7) is on the graph of the equation
 $2y - kx = 5$, then the value of k is
 (1) $1/7$; (2) $-11/7$; (3) $-19/3$; (4) 3 ; (5) none of these.
37. A beaker contains 80 milliliters of a solution that is 40 per cent acid and 60 per cent water. This solution should be added to how many milliliters of water to obtain a mixture that is 30 per cent acid?
 (1) 8 ; (2) $80/3$; (3) $8/3$; (4) 40 ; (5) none of these.
38. If $a * b = c$ means that $c = a(b + 1)$, then $4 * 5$ is
 (1) 25 ; (2) 21 ; (3) 24 ; (4) 30 ; (5) none of these.
39. Let a and b be any two elements of the set $\{0, 1, 2, 3, 4, 5, 6\}$. The product of a and b denoted by $a \pi b$ is r, if and only if $ab = r + 7q$, where $0 \leq r < 7$ and q and r are non-negative integers. Then $4 \pi 3$ is
 (1) 1 ; (2) 2 ; (3) 3 ; (4) 4 ; (5) 5.
40. The statement, "If p, then q." is logically equivalent to the statement
 (1) If not q, then not p ; (2) If q, then p ; (3) If not p, then not q ;
 (4) p if and only if q ; (5) q implies p .

