## Indiana State Mathematics Contest $201 \square$

## Algebra I/Integrated Math I

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

This test was prepared by faculty at University of Southern Indiana

1. Solve the equation $0.2(5000)+0.3 x=0.25(5000+x)$
a. $-\frac{25000}{19}$
b. $-\frac{2500}{7}$
c. $\frac{25000}{29}$
d. $-\frac{57500}{11}$
e. 5000
2. Solve the inequality $\frac{1}{4}<\frac{1}{3}-x<\frac{1}{2}$
a. $-2<x<1$
b. $-1<x<1$
c. $-\frac{1}{6}<x<\frac{1}{12}$
d. $-\frac{4}{3}<x<-\frac{2}{3}$
e. None of
these
3. Solve the compound inequality $8 x-1 \leq-17$ or $8 x-1>7$
a. $(-\infty,-2] \cup(1, \infty)$
b. $[-2,1)$
c. $(-\infty,-2) \cup[1, \infty)$
d. $\varnothing$
e. $(-\infty, \infty)$
4. Solve the equation $\frac{x-2}{3}=\frac{4 x}{5}-6$
a. $\frac{8}{7}$
b. $\frac{80}{7}$
c. $-\frac{4}{7}$
d. $\frac{4}{3}$
e. $\frac{8}{3}$
5. What is the solution set of the equation $|x-3|-1=4$ ?
a. $\{8\}$
b. $\{2\}$
c. $\{-2,8\}$
d. $\{0,8\}$
e. $\{6\}$
6. The sum of three times a number and 7 more than the number is the same as the difference of -11 and twice the number. What is the number?
a. -6.4
b. -6
c. -3
d. $-\frac{11}{12}$
e. $\frac{2}{3}$
7. Delores bought a sweater on sale for $15 \%$ off the original price. If the discounted price was $\$ 34.00$, what was the original cost of the sweater?
a. $\$ 28.90$
b. $\$ 36.15$
c. $\$ 39.10$
d. $\$ 40.00$
e. $\$ 41.40$
8. The population of India is currently 1.3 billion and growing annually at a rate of
$1.3 \%$. By about how much will the population of India increase in one day?
a. 2,713
b. 46,300
c. 1 million
d. 1.7 million
e. 17 million
9. Hoosier Carpentry makes bookcases and desks. Each bookcase requires 5 hours of woodworking and each desk requires 10 hours of woodworking. Each month the shop has a maximum of 600 hours available for woodworking. If $b$ is the number of bookcases and $d$ the number of desks, which constraint models this information?
a. $5 b+10 d \leq 600$
b. $5 b+10 d \geq 600$
c. $10 b+5 d \geq 600$
d. $5 b-10 d \geq 600$
e. $5 b-10 d \leq 600$
10. What is the the $y$-intercept of the line $-3 x+\frac{2}{5} y=8$ ?
a. $\left(0, \frac{2}{5}\right)$
b. $\left(0,-\frac{2}{5}\right)$
c. $\left(0, \frac{15}{2}\right)$
d. $\left(0,-\frac{15}{2}\right)$
e. $(0,20)$
11. Which of the following statements is true?
a. The lines $x-2 y=14$ and $2 x+y=3$ are parallel.
b. The lines $x-2 y=14$ and $x+2 y=4$ are parallel.
c. The lines $2 x+y=3$ and $x+2 y=4$ are parallel.
d. The lines $x-2 y=14$ and $2 x+y=3$ are perpendicular.
e. The lines $2 x+y=3$ and $x+2 y=4$ are perpendicular.
12. If $x-y=9$ and $x+2 y=3$, what is the value of $x^{2}+y^{2}$ ?
a. -45
b. 25
c. 45
d. 53
e. 90
13. Assume there is a linear relation between air temperature ( ${ }^{\circ} \mathrm{F}$ ) and elevation ( m ) on Pikes Peak. If the temperature is $56^{\circ} \mathrm{F}$ at 1500 m and $63^{\circ} \mathrm{F}$ at 1000 m , estimate the temperature at 3000 m .
a. $28^{\circ} \mathrm{F}$
b. $35^{\circ} \mathrm{F}$
c. $49^{\circ} \mathrm{F}$
d. $53^{\circ} \mathrm{F}$
e. $77^{\circ} \mathrm{F}$
14. How many ordered pairs satisfy the system of equations $\left\{\begin{array}{l}\frac{1}{3} x-7=2 y \\ x-6 y=21\end{array}\right.$ ?
a. None
b. Exactly one
c. Exactly two
d. An infinite number, but not all.
e. All ordered pairs.
15. Solve the equation $2 x(x-6)=9$.
a. $\left\{\frac{3}{2}, 9\right\}$
b. $\left\{\frac{9}{2}, 15\right\}$
c. $\left\{\frac{3 \pm 6 \sqrt{6}}{2}\right\}$
d. $\left\{\frac{3 \pm 6 \sqrt{2}}{2}\right\}$
e. $\left\{3 \pm \frac{3 \sqrt{6}}{2}\right\}$
16. The width of a rectangular patio is 2 yards less than its length. If the area of the patio is 64 square yards, which equation could be used to find the dimensions of the patio?
a. $x^{2}-4=64$
b. $x^{2}-2 x=64$
c. $x^{2}-4 x+4=64$
d. $x^{2}-4 x-4=64$
e. $x^{2}=64$
17. Solve $z=x y-x y^{2}$ for $x$.
a. $\quad x=\frac{z}{y-y^{2}}$
b. $x=\frac{y-y^{2}}{z}$
c. $x=\frac{x y-z}{y^{2}}$
d. $x=\frac{z+x y^{2}}{y}$
e. This equation cannot be solved for $x$.
18. Which equation represents the data shown in the table?

| $x$ | 0 | 1 | 2 | 3 |
| :---: | :---: | :---: | :---: | :---: |
| $y$ | 2 | 4 | 10 | 28 |

a. $y=2 x+2$
b. $y=2 x^{2}+2$
c. $y=3^{x}+1$
d. $y=\frac{6 x+2}{x+1}$
e. $y=12 x-8$
19. Which is the graph of $y=-\frac{1}{2}|x-1|+2 ?$

20. Which of the following is the sum of a rational number and an irrational number?
a. $5 \sqrt{5}(\sqrt{5}+\sqrt{20})$
b. $7.2+\sqrt{-16}$
c. $2 \pi+\sqrt{7}$
d. $7+\sqrt{2.25}$
e. $2.5+\sqrt{7.1}$
21. Factor completely: $48 x^{4} y-216 x^{3} y^{2}+243 x^{2} y^{3}$
a. $3 x^{2} y(4 x-9 y)^{2}$
b. $3 x^{2} y(4 x+9 y)(4 x-9 y)$
c. $\left(12 x^{3} y-27 x^{2} y^{2}\right)(4 x-9 y)$
d. $y\left(12 x^{2}-27 x y\right)\left(4 x^{2}+9 x y\right)$
e. All of the above
22. Which is the graph of $|x+y|=4$ ?

23. If $f^{(n)}(x)=\overbrace{(f \circ f \circ \cdots \circ f)}^{n \text { times }}(x)$ and $f(x)=x^{2}-2 x-5$, find $f^{(15)}(3)$
a. -62
b. -5
c. -2
d. 3
e. 45
24. Let f be the function defined by $f(x, y)=x^{2}-4 x+y^{2}+6$.

Which of the following is the minimum value of $f$ ?
a. -10
b. 0
c. 2
d. 4
e. 6
25. Let $A=\{10,11,12,13, \cdots, 98,99\}$.

Which of the following does not describe a function with a domain of $A$.
a. The difference of the ones digit and the tens digit of a member of $A$.
b. The difference of the tens digit and the ones digit of a member of $A$.
c. The quotient of the ones digit and the tens digit of a member of $A$.
d. The quotient of the tens digit and the ones digit of a member of $A$.
e. Reversing the order of the digits of a member of $A$.
26. Let $f(x)=\sqrt{-x}$ and $g(x)=\sqrt{25-x^{2}}$. What is the domain of $\left(\frac{f}{g}\right)(x)$ ?
a. $[-5,5]$
b. $[0,5)$
c. $(0,5]$
d. $[-5,0)$
e. $(-5,0]$
27. The operation $*$ is defined for non-zero integers as follows: $a * b=\frac{1}{a}-\frac{1}{b}$ If $a-b=3$ and $a b=15$, what is the value of $a * b$ ?
a. -5
b. 5
c. $-\frac{1}{5}$
d. $\frac{1}{5}$
e. -12
28. Simplify completely: $\frac{\left(-2 a^{4} b^{2}\right)^{3}\left(4 a^{3} b^{2}\right)}{-4 a^{5} b^{2}}$
a. $8 a^{10} b^{6}$
b. $-8 a^{10} b^{6}$
c. $8 a^{3} b^{4}$
d. $-8 a^{3} b^{4}$
e. $8 a^{6} b^{6}$
29. Let $g(2 x+5)=4 x^{2}-3 x+2$. Find $g(-3)$.
a. -4
b. -3
C. -1
d. 9
e. 78
30. Simplify leaving the answer with no grouping symbols and no negative exponents: $(2 n-3)^{3} \cdot(2 n-3)^{-5}$
a. $\frac{1}{4 n^{2}+9}$
b. $-\frac{1}{4 n^{2}+9}$
C. $\frac{1}{4 n^{2}-9}$
d. $\frac{1}{4 n^{2}-12 n+9}$
e. $-2(2 n-3)$
31. The volume of a rectangular prism is $6 x^{3}-11 x^{2}-57 x+20$. If the length is $2 x+5$ and the height is $x-4$, what is the width?
a. $-3 x$
b. $3 x+1$
c. $3 x-1$
d. $-3 x-2$
e. $-2 x-1$
32. Divide: $\frac{30 x^{3}-15 x^{2}+5 x}{-15 x^{2}}$
a. $-5 x$
b. $-5 x+1$
c. $-2 x-\frac{1}{3 x}$
d. $30 x^{3}+5 x$
e. $-2 x+1-\frac{1}{3 x}$

Use the graph of $y=f(x)$ below for questions $3-3$.


3 . What is the range of $f(x)$ ?
a. $[-4,4]$
b. $[-4,4)$
c. $[-4,1) \cup(1,2)$
d. $[-1,2]$
e. $[-1,2)$

3 .Evaluate the expression $f(2 f(2))$.
a. 0
b. $\frac{7}{4}$
c. $-\frac{7}{4}$
d. $\frac{3}{2}$
e. $\frac{1}{2}$

3 .Solve the equation. $f(f(f(x)))=-\frac{1}{2}$
a. -2
b. 0
c. -3
d. -1
e. -4

$$
3 \text {.Multiply: }(4 \sqrt{2}+3 \sqrt{5})(5 \sqrt{2}-\sqrt{5})
$$

a. $25+11 \sqrt{10}$
b. $20 \sqrt{2}-3 \sqrt{5}$
C. $9 \sqrt{2}+2 \sqrt{5}$
d. $20 \sqrt{2}-3 \sqrt{5}+11 \sqrt{10}$
e. $5+11 \sqrt{10}$

$$
3 \text {.If }(f \circ g)(x)=6 x+7 \text { and } f(x)=5-2 x \text {, what is } g(x) \text { ? }
$$

a. $g(x)=4 x-2$
b. $g(x)=-3 x-1$
C. $g(x)=8 x-12$
d. $g(x)=\frac{6 x-7}{5-2 x}$
e. $g(x)=-12 x^{2}+44 x-35$

The graph below represents the total circulation of US newspapers in millions $(C)$, and the number of years after $2000(t)$. Use the graph and the trend line equation to answer questions 3-4 .


3 .In the trend line equation, what does the number 1.25 signify?
a. The number of newspapers read in 2000.
b. The number of newspapers read in 2011.
c. The yearly drop in newspaper readership.
d. The overall drop in newspaper readership.
e. The average cost of a newspaper.
.In the trend line equation, what does the number 58.3 signify?
a. The number of newspapers read in 2000.
b. The number of newspapers read in 2011.
c. The yearly change in newspaper readership.
d. The overall change in newspaper readership.
e. The number of years until nobody reads newspapers.

4 .What is the best approximate value for the correlation coefficient $(r)$ ?
a. -1.25
b. -0.9
c. 0.9
d. 46.64
e. 58.3

