

FIFTY-EIGHTH ANNUAL MATHEMATICS CONTEST
sponsored by
THE TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

Algebra I 2014

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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.

TMTA
ALGEBRA I TEST
Spring 2014

1. Simplify: $\frac{-5 - |-3 + 12| \div 3^2}{3 - 2|-5| + 2^2}$

A. 2

B. -2

C. $\frac{4}{3}$

D. $\frac{-4}{3}$

E. $-\frac{6}{17}$

2. Simplify the following expression: $-5x + 2[3 - 2](5x - 3) + 2$

A. $5x - 4$

B. $-25x + 20$

C. $-15x + 20$

D. $-25x + 22$

E. $-15x - 4$

3. Evaluate: $-3x^3y^2 - 2xy^3$ if $x = -1$ and $y = -2$.

A. -28

B. 28

C. 20

D. 4

E. -4

4. Copy machine A can copy 500 pages in 12 minutes. If both copy machine A and copy machine B can do the same job together in 8 minutes, how long would it take copy machine B to copy the 500 pages alone?

A. 0.4 hr.

B. 4.8 min.

C. 4 min.

D. 10 min.

E. 24 hours

5. Perform the following operation: $\frac{2x^2 - 7x + 6}{2x^2 + 3x - 2} \div \frac{2x^2 - 3x - 2}{1 - 4x^2}$

A. $\frac{2x - 3}{x + 2}$

B. $\frac{2x + 3}{x + 2}$

C. $-\frac{2x - 3}{x + 2}$

D. $\frac{-2x - 3}{x + 2}$

E. $-\frac{x + 3}{2x - 3}$

6. Given $\begin{cases} 3x - y = 4 \\ 5x + 2y = 3 \end{cases}$, find the value of $x + 7y$.

A. 8

B. 0

C. 6

D. -6

E. $-\frac{1}{4}$

7. J.C. Nichols has a 35% off sale on shirts. What is the total price to be paid at the register if a shirt originally cost \$125.00? Remember that TN has a sales tax rate of 9.25%, and the tax must be added to the sales price.

A. \$156.41

B. \$90.50

C. \$75.16

D. \$81.25

E. \$88.77

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

A. $\frac{1}{2x + 1}$

B. $\frac{x}{2x + 1}$

C. $\frac{1}{2x}$

D. $\frac{1}{2 - x}$

E. $\frac{x}{2}$

9. Solve for x : $\frac{1}{x} + \frac{2}{a} = \frac{1}{b}$

A. $b - \frac{a}{2}$

B. $\frac{ab + bx}{a}$

C. $\frac{a + 2b}{ab}$

D. $-\frac{1}{2}$

E. $\frac{ab}{a - 2b}$

10. Simplify: $\frac{\frac{1}{a}}{a - \frac{1 - \frac{1}{a}}{a}}$

A. $\frac{a}{a^3 - a + 1}$

B. $\frac{1}{a^3 - 1}$

C. -1

D. $\frac{1}{a^3 - a - 1}$

E. $a^3 - a + 1$

11. Simplify: $\frac{a^{-2} - b^{-2}}{a - b}$

A. $-\frac{b + a}{a^2 b^2}$

B. $\frac{1}{(a^2 + b^2)(a - b)}$

C. $a + b$

D. $\frac{a - b}{a^2 b^2}$

E. $-(a + b)$

12. Solve for b : $|3 - x| = b + 7$.

A. $b = -x - 4$

B. $b = x - 4$

C. $b = -(x + 4)$
or $b = x - 10$

D. $b = x - 10$

E. $b = -(x - 4)$
or $b = x - 10$

13. Simplify: $\frac{a^3 - b^3}{(b^3 - a^3)}$.

A. $-\frac{1}{2}$

B. 1

C. -1

D. $\frac{a^2 + ab + b^2}{a^2 - 2ab + b^2}$

E. $\frac{a^2 + ab + b^2}{a^2 + 2ab + b^2}$

14. Simplify: $\left(\frac{-2x^3y^2}{xy^{-2}z}\right)^{-1}$

A. $\frac{2}{x^2 z}$

B. $-\frac{z}{2x^2 y^4}$

C. $\frac{2z}{x^2}$

D. $\frac{2z}{x^2 y^4}$

E. $\frac{-2z}{x^2 y^4}$

15. John broke his piggy bank and found that he had 32 coins made up of only dimes and quarters. If the number of quarters increased by 3 and the number of dimes decreased by 3 he would then have \$5.60. How many dimes did John originally have?
- A. 13 dimes B. 16 dimes C. 19 dimes
- D. 22 dimes E. not possible
16. If a line has a y-intercept of $(0, -5)$ and a slope of $\frac{1}{3}$, find the x-intercept of the line.
- A. $(0, 15)$ B. $(-5, 15)$ C. $(-15, 0)$
- D. $(\frac{5}{3}, 0)$ E. $(15, 0)$
17. If $5^{3x} = \frac{1}{625}$, find 8^x .
- A. $\frac{1}{16}$ B. 16 C. $-\frac{4}{3}$
- D. $\frac{4}{3}$ E. $-\frac{1}{16}$
18. Find the domain for $f(x) = \frac{\sqrt{x+1}}{x+6}$.
- A. $x \geq -6$ B. $x \geq -1$ C. $x \leq -1$
- D. $x < -6$ E. $-6 < x \leq -1$
19. Given $f(x) = -x^2 + 3x - 1$, find $f(-1+h)$.
- A. $h^2 + 5h - 4$ B. $h^2 + 5h + 4$ C. $-h^2 + 5h - 5$
- D. $h^2 + 5h - 3$ E. $h^2 - h + 3$
20. It takes 13 hours to fly to a far east country and 11 hours to return. Find the average speed, if the distance traveled one way is 3600 miles.
- A. 276.92 B. 327.27 C. 302.10
- D. 300 E. 289.51

27. In a local store, chocolates are priced for \$16/lb. and almonds are priced for \$9/lb. How many pounds of chocolate must be mixed with 15 pounds of almonds to produce chocolate covered almonds priced for \$12/lb.?
- A. 11.25 B. 25 C. 78.75
- D. 1.61 E. 31
28. Given $f(x) = 7 - 3x$, find the domain of $g(x) = \frac{f(x+h)-f(x)}{h}$.
- A. $(-3, 3)$ B. $(-3, 0)$ C. $(-\infty, -3)$
- D. $(-\infty, \infty)$ E. $(-3, \infty)$
29. Lines $y = 3x - 1$ and $x + 3y = 10$ are perpendicular to each other. Find the intersection point.
- A. $(1.3, .79)$ B. $(\frac{7}{10}, -\frac{79}{100})$ C. $(-.7, 1.90)$
- D. $(1.30, 2.90)$ E. $(\frac{13}{8}, \frac{31}{8})$
30. Given $\frac{V_1 + V_2}{P_1 + P_2} = R$, solve for P_1 .
- A. $P_1 = \frac{V_2 - V_1}{R} + P_2$ B. $P_1 = \frac{V_1 + V_2 + RP_2}{R}$ C. $P_1 = R(V_1 + V_2 - P_2)$
- D. $P_1 = \frac{V_1 + V_2}{P_2}$ E. $P_1 = \frac{V_1 + V_2}{R} - P_2$
31. The sides of a right triangle are three consecutive integers. Find the area of the triangle.
- A. 3 square units B. 15 square units C. 6 square units
- D. 12 square units E. 20 square units

32. Simplify: $\sqrt{\frac{x^2}{49} - \frac{x^2}{81}}$, $x > 0$

A. $\frac{4\sqrt{2x}}{63}$

B. $\frac{4\sqrt{2}}{63} x$

C. $\frac{4\sqrt{2} x^2}{63}$

D. $\frac{4\sqrt{2x^2}}{63}$

E. $\frac{2x}{63}$

33. Given $f(x) = \sqrt{x+1}$ and $g(x) = x^2 - 1$. Find the x intercept of $h(x) = (f \circ g)(x)$.

A. (1, 0)

B. (0, -1)

C. none

D. (0, 0)

E. (-1, 0)

34. 5 acres of land costs C thousand dollars. How much does x acres of land cost?

A. $\frac{5}{xc}$

B. $\frac{xc}{5}$

C. $\frac{1000xc}{5}$

D. $\frac{5}{5x}$

E. $\frac{xc}{5000}$

35. Simplify: $\frac{x^{-3} + 2}{2x^{-2} + 1}$.

A. $\frac{3}{2x + 1}$

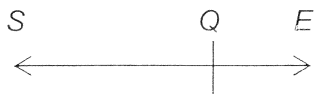
B. $\frac{2(2x^3 + 1)}{x(2x^2 + 1)}$

C. $\frac{1 + 2x^2}{2 + x^3}$

D. $\frac{-x^3 + 2}{-2x^2 + 1}$

E. $\frac{1 + 2x^3}{2x + x^3}$

36. The coordinates of S and E are $(-4, 6)$ and $(6, -2)$ respectively. Find coordinates of Q when $\overline{QE} = \frac{1}{4}(\overline{SE})$.



A. (3.5, 0)

B. (0, 3.5)

C. (0, -3.5)

D. (-3.5, 0)

E. (-1.5, 2)

37. Rationalize: $\frac{(\sqrt{25} - \sqrt[3]{8})}{\sqrt{5} - \sqrt{2}}$.

A. $\frac{3(\sqrt{5} - \sqrt{2})}{3}$

B. $\sqrt{5} - \sqrt{2}$

C. $\sqrt{5} + \sqrt{2}$

D. $\sqrt{3}$

E. $\sqrt{7}$

38. Solve: $4x^2 + 25 = 20x$ for x .

A. $\frac{20 \pm 20\sqrt{2}}{8}$

B. $\frac{5 \pm 20\sqrt{2}}{2}$

C. $\pm \frac{5}{2}$

D. $\frac{20 \pm 5\sqrt{2}}{2}$

E. $\frac{5}{2}$

39. $f(x) = \sqrt{x+1}$ and $g(x) = x^2 - 4$. Find $(f \circ g)(-1)$.

A. $\sqrt{-3}$

B. $-3i$

C. $\sqrt{2}i$

D. $\sqrt{2}i$

E. $\sqrt{3}i$

40. If $5x = 7y$ and $y = 6z$, find the ratio of z to x .

A. $\frac{42}{5}$

B. $\frac{5y^2}{42}$

C. $\frac{5}{42y^2}$

D. $\frac{5}{42}$

E. $\frac{42y}{5}$