Franklin Math Bowl

Algebra I Exam

2002

1. Solve for x: \(2( x - 3 ) + 5 = ( 2x - 1 ) - 5( 1 - x )\)
   a) \(x = 1\)  
   b) \(x = 3\)  
   c) \(x = \frac{1}{2}\)  
   d) \(x = -1\)

2. Solve for y: \(4 - 3y \leq 2( 5 - y )\)
   a) \(y \leq 6\)  
   b) \(y < 6\)  
   c) \(y \geq -6\)  
   d) \(y \geq -3/2\)

3. Solve for B: \(2B^2 + 5B - 3 = 0\)
   a) \(B = 2\) or \(B = 1\)  
   b) \(B = \frac{1}{2}\) or \(B = -3\)  
   c) \(B = 2\) or \(B = 3\)  
   d) \(B = -1/2\) or \(B = 3\)

4. Solve for \(\theta\): \(\theta^2 - \theta - 6 > 0\)
   a) \(1 < \theta < 6\)  
   b) \(-2 < \theta < 3\)  
   c) \(\theta < -2\) or \(\theta > 3\)  
   d) \(\theta > 3\)

5. Simplify:
   \[
   \frac{x}{2} - \frac{4}{x^2} - \frac{2}{x}
   \]
   a) \(\frac{x^2 + 2x + 4}{2}\)  
   b) \(\frac{x^3}{4 - x^2}\)  
   c) \(-(x-4)\)  
   d) \(\frac{(x-4)(x-x^2)}{2-x^2}\)
6. Let \( f(x) = 1 - 3x^2 \) and \( g(x) = 2x + 5 \). Find \( f(g(x)) \).
   
a) \( 7 - 6x^2 \)  
   b) \(-3 - 6x^2 \)  
   c) \( 4x^2 + 20x + 23 \)  
   d) \(-12x^2 - 60x - 74 \)

7. The sum of two numbers is 12. The difference between them is 4. What are the two numbers?
   
a) 8 and -4  
   b) 8 and 4  
   c) -8 and -4  
   d) 6 and -6

8. What is the domain of the function \( f(x) = \sqrt{4-x} \) ?
   
a) \( 4 \geq x \)  
   b) \( 4 > x \)  
   c) \( x > -4 \)  
   d) \( x \geq 0 \)

9. The solution for \( 3 < |2x - 5| \) is
   
a) \( 1 < x < 9 \)  
   b) \( 1 < x < 4 \)  
   c) \( x < 1 \) or \( 4 < x \)  
   d) \( 4 < |x| \)

10. Tub A contains a solution that is 10% hydrochloric acid. Tub B contains 3 liters of a solution that is 50% hydrochloric acid. How much of the liquid from Tub A must be carefully added to Tub B so that the new mixture in Tub B is 40% hydrochloric acid?
   
a) 1 liter  
   b) 2 liters  
   c) 2/3 liter  
   d) 3 liters

11. Find the greatest common divisor for these two expressions:
   
   \( (x - 2)^2(x^2 - x - 12) \) and \( (x - 2)(x^2 + x - 6) \)
   
a) \( x - 2 \)  
   b) \( (x - 2)(x + 3) \)  
   c) \( (x - 2)^2(x + 3) \)  
   d) \( (x - 2)^2(x + 3)(x - 4) \)
12. The unique solution to this system of equations is

\[
\begin{align*}
2x - 3y &= 4 \\
5x - 6y &= 10
\end{align*}
\]

a) (-2, 0)  b) (0, 2)  c) (5, 2)  d) (2, 0)

13. Keith can paint a certain room by himself in 4 hours. Michael can paint the same room by himself in 6 hours. How long will it take them to paint the room together?

a) 2.4 hours  b) 4.2 hours  c) 5 hours  d) 5/12 hours.

14. The least common multiple of these two expressions is

\[
\begin{align*}
x^4y^6z \quad \text{and} \quad x^5y^2z^7
\end{align*}
\]

a) \(x^4y^2z\)  b) \(x^5y^6z^7\)  c) \(x^9y^8z^8\)  d) \(xy^4z^6\)

15. Solve for \(x\):

\[
\frac{2}{x} + \frac{3}{x-1} = 4 + \frac{3}{x^2-x}
\]

a) \(x = \frac{5}{4}\) and \(x = 1\)  b) \(x = 1\) and \(x = 5\)  c) \(x = 5\)  d) \(x = \frac{5}{4}\)

16. The perimeter of a rectangle is three times its width. Its length is five meters. What is the width of the rectangle?

a) 5 m  b) 15 m  c) 10 m  d) 30 m

17. The prime factorization of 1200 is

a) \(12 \times 100\)  b) \(10^2 \times 12\)  c) \(2^4 \times 75\)  d) \(2^4 \times 3 \times 5^2\)

18. Evaluate

\[
\begin{align*}
3 \div 2 + 1 \div 6 - 5 \div 12 \div 3
\end{align*}
\]

a) -1  b) 1  c) 3 \(\div\) 1 \(\div\) -1 \(\div\) 4 \(\div\)  d) 0
19. Simplify \((x^2y^3)^4(x^3z)^{-1}\)

\[\text{a) } \frac{x^2 y^{14}}{z} \quad \text{b) } \frac{y^{14}}{x^9 z} \quad \text{c) } \frac{x^2 y^{14}}{x^{11} z} \quad \text{d) } -8x^2y^4z\]

20. An air taxi service can sell a maximum of 500 tickets for seats on a certain airplane. When the tickets cost $100 each, all of the tickets will sell. For every $10 increase in the price of a ticket, 1 more ticket will not be sold. Find expressions for the ticket price and the number of tickets that will be sold if 't' tickets are not sold.

\[\text{a) price } = 100 + 10t \quad \text{b) price } = 500 - 10t \]

\[\text{tickets } = 500 - t \quad \text{tickets } = 100 + t\]

\[\text{c) price } = 100 - 10t \quad \text{d) price } = 100 \]

\[\text{tickets } = 500 + t \quad \text{tickets } = 500\]

21. Which of the following is a linear expression?

\[\text{a) } 2 + xy \quad \text{b) } 2x^2 + 3y \quad \text{c) } 3x - 2/y \quad \text{d) } 2x + 3y\]

22. Suppose \(a, b, \) and \(c\) are real numbers. Which statement reflects the distributive property of multiplication over addition?

\[\text{a) } a(b + c) = ab + ac \quad \text{b) } a(bc) = (ab)c \]

\[\text{c) } a/(b + c) = a/b + a/c \quad \text{d) } ab = ba\]

23. Put these numbers in increasing order: 50%, 1/5, 5/11, 0.50

\[\text{a) } 1/5, 5/11, 0.50, 50\% \quad \text{b) } 50\%, 1/5, 5/11, 0.50 \]

\[\text{c) } 1/5, 5/11, 50\%, 0.50 \quad \text{d) } 5/11, 0.50, 50\%, 1/5\]

24. Which of \(1/3, \sqrt{3}, 33/47, \pi\) are irrational numbers?

\[\text{a) } \sqrt{3}, \pi \quad \text{b) } 1/3, 33/47 \quad \text{c) } \text{only } \sqrt{3} \quad \text{d) } \sqrt{3}, 33/47, \pi\]
25. The solution to this system of equations consists of three numbers. What is the sum of the three numbers?

\[
\begin{align*}
x + 3y - z &= 2 \\
3x - 3y + 2z &= -2 \\
-x + 6y - \frac{1}{2}z &= 13
\end{align*}
\]

a) 13 \hspace{1cm} b) \frac{5}{3} \hspace{1cm} c) \frac{7}{3} \hspace{1cm} d) -2 \frac{2}{3}