



**Indiana State Math Contest
2023
Algebra I/Integrated I
Exam**

This test was prepared by faculty of
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Mark your calendar:

ICTM State Awards Ceremony 2023: Friday, June 9, 2023

ICTM State Math Contest 2024: Saturday, April TBA, 2024

**Do not open this test booklet until you have been
advised to do so by the test proctor.**

1. Find the y-intercept of the line that goes through the points (-1, 5) and (3, 13).

- A. -13.5 B. -7 C. 2 D. 7 E. 19
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2. For the functions $f(x) = x^2 - 8$ and $g(x) = \frac{4}{x+7}$, what is the value of $f(5) - g(-8)$?

- A. -68 B. -7 C. 13 D. 21 E. $-\frac{17}{4}$
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3. In the following number puzzle, suppose A, B, and C are all unique digits and $B > C$. What is the value of $4A + 3C$?

A9B
+35C
1057

- A. 48 B. 0 C. 51 D. 24 E. 27
-

4. If $5x + 4 = 18$, what is the value of $\frac{6}{5x-7}$?

- A. 6 B. $\frac{2}{21}$ C. $\frac{7}{6}$ D. $\frac{6}{7}$ E. $-\frac{6}{7}$
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5. Carter works at the school concession stand with two of his friends. At one basketball game, they sold 36 Blowpops for 50 cents each, 40 bowls of nachos for \$3.50 each, 40 hotdogs for \$2 each, and 50 bags of popcorn for \$2 each. At the start of the game, they had \$70 in the register. How much money should be in the register at the end of the game?

- A. \$78 B. \$338 C. \$370 D. \$408 E. \$426
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6. Suppose $(2x^a y^{-2})^6 = \frac{64x^{12}}{y^{3b}}$. Find the value of $a - b$.

- A. 2 B. -2 C. 0 D. 6 E. -6
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7. Simplify the expression $x^4 \cdot \sqrt{20y^8} \cdot \sqrt{720x^{12}y^{22}}$.

- A. $120x^{10}y^{15}$ B. $12x^{10}y^{15}\sqrt{50}$ C. $60x^{24}y^{44}\sqrt{2}$ D. $12x^{24}y^{44}\sqrt{50}$ E. $3600x^{10}y^{15}$
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8. What is the solution to the compound inequality $5(1 - 2x) + 3 \leq 7$ and $0.1(70x + 10) - \frac{1}{2} < 8.2$?

- A. $x > \frac{11}{10}$ B. $x \geq \frac{1}{10}$ C. $x \leq \frac{1}{10}$ and $x > \frac{11}{10}$ D. $\frac{1}{10} \leq x < \frac{11}{10}$ E. No solution

9. Solve the absolute-value equation $4\left|\frac{1}{2}x - 1\right| + 7 = 19$.

- A. $x = -4$ and $x = 8$ B. $x = -8$ and $x = 4$ C. $x = -1$ and $x = 2$
 D. $x = 1$ and $x = -2$ E. No solution

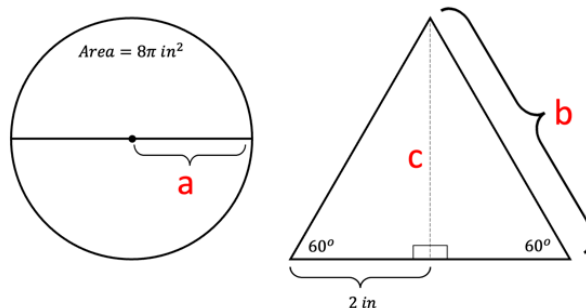
10. A number between 0 and 1 has a digit in the tenths place and a digit in the hundredths place such that the sum of these digits is 9. If the digits are reversed, the number is increased by 0.27. Find the number.

- A. 0.27 B. 0.72 C. 0.36 D. 0.63 E. 0.45

11. A collection of 107 nickels, dimes, and quarters is worth \$14.85. There are 14 more nickels than dimes. How many dimes are there?

- A. 8 B. 10 C. 12 D. 26 E. 40

12. Using the images of the circle and equilateral triangle below, find the values of the lengths a , b , and c and put them in order from least to greatest.



- A. $a < b < c$ B. $a < c < b$ C. $b < a < c$ D. $c < a < b$ E. $c < b < a$

13. There are two solutions to the equation $24x^2 = 15 - 26x$. Find the sum of the two solutions.

- A. $\frac{13}{12}$ B. $-\frac{13}{12}$ C. $\frac{12}{13}$ D. $-\frac{12}{13}$ E. -26

14. When you multiply the following polynomials, what is the coefficient on the x^2 term?

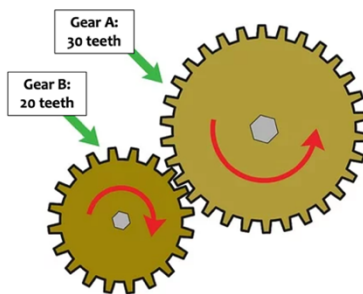
$$(3x^2 - 2x + 7)(5x + 8)$$

- A. 24 B. -10 C. 14 D. 34 E. -16

15. Simplify $\left(\frac{3a^4b^{-2}}{6a^4b^{-3}c^{-7}}\right)^2$ as much as possible. Use only positive exponents in your solution.

- A. $4b^2c^{14}$ B. $\frac{b^2}{4}$ C. $\frac{9b^2}{36c^{14}}$ D. $\frac{b^2c^{14}}{4}$ E. $\frac{a^8bc^7}{4}$

16. Gear B is moving a rate of 5 full rotations every minute. How many rotations does Gear A make in 24 minutes?



- A. 160 B. $16\frac{2}{3}$ C. 120 D. 36 E. 80

17. Sonya notices a leak under her sink, but the plumber cannot come until 3:00 pm. She places a bucket under the sink. After 30 minutes, she finds the container to be $\frac{5}{6}$ full. She dumps the container outside and quickly puts it back under the sink at 2:15 pm. She decides to set an alarm for **two minutes** before the container is full, so she doesn't forget to dump it! What time does she input?

- A. 2:43 pm B. 2:45 pm C. 2:47 pm D. 2:49 pm E. 2:51 pm

18. Solve the equation $x\sqrt{100} + \frac{5}{2^4}x^2 - \sqrt[3]{64x^3} + \frac{3}{4^2}x^2 = \frac{\sqrt{81}}{3}x^2$.

- A. $x = 0$ B. $x = 0$ and $x = 1$ C. $x = \pm 1$ D. $x = 2.4$ E. $x = 0$ and $x = \frac{12}{5}$

19. Brianna selected a number b . She divided b by 3 and then subtracted $\frac{1}{3}$ from the result. She took half of that result and subtracted $\frac{1}{3}$ to get a final result of 10. What is the value of b ?

- A. $\frac{10}{3}$ B. $\frac{25}{6}$ C. 57 D. 63 E. 66

20. Find the y-coordinate for the solution of the system of equations $\begin{cases} 2x - y = 7 \\ \frac{1}{2}x - 1 = \frac{1}{3}y \end{cases}$

- A. 8 B. 9 C. 17 D. Infinitely many solutions E. No solution

21. What are the domain and range of the function $f(x) = \sqrt{7-x}$?

- A. $D: x \leq 7$; $R: y < 0$ B. $D: x > 7$; $R: y \geq 0$ C. $D: x \leq 7$; $R: y \geq 0$
 D. $D: x \leq 7$; $R: \text{All real numbers}$ E. $D: \text{All real numbers}$; $R: y \leq 0$

22. Two points on the linear equation $Mx + Ny = 17$ are $(-3, 10)$ and $(6, -8)$. Find $3M + 2N$.

- A. 0 B. 34 C. -17 D. 8.5 E. 68

23. Find the distance between the two points $(-2, 11)$ and $(-10, 17)$.

- A. 10 B. $\sqrt{10}$ C. $2\sqrt{7}$ D. 25 E. 50

24. There are two solutions to the equation $(2x - 1)^2 = 49$. Find the average of the two solutions.

- A. 0 B. $-\frac{1}{2}$ C. $\frac{1}{2}$ D. 1 E. -1

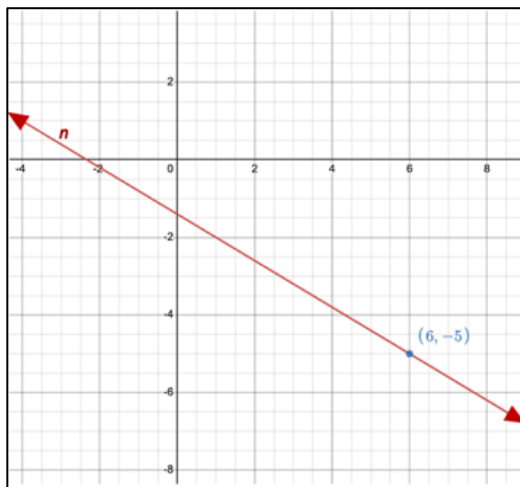
25. Solve the absolute-value inequality $\frac{1}{3}|4 - 5x| + 8 \leq 12$.

- A. $0 \leq x \leq \frac{16}{5}$ B. $-\frac{16}{5} \leq x \leq \frac{8}{5}$ C. $-\frac{8}{5} \leq x \leq \frac{16}{5}$ D. All real numbers E. No solution

26. The equation $3x^3 - x^2 - kx + 9 = 0$ has three solutions: $x = -3$, $x = 3$, and $x = 1/3$. Find the value of k .

- A. -3 B. 3 C. -27 D. 27 E. 9

27. Suppose you know line n (shown below, with point $(6, -5)$ marked) is perpendicular to line p (not shown) with equation $y = \frac{5}{3}x - 8$. Write the equation of line n in standard form ($Ax + By = C$).



- A. $5x + 3y = -7$ B. $3x + 5y = -7$ C. $5x + 3y = 7$ D. $5x - 7y = 3$ E. $5x - 3y = 45$

28. Find the value of k if you know the system of equations shown below has no solution.

$$\begin{cases} kx + 6y = 13 \\ 5x - 12y = -1 \end{cases}$$

- A. 5 B. -5 C. $-\frac{2}{5}$ D. $-\frac{5}{2}$ E. $\frac{5}{2}$

35. The parabola $y = 2x^2 - 17x + 30$ and the line $y = -x + 6$ intersect in two points. What is the sum of the x-coordinates of these two points?

- A. 17 B. -17 C. 6 D. -8 E. 8
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36. Myles recently began his first job, with a starting salary of \$50,000 for his first full year of employment. He will receive a 3% raise every year. After working 15 years for the company, what will be his projected salary for the 16th year, rounded to the nearest dollar?

- A. \$72,500 B. \$74,525 C. \$75,629 D. \$77,898 E. \$78,950
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37. What is the sum of all numbers in the sequence 3, 6, 9, 12, ..., 294, 297, 300?

- A. 3,030 B. 5,050 C. 10,300 D. 15,150 E. 30,300
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38. Find the greatest integer k such that 2^k is a factor of $20!$. (Recall $n! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot \dots \cdot n$)

- A. 10 B. 17 C. 18 D. 20 E. 22
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39. Aiyana can finish her weekend chores in 3 hours. One weekend, after Aiyana worked alone for 1.5 hours, she was joined by her older brother Beau and they finished the chores in 45 minutes. How long would it have taken Beau if he did the job alone?

- A. 1.5 hours B. 3 hours C. 3.5 hours D. 4 hours E. 6 hours
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40. Josh is designing a special firework for his town's firework finale. The firework will be launched directly upward from the top of a 128-foot high building at a speed of 192 feet per second. The firework's height above the ground, t seconds after launch, can be modeled by the equation $h(t) = -16t^2 + 192t + 128$. Josh wants the firework to "explode" at its maximum height. What is this maximum height?

- A. 134 feet B. 304 feet C. 424 feet D. 576 feet E. 704 feet