

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

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Scoring formula:  $4R - W + 40$

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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 high school mathematics. For 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 the 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 to have 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 and begin. The working time for the entire test is 80 minutes.

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Contributors to TMTA for Annual Mathematics Contest:

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1. Translate and simplify: Six minus the difference between three times a number and ten.
  - a.  $16+3n$
  - b.  $4+3n$
  - c.  $16-3n$
  - d.  $-4-3n$
  - e.  $-16-3n$
  
2. A line has a slope of  $-\frac{2}{3}$  for a pair of points on the line. Find the missing coordinate if the points are  $(-1,y)$  and  $(4,7)$ :
  - a.  $10\frac{1}{3}$
  - b.  $-9$
  - c.  $14\frac{1}{2}$
  - d.  $-11\frac{1}{2}$
  - e.  $3\frac{2}{3}$
  
3.  $5n+n = 5n+1n$  illustrates what property?
  - a. Reflexive property of equality
  - b. Identity of addition
  - c. Identity of multiplication
  - d. Commutative property of addition
  - e. Symmetric property of equality
  
4. Evaluate the function  $f(x)=-x^2+2x-3$  at  $x = -5$ .
  - a.  $-18$
  - b.  $32$
  - c.  $12$
  - d.  $-38$
  - e.  $-3$
  
5. If  $n$  is an integer and  $n < 0$ , which is always true?
  - a.  $-2n < n^2$
  - b.  $n-5 < 5-n$
  - c.  $n+4 < 4+n$
  - d.  $n-3 < 3n$
  - e.  $n^2 > 2+n$
  
6. If  $5x-2$  is an odd integer, what is the next consecutive odd integer?
  - a.  $5x$
  - b.  $5x-3$
  - c.  $5x+1$
  - d.  $5x-4$
  - e.  $5x-1$
  
7. Write  $-2x+6y=-4$  in slope-intercept form.
  - a.  $2x-6y-4=0$
  - b.  $y = -\frac{1}{3}x + \frac{2}{3}$
  - c.  $-y = \frac{1}{3}x + \frac{2}{3}$
  - d.  $y = \frac{1}{3}x + \frac{2}{3}$
  - e.  $y = \frac{1}{3}x - \frac{2}{3}$
  
8. If  $m \odot c$  is defined as  $3m^2+c^2+5mc$ , what is the value of  $-1 \odot -3$ ?
  - a.  $24$
  - b.  $3$
  - c.  $-3$
  - d.  $27$
  - e.  $-27$

9. List all statements which are true from the following group:
1.  $\sqrt{35}$  is both irrational and real.
  2.  $\sqrt{64}$  is a rational number.
  3. No real number is both a whole number and an integer.
  4.  $-\frac{11}{4}$  is rational and real.
  5. No real number is both rational and irrational.
- a. 2,3,5,    b. 1,3,4    c. 1,2,3,4    d. 2,4,5    e. 1,2,4,5

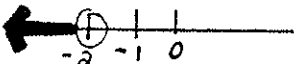
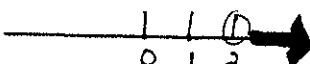
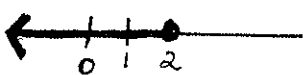
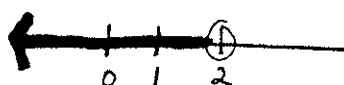
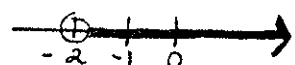
10. Simplify:  $5 - 30[-3 - (-4)]^2 \div 15$
- a. -93    b. 3    c. -55    d. -25    e. -45

11.  $|6x-5| > 10$  is valid for:
- a. no real number x
  - b.  $x > 5/6$  or  $x < -2.5$
  - c.  $-2.5 < x < 5/6$
  - d.  $-5/6 < x < 2.5$
  - e.  $x > 2.5$  or  $x < -5/6$

12. The solution for  $5^{(1+2x)} = 125^{(x-1)}$  is x=
- a. 2/3    b. 3/5    c. 3    d. 4    e. 1

13. The simplest form for  $\left[ \frac{2^2 \cdot a^{1/2} \cdot b^3 \cdot x^{-3/2}}{2ax^4} \right]^2$  is:
- a.  $\frac{4b^6}{ax^5}$
  - b.  $\frac{4ab^6}{x^{11}}$
  - c.  $\frac{4b^6}{ax^{11}}$
  - d.  $\frac{4b^6 x^{11}}{a}$
  - e.  $\frac{4a^{-1}b^6}{x^{11}}$

14. The simplest form for:  $\sqrt{4x^5 y^{10} z^8} \sqrt{81x^2 y^4 z^4} \sqrt{256x^8}$  is:
- a.  $12x^4 y^6 z^5$
  - b.  $12^4 y^6 z^6$
  - c.  $6x^4 y^6 z^6$
  - d.  $24x^4 y^6 z^6$
  - e.  $\sqrt{12} x^4 y^6 z^6$

15. Which expression represents the distance between  $(x,y)$  and  $(-4,3)$ ?
- a. 5      b. 1      c.  $\sqrt{(x-3)^2 + (y+4)^2}$   
 d.  $\sqrt{(x-4)^2 + (y+3)^2}$       e.  $\sqrt{(x+4)^2 + (y-3)^2}$
16. A car radiator which holds 5 gallons is filled with a mixture of 30% antifreeze and 70% water. How much of this mixture should be drained and replaced with pure (100%) antifreeze so that the radiator will be filled with a mixture which is 70% antifreeze and 30% water?
- a. 2.14 gal.    b. 2.86 gal.    c. 5 gal.    d. 4 gal.    e. 1.5 gal.
17. All of these are true for exponents except:
- a.  $a^m \cdot a^n = a^{m+n}$       b.  $(a^m)^n = a^{mn}$       c.  $a^m \div a^n = a^{m-n}$   
 d.  $a^{m/n} = \sqrt[n]{a^m}$       e.  $a^0 = 1$
18. The slope of the line passing through the point  $(3,-5)$  and having the equation  $4x-ky+5=0$  is:
- a.  $-17/5$       b.  $3 \frac{2}{5}$       c.  $-20/17$       d.  $20/17$       e.  $-4/5$
19. The graph which shows the solution for the inequality  $6 - x > 4$  is:
- a.       b.   
 c.       d.   
 e. 
20. The solution for the system  $3(x+4)-2y=6$  is the ordered pair  $(x,y) =$   
 $7x-3(y-2)=2$
- a.  $(-2,6)$       b.  $(2,-6)$       c.  $(6,2)$       d.  $(-6,-2)$       e.  $(2,6)$

21.  $4\sqrt{75} - 3\sqrt{27} + 2\sqrt{125} =$   
 a.  $21\sqrt{5}$       b.  $30\sqrt{5} - 9\sqrt{3}$       c.  $10\sqrt{5} - 9\sqrt{3}$   
 d.  $11\sqrt{3} + 10\sqrt{5}$       e.  $21\sqrt{2}$
22. The expression  $\frac{2\sqrt{2}}{\sqrt{3} - \sqrt{5}}$  simplifies to:  
 a.  $2(\sqrt{3} + \sqrt{5})$       b.  $\sqrt{5} + \sqrt{3}$       c.  $-(\sqrt{10} + \sqrt{6})$   
 d.  $\sqrt{10} - \sqrt{6}$       e. 2
23. One bus leaves city A at 10:30 A.M. and travels toward city B at a rate of 50 miles/hr. Another bus leaves city B for city A at 12:00 P.M. and travels at 60 miles/hr. If they pass each other at 2:30 P.M. how far is it from city A to city B?  
 a. 150 miles      b. 200 miles      c. 350 miles  
 d. 400 miles      e. 450 miles
24. Combine terms where possible in the following polynomial. Give the degree of the polynomial:  $2x^2 - x^3 + 4x - 5$   
 a. -4      b.  $-4x$       c. 3      d. 2      e. 1
25. Combine terms where possible in the following expression and select the most specific description:  $11x^3 - x^2 + x^4 + x^4 - 7x^2$   
 a. monomial    b. binomial    c. trinomial    d. pentanomial    e. ethynomial
26. Add or subtract as indicated.  $-(y^2 - 5y - 3) + (3y^2 + 2y) - (y - 1)$   
 a.  $2y^2 + 6y - 4$       b.  $-4y^2 + 2y + 4$       c.  $2y^2 - 2y - 4$   
 d.  $4y^2 - 2y - 4$       e.  $2y^2 + 6y + 4$
27. What is the coefficient of k in the product  $(3k - 6)(2k + 1)$ ?  
 a. 3      b. -9      c. 2      d. 6      e. -6
28. One factor of  $x^3 + x^2 - 5x + 3$  is:  
 a.  $(x - 3)$       b.  $(x + 1)$       c. x      d.  $(x - 5)$       e.  $(x + 3)$

29. With formula  $S = 180(n - 2)/n$ , solve for n.  
 a.  $360/S$    b.  $S/360$    c.  $360/(S + 180)$    d.  $360/(180 - S)$    e.  $360/(S - 180)$
30. Factor  $2ax^2 + 4ax + 2a$  completely.  
 a.  $2(ax^2 + 2ax + a)$    b.  $2a(x^2 + 2x + 1)$    c.  $2a(x + 1)^2$   
 d.  $2ax(x + 1)^2$    e.  $2ax(x^2 + 2x + 1)$
31. Multiply and simplify:  $\frac{6x^2 + x - 35}{4x^2 - 1} \cdot \frac{4x^2 + 2x}{4x^3 + 14x^2 + 10x}$   
 a.  $\frac{3x - 7}{2x^2 + x - 1}$    b.  $\frac{3x - 7}{2x^2 - x - 1}$    c.  $\frac{6x - 14}{x(4x^2 + 2x - 2)}$    d.  $\frac{-x(6x^2 + x - 35)}{2x^3 + 7x^2 + 5x}$   
 e.  $\frac{-3x + 7}{2x^2 + x - 1}$
32. Add and Simplify:  $\frac{x^2 + 6x - 1}{x^2 + 6x - 7} + \frac{x + 1}{x^2 + 6x - 7}$   
 a.  $\frac{x^2 + 5x - 2}{x^2 + 6x - 7}$    b.  $\frac{7x - 2}{6x - 7}$    c.  $\frac{1}{7}$    d.  $\frac{x}{x - 1}$    e.  $\frac{x^2 + 7x}{x^2 + 6x - 7}$
33. Subtract:  $\frac{3}{25 - x^2} - \frac{4}{x^2 - 3x - 10}$   
 a.  $\frac{-x - 14}{x^3 + 2x^2 - 25x - 50}$    b.  $\frac{-1}{-3x + 15}$    c.  $-\frac{7x + 26}{x^3 + 2x^2 - 25x - 50}$    d.  $\frac{-1}{3x + 35}$   
 e.  $\frac{-7x + 26}{x^3 + 2x^2 - 25x - 50}$
34. Simplify:  $\frac{\frac{x}{y} - \frac{y}{x}}{\frac{1}{y} - \frac{1}{x}}$   
 a.  $-\frac{x^2 - y^2}{x - y}$    b.  $x + y$    c.  $\frac{1}{x + y}$    d.  $0$    e.  $\frac{x + y}{xy}$

35. Solve for x:  $|-5x + 3| < 7$

- a.  $-2 < x < 4/5$     b.  $x < -2$  or  $x > 4/5$     c.  $x > 2$  or  $x < -4/5$     d.  $2 < x < -4/5$   
 e.  $-4/5 < x < 2$

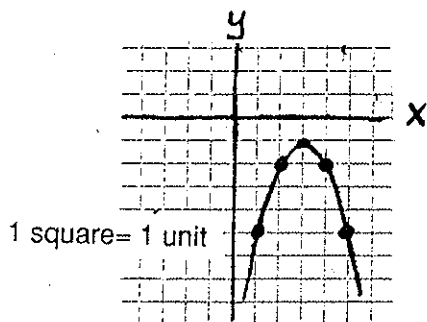
36. It takes Joe 16 hours to mow the lawns he has contracted for the summer. However, if his younger brother Tom helps him, they can mow the lawns in 10 hours. If Joe goes to summer camp one week and Tom mows the lawns by himself, how long should it take him?

- a. 6 hours, 9 minutes    d. 13 hours  
 b. 22 hours    e. 26 hours, 40 minutes  
 c. 16 hours

37. Solve for x:  $\frac{2x}{x-4} = \frac{-3}{x-13}$

- a.  $x = -12$  or  $x = -\frac{1}{2}$     b.  $x = -4$  or  $x = \frac{3}{2}$     c.  $x = 2$  or  $x = -6$   
 d.  $x = 12$  or  $x = -\frac{1}{2}$     e.  $x = -12$  or  $x = \frac{1}{2}$

38. Identify the quadratic function represented by the graph:



- a.  $f(x) = x^2 - 6x + 8$   
 b.  $f(x) = -x^2 + 6x - 10$   
 c.  $f(x) = -x^2 - 6x + 8$   
 d.  $f(x) = x^2 + 6x + 10$   
 e.  $f(x) = -x^2 - 6x - 8$

39. Solve for x using the quadratic formula. Express your answer in simplest radical form:  $8x^2 + 12x + 1 = 0$ .

- a.  $\frac{-12 \pm \sqrt{112}}{16}$     b.  $\frac{-6 \pm \sqrt{28}}{8}$     c.  $\frac{-3 \pm \sqrt{7}}{4}$     d.  $\frac{-3 \pm \sqrt{112}}{4}$   
 e.  $\frac{3 \pm \sqrt{7}}{4}$

40. An 8 x 12 picture is to be framed in a frame of uniform width. How wide is the frame if the area of the frame and the area of the photo are equal?

- a. 2"    b. 1"    c. 1 1/2"    d. 1/2"    e. 2 1/2"







