

1998 Hoover High School Math Tournament
Algebra I Ciphering
February 21, 1998

1. Find the equation in slope-intercept form of the line that contains the points $(-2, 7)$ and $(18, 11)$.

Answer: $y = \frac{1}{5}x + \frac{37}{5}$

2. Simplify:

$$(2\sqrt{5} + 3\sqrt{6})(4\sqrt{5} - 5\sqrt{6})$$

Answer: $-50 + 2\sqrt{30}$

3. Given $\begin{cases} 2x - 7y = 18 \\ 3x - 8y = 5 \end{cases}$, find $x - y$,

Answer: -13

4. Solve $\frac{3}{5}[3(x - 5) + x] < 0.6x$

Answer: $x < 5$

5. Solve for x :

$$\frac{x}{x^2 + 3x - 4} + \frac{x + 1}{x^2 + 6x + 8} = \frac{2x}{x^2 + x - 2}$$

Answer: $-\frac{1}{6}$

6. Evaluate $m + \frac{6}{5m^2}$ for $m = \frac{2}{3}$.

Answer: $\frac{101}{30}$

7. Given $g(x) = |3x - 6| + 2$. Find $g(g(g(1)))$.

Answer: 29

8. A drawer has 20 socks: 8 blue and 12 white. How many socks must Matthew pull out to ensure that he has a pair (2 of the same color)?

Answer: 3

9. Find the sum: $1 + 5 + 9 + 13 + 17 + \dots + 49 + 53$.

Answer: 378

10. If the three vertices of a triangle are $(0, 0)$, $(289, 0)$, and $(0, \frac{1}{17})$, then what is the area of the triangle?

Answer: $\frac{17}{2}$

11. Simplify $\frac{2^7 x^7 y^5 z^3}{4^2 x^8 y^0 z^{-1}}$

Answer: $\frac{8y^5 z^4}{x}$

12. Find the equation of the line (in slope-intercept form) of the line parallel to $7x + 3y = 9$ and through the origin.

Answer: $y = -\frac{7}{3}x$

13. Simplify:

$$\sqrt{63} + 5\sqrt{7} + \left(\frac{1}{7}\right)^{-3/2}$$

Answer: $15\sqrt{7}$

14. Find 20% of 50% of 40% of 200.

Answer: 8

15. What is the y--intercept of the function

$$\frac{1}{2}y = \frac{x^2 + 3x - 4}{x^2 - 9}$$

Answer: $\frac{8}{9}$

16. Proud Mary can travel 20 mph in still water. She travels from the station upstream to the Big Wheel cafe in 45 minutes. She travels back downstream to the station in 15 minutes. What is the rate of the current?

Answer: 10 mph

17. If the distance between the points $(-1,3)$ and $(7,9)$ is D, then find 3D.

Answer: 30

18. Solve for x: $2x^2 - 8x = -3$

Answer: $\frac{4 \pm \sqrt{10}}{2}$

19. What is the degree of the polynomial:

$$x^3(x^5 + x^2) + x^2(x^3 + 1)(x^5 - x^2) = x$$

Answer: 10

20. Find the largest prime factor of $2^{16} - 1$.

Answer: 257

21. If $x = 2$, $y = 3$, and $z = 10$, find $\frac{y^x + z}{yz^x}$.

Answer: $\frac{19}{300}$

22. Simplify the complex fraction

$$\frac{\frac{1}{a^2} - \frac{2}{ab} + \frac{1}{b^2}}{\frac{b}{a} - \frac{a}{b}}$$

Answer: $\frac{b-a}{ab(b+a)}$

23. If $f(x)$ is a linear function and $f(3) = 3$ and $f(-5) = 11$, find $f(0)$.

Answer: 6