

TWENTIETH ANNUAL MATHEMATICS CONTEST
Sponsored by
THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

ALGEBRA I TEST

1976

Scoring Formula: $4R - W$

EDITED BY:

Billy Edwards
and
Joe E. Kirk, Jr.
University of Tennessee at
Chattanooga
Chattanooga, Tennessee

This test was prepared from a list of Algebra I questions submitted by Maryville College.

DIRECTIONS:

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

This is a test of your competence in high school algebra. 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 soft lead (No. 2 lead or softer). A sample problem follows:

1. If $2x = 3$, then x equals

- (a). $2/3$. (b). 3. (c). 6.
(d). $3/2$ (e). none of these

	A	B	C	D	E
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The correct answer for the sample problem is $3/2$, which is answer (d); so you would answer this problem by making a heavy black mark under space D as indicated above.

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 be used for a statistical compilation and 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 1 and begin. When you have finished one page, go on to the next. The working time for the entire test is 80 minutes.

1. Find the solution set for the following inequality: $-2x + 5 < 2x - 9$.
 - (a) $\{x: x > -1\}$
 - (b) $\{x: x < -1\}$
 - (c) $\{x: x < 7/2\}$
 - (d) $\{x: x > 7/2\}$
 - (e) all real numbers

2. $\frac{\sqrt{6} - \sqrt{5}}{\sqrt{6} + \sqrt{5}}$ is equivalent to
 - (a) $1/\sqrt{11}$
 - (b) -1
 - (c) $11 - 2\sqrt{30}$
 - (d) $11 - \sqrt{30}$
 - (e) $11 - \sqrt{11}$

3. A straight line crosses the x axis at -2 and the y axis at 4 . Which of the following is an equation for this line?
 - (a) $-2x + 4y = 1$
 - (b) $x = 2y + 4$
 - (c) $x = -2y + 4$
 - (d) $x = \frac{1}{2}y - 2$
 - (e) none of the above

4. The remainder when $x^5 - 3$ is divided by $x + 1$ is
 - (a) -4
 - (b) -2
 - (c) 0
 - (d) 2
 - (e) none of the above

5. Factor $9x^2 - y^2 - 4y - 4$ completely.

- (a) Cannot be factored
- (b) $(3x - y + 2)(3x + y - 2)$
- (c) $(3x + y + 2)(3x - y + 2)$
- (d) $(3x + y - 2)(3x + y + 2)$
- (e) $(3x - y - 2)(3x + y + 2)$

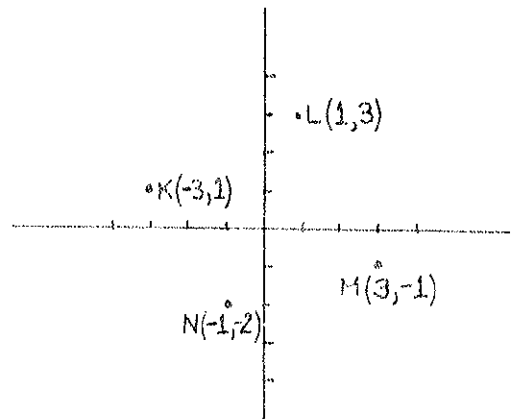
6. $\frac{6 \pm 2\sqrt{10}}{2}$ is equivalent to

- (a) $3 \pm 2\sqrt{10}$
- (b) $6 \pm \sqrt{10}$
- (c) $3 \pm \sqrt{5}$
- (d) $3 \pm \sqrt{10}$
- (e) $6 \pm \sqrt{5}$

7. If $x = 1/2$ then $\frac{1}{1 + \frac{1}{1 + \frac{1}{x}}} =$

- (a) 2
- (b) $3/5$
- (c) $4/3$
- (d) $3/4$
- (e) none of the above

8. If Y varies inversely as the square of X and $Y = 2$ when $X = 4$, what is Y when $X = 2$?
- 1
 - $1/2$
 - 4
 - 8
 - $\sqrt{2}$
9. If a and b are real numbers and $a > b$ then which of the following is true?
- If $b < 0$ then $a < 0$
 - If $b > 0$ then $a > 0$
 - If $b < 0$ then $a > 0$
 - If $a > 0$ then $b > 0$
 - If $a > 0$ then $b < 0$
10. Which pair of points determine the line $5x - 2y = -1$?
- L,N
 - K,L
 - K,N
 - K,M
 - M,N



11. A 30 ounce container is filled with a fruit drink which is 10% pure orange juice. How many ounces must be replaced by pure orange juice to make the drink 20% pure orange juice?

- 2
- 3
- $10/3$
- $7/2$
- 4

12. In a right triangle the length of the hypotenuse is 25 in. and the length of one leg is 7 in. How long is the other leg?
- (a) 18 in.
 - (b) 24 in.
 - (c) 10 in.
 - (d) 32 in.
 - (e) none of the above
13. If $f(x) = ax + 1$ and $g(x) = x + a$ and $f(g(x)) = g(f(x))$ for all x , then $a = ?$
- (a) 0 or 1
 - (b) 1 only
 - (c) 0 only
 - (d) Any real number
 - (e) No solution for a
14. For all real numbers x , $\sqrt{x^2} = ?$
- (a) x
 - (b) $-x$
 - (c) $|x|$
 - (d) $-|x|$
 - (e) 0
15. If $4^y = 1$ and $5^x = 1/5$ then $x + y = ?$
- (a) 1
 - (b) 0
 - (c) -1
 - (d) $-3/4$
 - (e) $x + y$ is not uniquely determined

16. One hundred people were polled and 55 said they watch football on TV, 35 watch basketball on TV, and 35 watch neither on TV. How many of the 100 people watch both on TV?
- (a) 10
 - (b) 15
 - (c) 20
 - (d) 25
 - (e) 30
17. The equation $\sqrt{x-1} = x+1$ has how many real solutions?
- (a) 0
 - (b) 1
 - (c) 2
 - (d) 3
 - (e) 4
18. What is the solution set of the following inequality? $-x^2 + 5x - 6 \geq 0$
- (a) $\{x: x \leq 2 \text{ or } x \geq 3\}$
 - (b) $\{x: 2 < x < 3\}$
 - (c) $\{x: 2 \leq x \leq 3\}$
 - (d) $\{x: x \leq -1 \text{ or } x \geq 6\}$
 - (e) the empty (or null) set
19. The volume V of a sphere of radius r is given by $V = \frac{4}{3} \pi r^3$. If the diameter of a sphere is doubled, how is the volume changed?
- (a) Multiplied by 8
 - (b) Multiplied by 2
 - (c) Unchanged
 - (d) Multiplied by 4
 - (e) None of the above

20. From a suit of 13 cards how many different hands of 3 cards can be dealt?
- (a) 572
 - (b) 13^3
 - (c) 13!
 - (d) 286
 - (e) $13 \cdot 12 \cdot 11$
21. Find the solution set of the equation $|5 - z| = 2$.
- (a) {3}
 - (b) {3,7}
 - (c) $\{x: 3 \leq x \leq 7\}$
 - (d) the empty (or null) set
 - (e) none of the above
22. $64^{-4/3} = ?$
- (a) 256
 - (b) $1/256$
 - (c) $-256/3$
 - (d) $3/256$
 - (e) -256
23. If $A = \{a, b, \{b\}\}$ and $B = \{a, b\}$ which of the following statements is false?
- (a) $B \subseteq A$
 - (b) $\{b\} \in A$
 - (c) $\{b\} \in B$
 - (d) $\{b\} \subseteq A$
 - (e) $\{b\} \subseteq B$

24. $3\sqrt[4]{32} - 2\sqrt[4]{162} = ?$
- (a) 0
 - (b) $\sqrt[4]{32} - \sqrt[4]{162}$
 - (c) $\sqrt[4]{132}$
 - (d) $6 - 2\sqrt[4]{162}$
 - (e) none of the above
25. If the function $f = \{(1,2), (2,3), (3,2), (4,1)\}$ then the inverse of f is
- (a) $\{(2,1), (3,2), (1,4)\}$
 - (b) $\{(2,1), (3,2), (2,3), (1,4)\}$
 - (c) $\{(1,2), (2,3), (3,2), (4,1)\}$
 - (d) $\{(1,1), (2,2), (3,3), (4,4)\}$
 - (e) does not exist
26. If $2^x = -1$ then $x = ?$
- (a) 0
 - (b) $-1/2$
 - (c) $1/2$
 - (d) -1
 - (e) none of the above
27. The rangers working in a state park wanted to know the approximate size of the chipmunk population in the park. From several locations in the park they captured 180 chipmunks, marked them, and set them free again. The following week they captured 150 chipmunks and among these were 20 marked chipmunks. What is the estimated size of the chipmunk population?
- (a) 2400
 - (b) 330
 - (c) 310
 - (d) 4800

28. If $ax^2 - \frac{1}{2}x + 7 = 0$ has equal roots then what is a ?
- (a) 28
 - (b) 112
 - (c) $1/7$
 - (d) $1/112$
 - (e) none of the above
29. If $\frac{2 - 3x}{5 - 2x} = 3$ then $x = ?$
- (a) $-13/9$
 - (b) $13/3$
 - (c) 3
 - (d) $3/13$
 - (e) none of the above
30. The roots of a quadratic equation are $\frac{-1 \pm \sqrt{5}}{3}$. Which of the following represents this equation?
- (a) $3x^2 + \sqrt{5}x - 1 = 0$
 - (b) $9x^2 + x - \sqrt{5} = 0$
 - (c) $9x^2 - 5 = 0$
 - (d) $9x^2 + 6x - 4 = 0$
 - (e) $9x^2 - 6x - 4 = 0$
31. The coordinates of the point of intersection of the graphs of $2x - 6y + 2 = 0$ and $x - 3y + 10 = 0$ are
- (a) (2, 1)
 - (b) (-1, 3)
 - (c) $(9/2, 11/6)$
 - (d) $(-11/2, -3/2)$
 - (e) none of the above

32. If the length L of a rectangle is increased by 2 in. and the width W is decreased by 2 in. then the area is increased by 4 square in. Which of the following is true?
- (a) $W = L$
 - (b) $W - L = 4$
 - (c) $W + L = 4$
 - (d) $W - L = 2$
 - (e) none of the above
33. If $f(x) = 2x^2 + x$ then $f(4)/f(2) =$
- (a) $f(2)$
 - (b) 18
 - (c) 10
 - (d) $5/18$
 - (e) $18/5$
34. If $x_1 = \sqrt{2} - \sqrt{1}$, $x_2 = \sqrt{3} - \sqrt{2}$, $x_3 = \sqrt{4} - \sqrt{3}$, $x_4 = \sqrt{5} - \sqrt{4}$, and $x_5 = \sqrt{6} - \sqrt{5}$ then $x_1 + x_2 + x_3 + x_4 + x_5 = ?$
- (a) $\sqrt{20} - \sqrt{15}$
 - (b) $\sqrt{5}$
 - (c) 0
 - (d) 5
 - (e) $\sqrt{6} - 1$
35. The least common multiple of 16 and 36 is
- (a) 576
 - (b) 288
 - (c) 144
 - (d) 72
 - (e) 4

36. Find the solution set of $(x + 1)^3 - 7(x + 1)^2 + 12(x + 1) = 0$.
- (a) $\{2, 3\}$
 (b) $\{-1, 3, 4\}$
 (c) $\{-1, 2, 3\}$
 (d) $\{3, 4\}$
 (e) $\{0, 3, 4\}$
37. $(x^{1/2} + x^{-2/3})^2 = ?$
- (a) $x + x^{-4/3}$
 (b) $x + 2x^{-1/3} + x^{-4/3}$
 (c) $x + x^{4/3}$
 (d) $x + x^{-1/6} + x^{-4/3}$
 (e) $x + 2x^{-1/6} + x^{-4/3}$
38. If $f(x) = 2x + 1$ then $\frac{f(2 + h) - f(2)}{h} = ?$
- (a) 1
 (b) $f(h)/h$
 (c) 2
 (d) -1
 (e) $4h + 1$
39. The expression $\frac{x - 1}{x^2 - 4} - \frac{x + 1}{x^2 - x - 2}$ is equivalent to
- (a) 0, $x \neq -1$
 (b) $-3/(x^2 - 4)$, $x \neq -1$
 (c) $(3x + 1)/(x^2 - 4)$, $x \neq -1$
 (d) $3/(x^2 - 2x - 2)$, $x \neq -1$
 (e) none of the above

40. If x and y are integers, then the number of solutions of the inequality $|x| + |y| \leq 3$ is

- (a) 3
- (b) 6
- (c) 12
- (d) 25
- (e) none of the above