

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

ALGEBRA I TEST 1982

Edited by: The University of
Tennessee at Martin

Scoring Formula: $4R - W + 40$

This test was prepared from a list of Algebra I questions submitted by Tennessee Technological 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.

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1. If $y_1 = 2x^2 + 2x$ and $y_2 = x^2 - x$, then $y_1 - y_2 =$
- a) $x^2 + x$
 - b) $-x^2 - 3x$
 - c) $x^2 + 3x$
 - d) $3x^2 + x$
 - e) $2x^2 + x$
2. $(-\frac{2}{3}x^3y^2)^3$ in simplified form is
- a) $-\frac{8}{27}x^9y^6$
 - b) $\frac{8}{27}x^6y^5$
 - c) $-\frac{2}{3}x^9y^6$
 - d) $\frac{8}{27}x^9y^6$
 - e) none of the above
3. The value of y which satisfied $\begin{cases} 4x + 3y = 7 \\ 2y - 3x = -4 \end{cases}$ is
- a) 0
 - b) $\frac{5}{17}$
 - c) $\frac{12}{5}$
 - d) $-\frac{5}{6}$
 - e) none of the above
4. If $f(x) = 2x + 3$, $f(f(x))$ is
- a) $4x^2 + 12x + 9$
 - b) $4x^2 + 6x + 3$
 - c) $4x + 9$
 - d) $4x^2 + 9$
 - e) $4x + 6$

5. The complete factoring of the expression $x^2 - 1 - 2y - y^2$ is
- a) $x^2 - (1 + y)^2$
 - b) $(x + y + 1)(x - y - 1)$
 - c) $(x + 1)(x - 1) - y(2 + y)$
 - d) $(x + y)(x - y) - (1 + 2y)$
 - e) none of the above
6. Which of the following statements is true?
- a) $0 > |-10|$
 - b) $|-10| = |8 + 4 - 2|$
 - c) $|-10| < |10|$
 - d) $(-5 - 7) = 12$
 - e) none of the above
7. If $f(x) = \sqrt[3]{x^3 - 1}$, $f(-x) =$
- a) $-x + 1$
 - b) $\sqrt[3]{-x^3 + 1}$
 - c) $\sqrt[3]{x^{-3} + 1}$
 - d) $-\sqrt[3]{x^3 + 1}$
 - e) none of the above
8. If $(0, 0)$ is a point of the graph of a linear function, which of the following is false?
- a) The y-intercept of the graph is 0.
 - b) The graph of the function is parallel to the x-axis.
 - c) The constant in the function is 0.
 - d) The coefficient of the independent variable can be determined from a single ordered pair.
 - e) The x-intercept of the graph is 0.

9. If $3(x + 3) - 4(x - 1)$ is simplified, the result is
- a) $-x + 10$
 - b) $-x + 5$
 - c) $7x + 10$
 - d) $-x + 4$
 - e) none of the above
10. If the points $(1, -2)$, $(x, 2)$ and $(5, 6)$ lie on a straight line,
- a) $x = 2 \frac{7}{8}$
 - b) $x = 3 \frac{1}{8}$
 - c) $x = 2 \frac{9}{10}$
 - d) $x = 3$
 - e) none of the above
11. The set of value(s) of k for which the point $(k, 10)$ lies on the graph of $y = 3x^2 - 17$ is
- a) $\{7, -7\}$
 - b) $\{3\}$
 - c) $\{-3\}$
 - d) $\{3, -3\}$
 - e) none of the above
12. If $2x^4 - 3x^2 + x + x^3 - 10$ is divided by $x - 2$ the remainder is
- a) 20
 - b) 0
 - c) -40
 - d) 4
 - e) none of the above

13. The slope of the line whose equation is $5x - 2y - 3 = 0$ is
- a) $\frac{2}{5}$
 - b) $-\frac{2}{5}$
 - c) $-\frac{5}{2}$
 - d) $\frac{5}{2}$
 - e) none of the above
14. The statement that $mp = np$ implies $m = n$ is
- a) true if $m \neq 0$
 - b) never true
 - c) true for all m, n and p
 - d) true if $p \neq 0$
 - e) true if $n \neq 0$
15. Of the numerals $\frac{39}{17}$, π , $\sqrt{4}$, $\sqrt[3]{4}$, $2.31\overline{31}$, the set of those which do not represent rational numbers is
- a) $\{\frac{39}{17}, \pi, \sqrt{4}, \sqrt[3]{4}, 2.31\overline{31}\}$
 - b) $\{\pi, \sqrt{4}, \sqrt[3]{4}, 2.31\overline{31}\}$
 - c) $\{\pi, \sqrt{4}, \sqrt[3]{4}\}$
 - d) $\{\pi, \sqrt[3]{4}, 2.31\overline{31}\}$
 - e) none of the above
16. The solution of $\frac{x+3}{x+2} + \frac{x+2}{x-3} = \frac{2x^2+7}{(x-3)(x+2)}$ is
- a) a negative integer
 - b) an imaginary number
 - c) a positive integer
 - d) an irrational number
 - e) none of the above

25. If $x \neq 0$ and $y \neq 0$ the expression $\frac{x^{-3} y^{-3}}{x^{-3} + y^{-3}} =$

- a) $\frac{x^3 + y^3}{x^3 y^3}$
- b) $\frac{1}{x^3 + y^3}$
- c) $x^{-3} + y^{-3}$
- d) $\frac{1}{2}$
- e) $\frac{1}{x^6 + y^6}$

26. The sum of the prime factors of $9x^2 + 15x - 16y^2 + 20y$ is

- a) $6x + 5$
- b) $6x - 8y$
- c) $3x - 4y + 5$
- d) $9x + 4y$
- e) none of the above

27. The domain of $\sqrt{\frac{t}{t-1}}$ is

- a) all real numbers
- b) $t \geq 1$
- c) $t \leq 0$ or $t > 1$
- d) $t \leq 0$ or $t \geq 1$
- e) $t \geq 0$

28. If a is a real number, then $\sqrt{a^2}$ is

- a) $|a|$
- b) $\pm a$
- c) a
- d) $-a$
- e) none of the above

29. How old is Mike if the result is 36 when seven times his age in twelve years is subtracted from the square of his present age?

- a) 12
- b) 14
- c) 13
- d) 15
- e) none of the above

30. The equation $\begin{vmatrix} 3 & 2 & 1 \\ -2 & x & 0 \\ 1 & -1 & x \end{vmatrix} = 0$

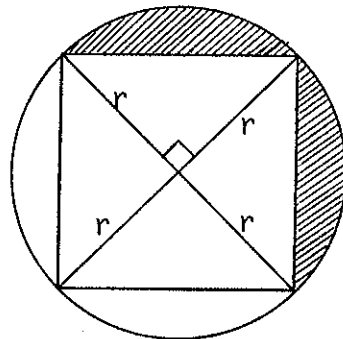
- a) has no solutions
- b) has two distinct real solutions
- c) has one solution
- d) has a double real solution
- e) has two complex solutions

31. The complete factoring of $2x^4 - 32y^8$ over the set of real numbers is

- a) $2(x^4 - 32y^8)$
- b) $(2x - 4y^2)(x + 2y^2)(x^2 + 4y^2)$
- c) $2(x - 2y^2)(x + 2y^2)^3$
- d) $2(x - 2y^2)(x^2 + 4y^4)(x + 2y^2)$
- e) none of the above

32. The measure of the area of the shaded region is

- a) $(\pi - 1)r^2$
- b) $(\pi - 2)r^2$
- c) $\frac{1}{2}(\pi - 2)r^2$
- d) $\frac{1}{2}(\pi - 1)r^2$
- e) none of the above



33. If two real numbers x and y satisfy the equation $xy = |x|y$, which of the following statements is always true?
- a) $x \geq 0$ or $y = 0$
 - b) $x \geq 0$
 - c) $y \geq 0$
 - d) $x \geq 0$ and $y \geq 0$
 - e) none of the above
34. For what value of k does the equation $x^2 - 4x + k = 0$ have two solutions m_1 and m_2 with $m_1 - m_2 = 1$?
- a) $\frac{7}{2}$
 - b) $\frac{17}{4}$
 - c) $\frac{15}{4}$
 - d) $\frac{9}{2}$
 - e) none of the above
35. Henry painted one-third of his yard fence in two hours. His brother John took over and finished the job in three hours. How long would it have taken both working together?
- a) $7\frac{1}{2}$ hours
 - b) $\frac{18}{7}$ hours
 - c) 5 hours
 - d) $\frac{7}{18}$ hours
 - e) none of the above
36. In how many years will the original amount be tripled at a 10% simple interest rate?
- a) 10
 - b) 20
 - c) 15
 - d) 5
 - e) none of the above

37. In order to complete the square of the expression $3x^2 - 7x + 1$, add
- $(-\frac{7}{2})^2 - (-\frac{7}{2})^2$
 - $(-7)^2 - (-7)^2$
 - $(-\frac{7}{3})^2 - (-\frac{7}{3})^2$
 - $(\frac{1}{3})^2 - (\frac{1}{3})^2$
 - none of the above
38. If r_1 and r_2 are the real roots of $x^6 - 7x^3 - 8 = 0$, find the value of $r_1^2 + r_2^2$.
- 1
 - 4
 - 20
 - 5
 - 65
39. The solution set of the inequality $|3 - 2x| \leq |x|$ is
- $\{x | 1 \leq x < \frac{3}{2}\} \cup \{x | \frac{3}{2} < x \leq 3\}$
 - $\{x | x \geq 3\}$
 - $\{x | 1 \leq x \leq 3\}$
 - $\{x | x \geq 1\}$
 - $\{x | x \geq 3\} \cup \{x | x \leq 1\}$
40. If the denominator of $\frac{1}{\sqrt[3]{a} + 1}$ is rationalized, the result is
- $\sqrt[3]{a^2} - \sqrt[3]{a} + 1$
 - $\frac{\sqrt[3]{a} - 1}{a - 1}$
 - $\frac{\sqrt[3]{a} + 1}{a + 1}$
 - $\frac{\sqrt[3]{a^2} + \sqrt[3]{a} + 1}{a + 1}$
 - none of the above

