

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

ALGEBRA I 1988

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Scoring formula: $4R - W + 40$

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. You are to work 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 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 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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ALGEBRA I TEST

1. Simplify: $(2a - 7)(5a^2 - 2a + 3) =$
 - a. $a^3 - 31a^2 + 20a - 21$
 - b. $10a^3 + 39a^2 + 20a - 21$
 - c. $10a^2 - 39a - 21$
 - d. $10a^3 - 39a^2 + 20a - 21$
 - e. $10a^3 - 39a^2 - 8a - 21$
2. Factor Completely: $18a^3 + 57a^2 + 30a =$
 - a. $3a(2a + 5)(3a + 2)$
 - b. $3(2a + 3)(3a + 2)$
 - c. $3a(3a + 5)(2a + 2)$
 - d. $3a(6a + 1)(a + 2)$
 - e. $3a(6a + 5)(a + 2)$
3. Simplify: $(2^a \cdot 5^b)^3 =$
 - a. 10^{a+b+3}
 - b. $2^{a+3}, 5^{b+3}$
 - c. $2^{3a} + 5^{3b}$
 - d. $2^{3a} \cdot 5^{3b}$
 - e. $2a^3 \cdot 5b^3$
4. One water pipe can fill a tank in 9 minutes while a second pipe requires 18 minutes to fill the tank. How long would it take both pipes working together?
 - a. 9 min.
 - b. 6 min.
 - c. 12 min.
 - d. 3 min.
 - e. 4.5 min.
5. Solve for R: $P = \frac{R - C}{n}$
 - a. $R = \frac{nP}{C}$
 - b. $R = Pn + C$
 - c. $R = n(P + C)$
 - d. $R = P + n + C$
 - e. $R = \frac{-nP}{C}$
6. $\frac{a^2 + 2ab + b^2 + ac + bc}{a + b + c}$ is
 - a. $a + b$
 - b. $b + c$
 - c. $a + c$
 - d. $a + b + c$
 - e. $ab + c$
7. The solution for $|4x + 5| \leq 3$ is:
 - a. $\frac{1}{2} \leq x \leq 2$
 - b. $-2 \leq x \leq \frac{-1}{2}$
 - c. $x \leq -2$ or $x \geq \frac{-1}{2}$
 - d. $x \leq \frac{-1}{2}$ or $x \geq 2$
 - e. $\frac{-1}{2} \leq x \leq 2$
8. If $4 - 3a > 8 - 2(2a + 5)$ then :
 - a. $a < \frac{-26}{15}$
 - b. $a < -6$
 - c. $a > 14$
 - d. $a > -6$
 - e. $a < -14$

9. Simplify: $\frac{(a^{-2}y^3)^{-3}}{a^2y} =$ a. $\frac{1}{y^6}$ b. $\frac{a^{12}}{y^6}$
 c. $\frac{1}{a^4y^{10}}$ d. $\frac{1}{a^7y}$ e. $\frac{a^4}{y^{10}}$
10. Factor Completely: $x^2(x - 3) + 4(3 - x) =$
 a. $(x^2 + 4)(x - 3)$ b. $(x^2 - 4)(x - 3)$
 c. $(x + 2)(x + 2)(x - 3)$ d. $(x - 3)(x + 2)(x - 2)$
 e. $(x^2 + 4)(3 - x)$
11. Which quadratic equation has irrational roots?
 a. $x^2 - 4x + 3 = 0$ b. $x^2 - 3x - 4 = 0$
 c. $2x^2 + 3x - 5 = 0$ d. $2x^2 - 3x - 5 = 0$
 e. $2x^2 + x - 5 = 0$
12. The diagonal of a square is 12 inches. The length of the side of the square is:
 a. 4 inches b. 12 inches c. 6 inches
 d. $6\sqrt{2}$ inches e. $2\sqrt{6}$ inches
13. $8\sqrt{8} - 4\sqrt{32} - 9\sqrt{50} =$ a. $-18\sqrt{5}$ b. $-45\sqrt{2}$
 c. $-25\sqrt{2}$ d. $-25\sqrt{2}$ e. $-5\sqrt{130}$
14. Three times the second of three consecutive even integers is fourteen more than the sum of the first and third integers. Find the middle even integer.
 a. 10 b. 16 c. 12 d. 14 e. 18
15. Evaluate for $a = -2$, $b = 4$, $c = -1$ and $d = 3$: $\frac{b - 2a}{bc^2 - d}$
 a. 8 b. $-2/7$ c. 2 d. $1/2$ e. 0
16. Simplify: $-2\{4x - [6x - 2(4x-5)]\} =$
 a. $-12x + 20$ b. $-12x - 20$ c. $-4x + 20$
 d. $-6x - 10$ e. $-22x + 10$

Algebra I

17. The simplified form of $\frac{x^6 - y^6}{x^2 - y^2}$ is:
- a. $x^4 - y^4$
 - b. $(x - y)(x^3 + y^3)$
 - c. $x^4 + x^2y^2 + y^4$
 - d. $x^3 - y^3$
 - e. $(x^2 + y^2)^2$
18. A square has a side that is twice as long as the width of a rectangle and only one-half as long as the length of the same rectangle. If the perimeter of the rectangle is 20 inches, what is the length of the side of the square?
- a. 4 inches
 - b. 8 inches
 - c. 5 inches
 - d. 10 inches
 - e. 2 inches
19. Divide $\frac{x^2 - 100}{x}$ by $\frac{x^2 + 12x + 20}{2x^2}$:
- a. $x - 10$
 - b. $\frac{2x(x - 10)}{x + 2}$
 - c. $2(x - 5)$
 - d. $\frac{x + 2}{2x(x - 10)}$
 - e. $10x$
20. If $h(x) = x^3 - x^2 + x - 1$, then $h(-a) =$
- a. $a^3 + a^2 - a - 1$
 - b. $-a^3 - a^2 + a - 1$
 - c. $-a^3 + a^2 - a - 1$
 - d. $-a^6 - 1$
 - e. $-a^3 - a^2 - a - 1$
21. Which is not an example of the commutative property of addition of integers?
- a. $(2 + 3)(4 + 5) = (4 + 5)(2 + 3)$
 - b. $2 + 0 = 0 + 2$
 - c. $(3 + 2) + 8 = 8 + (3 + 2)$
 - d. $[2 + (4 + 3) + 6] = [2 + (3 + 4) + 6]$
 - e. $3(4 + 9) = 3(9 + 4)$
22. The vertex of the parabola $y = x^2 - 6x - 3$ is:
- a. $(-3, 12)$
 - b. $(3, -12)$
 - c. $(3, -6)$
 - d. $(-3, 6)$
 - e. $(-3, -12)$

23. Simplify: $\frac{3 - \sqrt{3}}{5 - \sqrt{3}}$ a. $6/11$ b. $5\sqrt{3}/11$ c. 6
d. $\frac{6 - \sqrt{3}}{11}$ e. $6 - \sqrt{3}$
24. If $4^{x+2} = 2^{x+6}$, then x is
a. 0 b. 1 c. 2 d. 3 e. -2
25. $\frac{x}{1 - \frac{1}{x+1}}$ is a. x b. $x + 1$ c. $\frac{1}{x}$
d. $\frac{1}{x+1}$ e. $\frac{2}{x}$
26. If $x^6 - 5x^4 - 6x^2 + 2$ is divided by $x - 1$, the remainder is
a. 6 b. -4 c. -8 d. 2 e. 9
27. The solution set of $\sqrt{\frac{1}{1-x}} = \frac{1}{1+x}$ is
a. \emptyset b. $\{0\}$ c. $\{-3\}$ d. $\{0, -3\}$ e. $\{1\}$
28. $\left(\frac{a-1}{a-b} - \frac{b-1}{a-b}\right)^{-1}$ is a. $a^2 - b^2$ b. $b^2 - a^2$
c. $\frac{1}{a^2 - b^2}$ d. ab e. $-ab$
29. The distance between the points $(\sqrt{3}, 2)$ and $(2\sqrt{3}, 1)$ is
a. $1 + \sqrt{3}$ b. $\sqrt{3} - 1$ c. $3\sqrt{3}$ d. 1 e. 2
30. $|x^2 + 1| < 0$, has how many solutions for x ?
a. none b. one c. two d. three
e. more than three
31. $2x + y = 7$ has a solution of:
 $x - 2y = 6$
a. $(3, 1)$ b. $(2, -2)$ c. $(4, -1)$
d. $(0, -3)$ e. $(4, 0)$
32. $x^3 + 4x^2 + 3x + 12$ is the product of:
a. $x + 1; x + 2; x + 6$ b. $x^2 + 4$ and $x + 3$
c. $x - 1; x - 2; x + 6$ d. $x^2 + 3$ and $x + 4$
e. $x - 2; x + 2; x - 3$

33. Which of the following relations are functions $y = f(x)$?
- I. $x + y = 1$ II. $x^2 + y^2 = 1$ III. $x^2 + y = 1$
- a. I b. I and II c. II and III
- d. II e. I and III
34. For two resistors R_1 and R_2 , connected in parallel, the total resistance R can be found by using the following formula:
- $$1/R = 1/R_1 + 1/R_2$$
- If two resistors, connected in parallel, are such that one has three times the resistance of the other, and if the total resistance is 15 ohms, find the number of ohms in each resistor.
- a. 25 and 75 d. 20 and 60
- b. 10 and 30 e. 5 and 15
- c. 45 and 15
35. The equation of the straight line through $(-2,3)$ that is also parallel to the line with equation $2x - 4y = 1$ is:
- a. $x + 2y - 2 = 0$ d. $2x - y - 3 = 0$
- b. $2y - x + 1 = 0$ e. $x - 2y + 8 = 0$
- c. $x - 4y + 2 = 0$
36. A square flower bed has a three foot walk surrounding it. If the walk were to be replaced and planted with flowers, the new flower bed would have four times the area of the original bed. What is the length of one side of the original bed?
- a. 2 b. 4 c. 5 d. 10 e. 6
37. If $f(x) = \sqrt{x}$, then $\frac{f(2+h) - f(2)}{h} =$
- a. $1/\sqrt{h}$ b. 0 c. $\frac{1}{\sqrt{2+h} + \sqrt{2}}$ d. $\sqrt{2} + \sqrt{h}$ e. $h^2 - 4$
38. All values of x satisfying the equation: $\frac{3}{x-7} - \frac{2}{x+7} = \frac{x+35}{x^2-49}$ are
- a. 7, -7 d. 5, -5
- b. 9, 1 e. All real numbers except 7 and -7.
- c. 0

39. If a true pair of dice are tossed, what is the probability that they will turn up "snake eyes" (or 1 and 1)?
- a. 1 : 6
 - b. 1 : 12
 - c. 1 : 36
 - d. 1 : 3
 - e. 1 : 18
40. The slope of the line through $(3,4)$ and $(5,y)$ is 2. What is the value of y ?
- a. 6
 - b. 7
 - c. 8
 - d. 9
 - e. 10

