

THIRTY-NINTH ANNUAL MATHEMATICS CONTEST

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THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

Algebra I 1995

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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, 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 head (No. 2 lead or softer).

This test has been constructed so that most of you are not expected to answer all of the questions. Do your best on the questions you feel you know how to work. You will be penalized for incorrect answers, so wild guesses are not advisable.

If you 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 the 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 keep the booklet after the test is completed.

When told to do so, open your test booklet and begin. You will have exactly 80 minutes to work.

Contributors to TMTA for the Annual Mathematics Contest:

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6. Given $a + b = c$ and $c = d + e$, tell which of the following statements is FALSE for all non-zero values of the variables.

a) $d = a - e + b$

b) $\frac{a + b}{d + e} = 1$

c) $a + b = 2c - b - a$

d) $a = d + e + b$

e) $(a + b)^2 = c(d + e)$

7. Find the equation of the line passing through $(3, -2)$ and perpendicular to the line $3x - y = 5$.

a) $x + 3y = -3$

b) $x + 3y = 5$

c) $-x - 3y = 5$

d) $3x - y = -3$

e) $3x - y = 3$

8. As Carl was about to make the wrong move in a game of checkers, Steve said, "I wouldn't do that if I were you." Carl did not understand and asked Steve to explain. Which of the following statements has the same meaning as the original comment?

a) "If I were you, then I would do that."

b) "If I were not you, then I wouldn't do that."

c) "If I would do that, then I were not you."

d) "If I would not do that, then I were not you."

e) "If I were not you, then I would do that."

9. Divide: $\frac{-x - 8 + 9x^3}{3x - 4}$

a) $3x^2 - 4x - 5 + \frac{12}{3x - 4}$

b) $3x^2 - 4x + 5 + \frac{12}{3x - 4}$

c) $3x^2 + 4x - 5 - \frac{12}{3x - 4}$

d) $3x^2 + 4x - 5 - \frac{12}{3x - 4}$

e) $3x^2 + 4x + 5 + \frac{12}{3x - 4}$

10. Which is a factor of $2x^3 - x^2 - 6x + 3$?

a) $2x + 1$

b) $x - 2$

c) $2x^2 - 3$

d) $2x^2 - x - 6$

e) $x^2 - 3$

11. Which is a factor of $2(x - y)^2 + (x - y) - 3$?

a) $2x - y + 3$

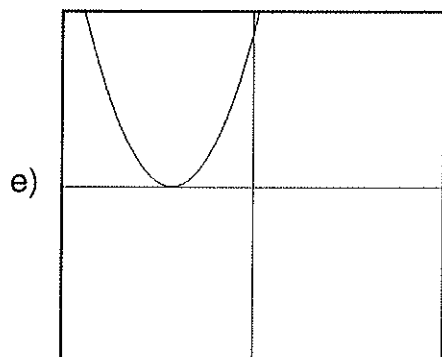
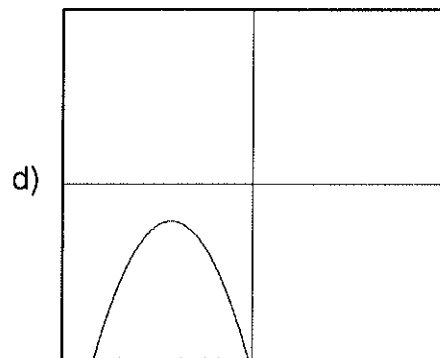
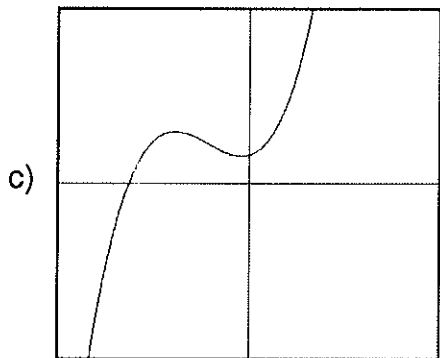
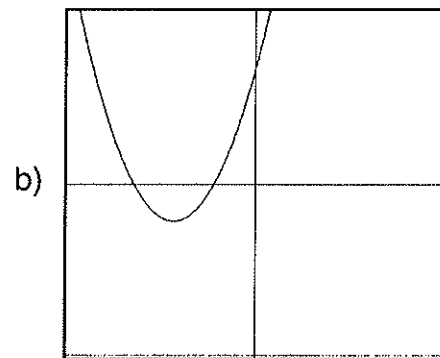
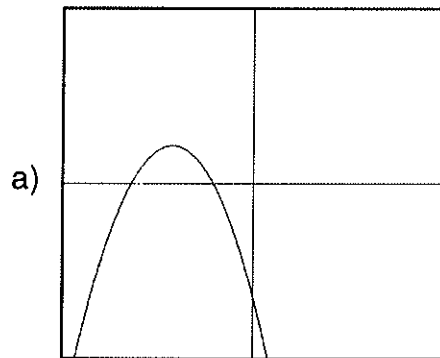
b) $2x - 2y - 3$

c) $2x - 2y + 3$

d) $x - y - 3$

e) $x - y + 1$

12. If $0 = ax^2 + bx + c$ has no real roots, then $y = ax^2 + bx + c$ could have which graph?



13. Solve for y: $ay + 2 = b + 2y$

a) $\frac{b}{a}$

b) $\frac{b - 2}{-2a}$

c) $\frac{b - 2}{a - 2}$

d) $\frac{b - 2}{2a}$

e) $\frac{b}{2 - a}$

14. The number of mosquitoes m , in millions, in a certain area can be modeled by $m = 10x - x^2$, where x is the July rainfall, in inches. Find the maximum number of mosquitoes possible using this model.

a) 5 million

b) 10 million

c) 15 million

d) 20 million

e) 25 million

15. $16^{\frac{1}{2}} + 16^{\frac{3}{2}} =$

a) 28

b) 68

c) 256

d) 520

e) 1024

16. Find the solution set to the system: $x^2 + y^2 = 10$
 $y = 3x$

a) $\{(1,3), (-1,3)\}$

b) $\{(1,3), (-1,-3)\}$

c) $\{(1,3), (1,-3)\}$

d) $\{(\pm 1, \pm 3)\}$

e) $\{(\pm 1, -3)\}$

17. Simplify: $\frac{\frac{2}{x - 2} - \frac{1}{x + 2}}{\frac{1}{x^2 - 4}}$

a) $\frac{1}{x - 2}$

b) $x + 2$

c) $x - 2$

d) 1

e) $x + 6$

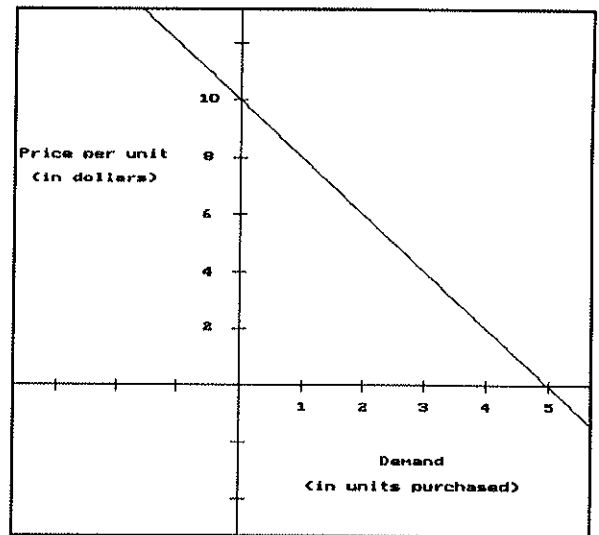
18. Find the solution of the equation

$$-4(2 - x) - [5 - 2(x - 3)] = 3[8 - (x - 3)] - 7$$

- a) 5 b) $\frac{27}{4}$ c) $\frac{29}{9}$
- d) $-\frac{29}{3}$ e) -7

19. Find the equation of the demand line shown below and the demand for the product when the price is \$4.00 per unit.

- a) $y = -x + 10$; 3 units
- b) $y = \frac{1}{2}x$; 8 units
- c) $y = -2x + 10$; 3 units
- d) $y = -\frac{1}{2}x + 10$; 12 units
- e) $y = -2x$; 2 units



20. Simplify: $\frac{(-2a^{-2}b^3)^3}{(16a^2b^{-3})^2}$

- a) $-\frac{3b^{15}}{16a^{10}}$ b) $-\frac{b^5}{32a^3}$ c) $-\frac{3b^5}{32a^3}$
- d) $-\frac{b^{15}}{32a^{10}}$ e) $-\frac{b^{15}}{8a^{10}}$

21. Find the solution to the system: $\begin{cases} x + y = a \\ x - y = b \end{cases}$

- a) (a, b) b) $\left(\frac{a+b}{2}, \frac{a-b}{2}\right)$ c) $\left(\frac{a-b}{2}, \frac{a+b}{2}\right)$
d) $\left(\frac{b-a}{2}, \frac{a+b}{2}\right)$ e) $\left(\frac{a+b}{2}, \frac{b-a}{2}\right)$

22. If a and b are the roots of $2\sqrt{2x+4} - 2 = x$, then $ab =$

- a) 0 b) 4 c) -12
d) -4 e) 12

23. In the rectangular coordinate plane, the length of the segment joining the points $(p + q, r)$ and $(p - q, r + s)$ is:

- a) s b) $2q + s$ c) $p - q - s$
d) $\sqrt{4q^2 + s^2}$ e) $\sqrt{p^2 - q^2 - s^2}$

24. $\frac{2x^2 + 3x + 1}{x^2 - 2x - 3}$ CANNOT represent which of the following real numbers?

- a) 3 b) $\frac{1}{4}$ c) $-\frac{1}{2}$
d) -1 e) $-\frac{1}{3}$

25. If $a < b$ and $c < d$, which of the following statements is ALWAYS true?

- a) $ac < bd$ b) $\frac{a}{c} < \frac{b}{d}$ c) $a + b < c + d$
d) $a - b < d - c$ e) $a + b > c + d$

26. If $a \otimes b = a^2 - ab$, find $(x + 1) \otimes (x - 1)$.

a) -2

b) 2

c) $x^2 - 1$

d) $-2(x - 1)$

e) $2(x + 1)$

27. Which sentence represents the graph shown here? (Assume the x-axis and y-axis are both marked-off in intervals of one unit.)

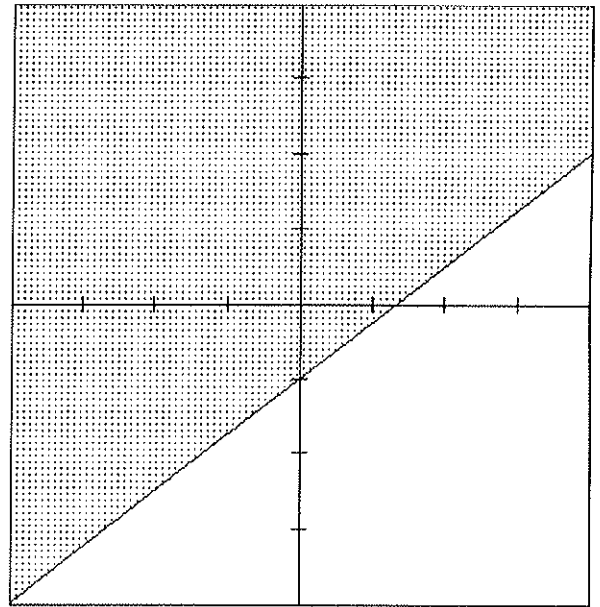
a) $y \geq \frac{3}{4}x + 1$

b) $y \leq -\frac{3}{4}x - 1$

c) $y \geq -\frac{3}{4}x + 1$

d) $y \geq \frac{3}{4}x - 1$

e) $y \leq \frac{3}{4}x - 1$



28. Solve for p : $\sqrt{2}p^2 - 3p + \sqrt{2} = 0$

a) $\{2, \sqrt{2}\}$

b) $\left\{-\frac{\sqrt{2}}{2}, \sqrt{2}\right\}$

c) $\left\{\sqrt{2}, \frac{\sqrt{2}}{2}\right\}$

d) $\left\{-2, \frac{\sqrt{2}}{2}\right\}$

e) $\left\{2, \frac{\sqrt{2}}{2}\right\}$

29. If x and y are elements of the real numbers, which of the following statements is true for ALL values of x and y ?

a) $\sqrt{x^2} = x$

b) $\frac{x^2 - y^2}{x + y} = x - y$

c) $x^2 > x$

d) $|x + y| \leq |x| + |y|$

e) $(x + y)^2 = x^2 + y^2$

30. What percentage of $\frac{\sqrt{24}}{3}$ is $\sqrt{\frac{8}{27}}$?
- a) 25% b) $33\frac{1}{3}\%$ c) 50%
d) $66\frac{2}{3}\%$ e) 150%
31. Jack and Don walk and run together during their lunch workout. Jack burns 200 calories per hour while running and Don burns 250 calories per hour while running. Jack burns 150 calories per hour while walking and Don burns 180 calories while walking. During one of their workouts, Jack burned a total of 150 calories and Don burned a total of 185 calories. How long did they run and walk during the workout?
- a) ran 30 minutes, walked 20 minutes
b) ran 60 minutes, walked 30 minutes
c) ran 45 minutes, walked 20 minutes
d) ran 20 minutes, walked 30 minutes
e) ran 20 minutes, walked 45 minutes
32. Find the equation of the line passing through the points (-2,1) and (1,-3).
- a) $y = -\frac{4}{3}x - \frac{5}{3}$ b) $y = \frac{4}{3}x + \frac{11}{3}$ c) $y = -\frac{3}{4}x - \frac{1}{2}$
d) $y = \frac{3}{4}x + \frac{5}{2}$ e) $y = \frac{4}{3}x - \frac{5}{2}$
33. Solve the inequality: $|5 - 3x| + 2 < 6$
- a) $x < \frac{1}{3}$ or $x > 3$ b) $\frac{1}{3} < x < 3$ c) $x < \frac{1}{3}$ or $x > \frac{13}{3}$
d) $\frac{1}{3} < x < \frac{13}{3}$ e) $x > \frac{1}{3}$

34. The publisher of a local newspaper has a publishing cost of 19¢ per copy. The revenue from sales is 25¢ per copy. Additional revenue from advertising is 15% of the revenue from sales in excess of 1,000 copies. If x represents the number of copies sold, which of the following expressions represents the daily profit?

- a) $.25x + .15(1000 - x) - .19x$
- b) $.25x + .15[.25(1000 - x)] - .19x$
- c) $.19x + .25x - 1000$
- d) $.25x + .15(x - 1000) - .19x$
- e) $.25x + .15[.25(x - 1000)] - .19x$

35. Which is a factor of $5x^4 - 135xy^3$?

- a) $x^2 + 6xy + 9y^2$
- b) $x^2 - 6xy - 9y^2$
- c) $x^2 - 3xy + 9y^2$
- d) $x^2 + 3xy + 9y^2$
- e) $x^2 - 6xy + 9y^2$

36. The Acme Sports Company has a number of sweatshirts in stock. The table shown here represents the number of sweatshirts in stock by color and size.

Sweatshirt Inventory			
Color\Size	Small	Medium	Large
Red	12	23	17
Blue	15	20	23
Green	13	22	15

Martin wears a small sweatshirt and will not wear anything red. If a sweatshirt is selected at random, what is the probability that it will be an appropriate color and size for Martin?

- a) $\frac{3}{40}$
- b) $\frac{7}{40}$
- c) $\frac{1}{4}$
- d) $\frac{27}{40}$
- e) $\frac{9}{80}$

37. Which is a factor of $a^3 - 8a^2 + a^2b - 5ab - 24b$?

a) $a + 8$

b) $a + 3$

c) $a + 2$

d) $a - 3$

e) $a - 8$

38. Subtract: $\frac{3}{2x - 1} - \frac{4}{2x}$

a) $\frac{2 - x}{2x^2 - x}$

b) $\frac{7}{2x - 1}$

c) $\frac{-1}{2x - 1}$

d) $\frac{-1}{2x(2x - 1)}$

e) $\frac{-1}{4x - 1}$

39. Choose the line parallel to $3x - 6y = 1$ and passing through the point of intersection of $2x - y = 1$ and $4x - 3y = 7$.

a) $y = \frac{1}{2}x - 4$

b) $y = -\frac{1}{2}x - 6$

c) $y = \frac{1}{2}x + 2$

d) $y = -\frac{1}{2}x + 4$

e) $y = -\frac{1}{2}x - 2$

40. If y varies inversely as x , and $y = 15$ when $x = 8$, find y when $x = 20$.

a) $\frac{2}{75}$

b) $\frac{1}{6}$

c) 6

d) $\frac{32}{3}$

e) $\frac{75}{2}$

