



Algebra I / Integrated Math I

2012

Sponsored by the Indiana Council of Teachers of Mathematics

Indiana State Mathematics Contest

This test was prepared by faculty at **University of Southern Indiana**

ICTM Website

<http://www.indianamath.org/>

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Next year's math contest date: April 27, 2013

1. The point $(4, -8)$ is on the graph of which of the following equations?
- a. $y = -8$ b. $y = 4$ c. $y = -2x$ d. Both a and c e. Both b and c
2. Which is the equation of a line with the same y-intercept but half the slope of the line $y = 10 - 6x$?
- a. $y = 5 - 6x$ b. $y = 10 + 3x$ c. $y = -3x + 10$ d. $y = -6 + 5x$ e. $y = -12x + 10$
3. Solve the inequality: $\frac{3-z}{2} + \frac{z}{8} < 0$
- a. $(-\infty, 4)$ b. $(4, \infty)$ c. $(-\infty, -4)$ d. $(-4, \infty)$ e. None of these
4. Solve the compound absolute value inequality: $|w-3| < 7$ or $|2w| < 10$
- a. $(-4, 10)$ b. $(-4, 5)$ c. $(5, 10)$ d. $(-5, 10)$ e. None of these
5. Larry, Curly, and Moe love jelly beans. Larry opens a new jar and eats one-third of them. Later, Moe eats three-fifths of the original number of beans. There are then twenty-five left for Curly. What fraction of the original amount does Curly get?
- a. $\frac{1}{15}$ b. $\frac{4}{15}$ c. $\frac{11}{15}$ d. $\frac{1}{4}$ e. None of these
6. Which of the following does NOT define a function?
- a. $5x - 3y = 15$ b. $\{(-3, 2), (0, 2), (2, -3)\}$ c. $y = |x|$ d. $\{(-5, 3), (3, 0), (3, -5), (-2, 7)\}$ e. $y = x^2$
7. Solve the equation: $10[8 - (-3 + 7x)] = -18x - 4(3x - 4)$
- a. $\{-7\}$ b. $\left\{\frac{3}{50}\right\}$ c. $\left\{\frac{61}{29}\right\}$ d. $\left\{\frac{47}{20}\right\}$ e. None of these

8. Solve the equation: $5 + \sqrt{x+7} = x$

- a. $\{2\}$ b. $\{9\}$ c. $\left\{\frac{1 \pm \sqrt{129}}{2}\right\}$ d. Both a and b e. \emptyset

9. A gardener wishes to line the 96 cm front of a rock garden with miniature bricks. He has six 12 cm bricks and five 16 cm bricks available. Assuming he uses some of each size of brick, lines the entire front of the garden exactly, and does not cut any of the bricks, how many 16 cm bricks will he use?

- a. 1 b. 2 c. 3 d. 4 e. 5

10. Joe has a cell phone plan where he pays \$12 per month plus \$0.10 per minute of talk time. Let x represent the number of minutes of talk time and y represent the cost of his cell phone bill. What equation represents his cell phone bill at the end of each month?

- a. $x = 12y + 0.1$ b. $x = 0.1y + 12$ c. $y = 12x + 0.1$ d. $y = 10x + 12$ e. $y = 0.1x + 12$

11. What is the equation of a vertical line passing through the point $(4, -3)$?

- a. $y = -3$ b. $y = 4$ c. $x = -3$ d. $x = 4$ e. $x + y = 1$

12. Find the range of $f(x) = x^2 + x - 3$ if the domain is $\{-2, -1, 0, 1, 2\}$.

- a. $\{-3, -1, 3\}$ b. $\{-9, -5, -3, -1, 3\}$ c. $\{-5, -3, -1, 3\}$ d. $\{-3, -1, 3, 5\}$ e. $\{-9, -3, -1, 3\}$

13. Simplify the expression: $\frac{3x+9y}{3} - \frac{33y-22x}{11}$

- a. $-x$ b. x c. $-3x$ d. $3x$ e. $\frac{99x+208y}{33}$

14. Write the equation of the line in standard form that passes through the points $(5, 1)$ and $(-3, -2)$.

- a. $4x + 2y = 21$ b. $3x - 8y = 7$ c. $3x + 8y = -7$ d. $5x + y = -5$ e. $3x - 8y = -37$

15. Determine the domain of the function: $f(x) = \frac{x^2 - 4}{3x^2 - x - 10}$

- a. $\left\{x \mid x \in \mathbb{R}, x \neq -\frac{5}{3}, -2, 2\right\}$ b. $\left\{x \mid x \in \mathbb{R}, x \neq -\frac{5}{3}, 2\right\}$ c. $\left\{x \mid x \in \mathbb{R}, x \neq -\frac{5}{3}\right\}$
- d. $\{x \mid x \in \mathbb{R}, x \neq 2, -2\}$ e. $\{x \mid x \in \mathbb{R}\}$

16. Solve the equation: $\frac{5x+16}{x^2-4x} = \frac{9}{x-4}$

- a. $\{4\}$ b. $\{-4\}$ c. $\{-4, 4\}$ d. $\{2, 8\}$ e. \emptyset

17. Solve the equation: $\frac{-2x}{x+5} + 2 = \frac{6}{x-3}$

- a. $\left\{\frac{35}{4}\right\}$ b. $\{\sqrt{14}\}$ c. $\{15\}$ d. $\{0\}$ e. \emptyset

18. Which of the following numbers is greater than 4 and less than 5 ?

- a. $\frac{5}{2} - \frac{2}{5} + \frac{4}{3}$ b. $-\frac{2^3 + \frac{2}{5}}{\sqrt[3]{6-14}}$ c. $\frac{\frac{1}{2} + \frac{1}{4}}{\sqrt{\frac{1}{2} - \frac{7}{16}}}$ d. $\frac{7}{1 + \frac{1}{2}} + \frac{1}{1 + \frac{1}{2}}$ e. None of these

19. Find a non-zero value for k such that $x^2 + kx + k = 0$ has one unique real solution.

- a. 1 b. 2 c. 3 d. 4 e. 5

20. For three consecutive positive integers, the product of the first and second integer is five times the sum of the first and third integers. What is the sum of the three consecutive integers?

- a. 30 b. 33 c. 36 d. 39 e. None of these

21. Which two ordered pairs are part of the solution set of the system of inequalities?
- $$\begin{aligned} x + 5 &< 7 \\ -2y &< 4x - 6 \end{aligned}$$

- a. $(3, -1)$ b. $(-1, 3)$ c. $(1, 3)$ d. $(0, 3)$ e. $(3, -4)$
 $(6, 1)$ $(1, -3)$ $(-1, 6)$ $(2, 1)$ $(6, -10)$

22. Dan D. Lyon is growing like a weed. Last year he grew 3 inches. At what rate in cm per month did he grow last year? (1 inch = 2.54 centimeters)

- a. 0.0984 b. 0.635 c. 1.18 d. 7.62 e. 14.17

23. Which system of equations below has no solution?

- a. $3x - y = -5$ b. $3x + y = 5$ c. $3x + y = 6$
 $3x + y = 5$ $3x + y = 15$ $15x - y = 0$
- d. $3x - y = -5$ e. $y = 6$
 $-6x + 2y = 10$ $5x = 15$

24. Which of the following statements is NOT true?

- a. All negative integers are irrational numbers.
 b. All negative rational numbers are real numbers.
 c. All even integers are rational numbers.
 d. All positive integers are rational numbers.
 e. All irrational numbers are real numbers.

25. In the solution to the system, $\frac{2}{3}x + \frac{3}{5}y = -17$ the sum of x and y is what?
 $\frac{1}{2}x - \frac{1}{3}y = -1$

- a. $-\frac{125}{47}$ b. -27 c. -23 d. 1 e. None of these

26. Simplify the expression: $\frac{1}{2} \left(\frac{9^{\frac{1}{2}} + 81^{\frac{1}{4}}}{27^{\frac{1}{3}}} \right)^3$

- a. 1 b. $\sqrt[8]{27}$ c. 4 d. 8 e. $\frac{27}{2}$

27. A Boeing 747 flies the 3000-mile distance from Los Angeles to New York City with the wind in 5 hours. The return trip, against wind of the same speed, takes 6 hours to complete. Assuming the wind speed doesn't change find the correct wind speed from the choices below.

- a. 50 b. 40 c. 30 d. 25 e. 15

28. For the equation $8x^2 + 2x = 3$, which of the following is/are true?

- I. The sum of the solutions is negative
 II. The product of the solutions is negative
 III. Exactly one of the solutions is a fraction

- a. I only b. II only c. III only d. I and II only e. II and III only

29. Find all values of k that will result in the equation $2x^2 + 3x + k = 0$ having no real number solution.

- a. $k < \frac{9}{8}$ b. $k \geq 1$ c. $k > \frac{9}{8}$ d. $k < 1$ e. It is not possible to find all values for k

30. The expression $x^3 + x^2 + x + 1$ is equivalent to which of the following?

- a. $(4x^4 + 3x^3 - 4x^2 + 5) - (4x^4 - 2x^3 + 5x^2 + x - 4)$
 b. $(3x^3 - 4x^2 + 5) - (2x^4 - 5x^2 - x + 4)$
 c. $(4x^4 + 8x^3 - 4x^2 + 11) - (4x^4 + 7x^3 - 5x^2 - x + 10)$
 d. Both a and b
 e. None of these

31. A ball is thrown from a height of 128 feet. The height of the ball t seconds after it has been thrown is given by the function $s(t) = -16t^2 + 96t + 128$. After how many seconds will the ball hit the ground?

- a. $3 + \sqrt{17}$ b. $6 + 2\sqrt{17}$ c. $2\sqrt{2}$ d. 2 e. 4

32. For which of the following equations does the graph have x -intercepts at $\left(\frac{5}{2}, 0\right)$ and $\left(-\frac{1}{3}, 0\right)$?

a. $y = 18x^2 - 39x - 15$

b. $y = 6x^2 - 13x - 5$

c. $y = 12x^2 - 26x - 10$

d. $y = -6x^2 + 13x + 5$

e. All of the these

33. Factor $144x^4y^2z - z^7$ completely.

a. $z(12x^2y - z^3)(12x^2y + z^3)$

b. $(12x^2yz - 1)(12x^2y + z^7)$

c. $(144xyz - z^3)(x^3y + z^4)$

d. $z(12x^2y - z^3)(12x^2y - z^3)$

e. $z^7(12x^2y - 1)(12x^2y + 1)$

34. A seed farm has two separated square test plots. The side length of the larger plot is 3 times the side length of the smaller plot. If the total area contained in both plots is 2250 ft^2 , how many feet of fencing is needed to enclose both plots? (If necessary, round answer to the nearest foot.)

a. 240 feet

b. 287 feet

c. 384 feet

d. 562 feet

e. 752 feet

For the remainder of the test, assume all denominators to be non-zero.

35. Solve the formula for C: $\frac{2C}{C+B} - A = 0$

a. $A + B$ b. AB c. $\frac{AB}{2-A}$ d. $\frac{-B}{2}$

e. None of these

36. Divide : $\frac{3x^5 - 6x^3 + 5x^2 - 10}{x^2 - 2}$

a. $3x^3 + 3$

b. $3x^3 + 5$

c. $3x^3 + 6x + 10$

d. $3x^3 - 12x + 5 + \frac{24x - 20}{x^2 - 2}$

e. $3x^3 - 5 - \frac{20}{x^2 - 2}$

37. Simplify the expression: $\frac{1}{a-5b} + \frac{1}{a+5b} - \frac{2}{a}$

- a. $50b^2$ b. $\frac{50b^2}{a(a-5b)(a+5b)}$ c. $\frac{-50b^2}{a(a-5b)(a+5b)}$ d. $\frac{4a^2 - 50b^2}{a(a-5b)(a+5b)}$ e. None of these

38. Multiply and divide, writing the answer in simplest terms.

$$\frac{25x^2 - 9}{x^2 - 7x + 12} \square \frac{x^2 + x - 20}{3 - 5x} \div \frac{5x^2 + 28x + 15}{x^2 - 3x}$$

- a. $-x$ b. x c. $-(x+3)$ d. $x+3$ e. None of these

39. Simplify the expression: $\frac{24x^9y^{-2}z}{96x^{-9}y^{-2}z^{15}}$

- a. $\frac{y^4}{4z^{14}}$ b. $\frac{x^{18}y^4}{4z^{14}}$ c. $\frac{x^{18}y^{-4}}{4z^{16}}$ d. $\frac{x^{18}}{4z^{14}}$ e. $\frac{1}{4z^{14}}$

40. The expression $64x^9y^{12}z^{21}$ is equivalent to what?

- a. $41x^9y^{12}z^{21} - (-23x^9y^{12}z^{21})$ b. $\frac{128x^{16}y^5z^{-8}}{2x^7y^3z^{-29}}$ c. $(4x^3y^4z^7)^3$ d. Both a and c e. All of the these