2014 Hoover HS Math Tournament
Algebra I Written Test

1. Find the sum of two positive numbers such that the positive difference of the numbers is 12 and the sum of their squares is 1424.

A. 24 B. 52 C. –24 D. –52 E. NOTA

2. Mr. Zero bought a number of gold pieces for $60. He kept 15 of them and sold the rest for $54. He made a profit of $0.10 on each of those he sold. How many gold pieces did he buy?

A. 60 B. 120 C. 75 D. 150 E. NOTA

3. Sam and Claudia start at the same time on a bike hike of 150 miles. Sam travels 3 miles per hour faster than Claudia and finishes the trip $8\frac{1}{3}$ hours before Claudia. At what rate in miles per hour does Sam travel?

A. 9 B. 7.5 C. 12 D. 6.5 E. NOTA

4. Three standard six-sided dice are thrown. What is the probability that the three dice will show three different numbers?

A. $\frac{1}{8}$ B. $\frac{1}{3}$ C. $\frac{1}{216}$ D. $\frac{5}{9}$ E. NOTA

5. A large storage tank has two inlet pipes, *A* and *B*, and one outlet pipe, *C*. Alone, pipe *A* can fill the tank in 8 hours. Alone, pipe *B* can fill the tank in 6 hours. Alone, pipe *C* can empty the tank in 10 hours. If the tank is empty and all three pipes are opened at the same time, how long will it take to fill the tank?

A. $6\frac{1}{4}$ hrs. B. 8 hrs. C. 24 hrs. D. $5\frac{5}{23}$ hrs. E. NOTA

6. Line *m* passes through $E\ (-2, 4)$ and $F\ (1, -3)$. If line *m* is written in the form $Ax + By = C$, where $A > 0$ and *A*, *B*, and *C* are relatively prime integers, find the value of *C*.

A. -22 B. -2 C. 22 D. -32 E. NOTA

7. If $f(x) = x^3 + 20$ and $g(x) = x - 5$, what is the value of the constant term of $f\big(g(x)\big)$?

A. -100 B. 75 C. -105 D. 15 E. NOTA

8. What is the value of z in the following system: $\begin{cases} x - y - z = 7 \\ -x + 2y - 3z = -12 \\ 3x - 2y + 7z = 30 \end{cases}$

A. -1 B. 1 C. -7 D. 7 E. NOTA

9. Suppose a varies directly as the square of b and inversely as c, and $a = 45$ when $b = 6$ and $c = 12$. What is the positive value of b when $a = 96$ and $c = 10$?

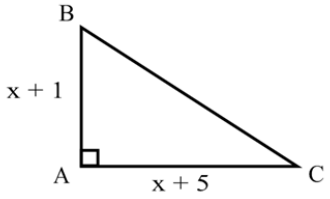
A. 3 B. 15 C. 8 D. 64 E. NOTA

10. A class of 25 students took a test. 10 students had a mean score of 76, and the others had a mean score of 60. What was the mean score of the entire class?

A. 70.4 B. 68.4 C. 66.4 D. 64.4 E. NOTA

2014 Hoover HS Math Tournament
Algebra I Written Test

11. What is the length of side BC?



A. $\sqrt{2x^2+12x+26}$ B. $\sqrt{x^2+12x+13}$ C. $\sqrt{x^2+12x+5}$ D. $\sqrt{2x^2+6}$ E. NOTA

12. What is the value of b^2 based on the equation $b^3-12b^2+48b-64=0$?

A. 256 B. 81 C. 16 D. $\frac{1}{16}$ E. NOTA

13. If $f(x) = x^2 + 7x - 2$, and $g(x) = 4x + 3$, find $f\left(g(-4)-g\left(f(-2)\right)\right)$.

A. 31 B. -45 C. 117 D. 76 E. NOTA

14. What is the product of the solutions of $|x-3| = 2x+7$?

A. 100 B. -30 C. $\frac{40}{3}$ D. $-\frac{4}{3}$ E. NOTA

15. If x varies directly with y, and $y = 4$ when $x = 15$, what is the value of $(6y-2x)^2$ when $x = 10$?

A. 625 B. 25 C. 16 D. 36 E. NOTA

16. Find the distance between the two points of intersection of $f(x)=(x+3)^2-4$ and $g(x)=-2(x+6)^2+5$.

A. $2\sqrt{17}$ B. $9\sqrt{2}$ C. $8\sqrt{5}$ D. $2\sqrt{15}$ E. NOTA

17. How many integer solutions are there for the equation: $4(x-4)^2+2 \le 2x+6$?

A. 2 B. 3 C. 4 D. infinite E. NOTA

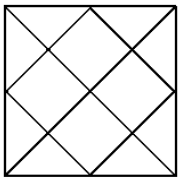
18. Simplify the complex fraction: $\dfrac{\frac{1}{\sqrt{x}}+\frac{\sqrt{x}}{2}}{\frac{\sqrt{x}}{3}+\frac{1}{\sqrt{x}}}$

A. $\frac{3}{2}$ B. $\frac{x+6}{x+3}$ C. $\frac{x+2}{x+3}$ D. $\frac{3x+6}{2x+6}$ E. NOTA

19. Find the average of the coefficients when $(4x^3+4)^7$ is completely expanded.

A. 262,144 B. 16,348 C.896 D. 65,536 E. NOTA

20. A floor tile is made up of small squares and isosceles right triangles, as shown. Each small square measures 3 in. on each side. Find the area of the floor tile.



A. $24\sqrt{2}$ in^2 B. 72 in^2 C. 324 in^2 D. $36\sqrt{2}$ in^2 E. NOTA

2014 Hoover HS Math Tournament
Algebra I Written Test

21. What is the sum of the coefficients of the terms of $(a-b)^4$ when in expanded form?

A. 2 B. 5 C. 1 D. 6 E. NOTA

22. What is the 2nd term of the polynomial of least degree with integer coefficients whose roots are $1, -1,$ 2, and $\sqrt{3}$,when the terms are written in descending order by exponent?

A. $-2x^4$ B. $8x^2$ C. $\left(2\sqrt{3}-1\right)x^3$ D. $-2x^3$ E. NOTA

23. The ratio of $2x^2 - x - 15$ to $x^2 + 4x - 21$ is 40%. What is the value of x?

A. 3 B. -4 C. 1 D. $-\frac{11}{8}$ E. NOTA

24. Four times the multiplicative inverse of a number is added to the number. The result is $10\frac{2}{5}$. What is the product of the possible values of the number?

A. 100 B. 4 C. $\frac{22}{5}$ D. $\frac{8}{25}$ E. NOTA

25. Find the ratio of b to a if $\frac{3a-b+4c}{4a+2b+5c} = \frac{4}{5}$.

A. $\frac{4}{3}$ B. $-\frac{21}{8}$ C. $\frac{9}{16}$ D. $-\frac{1}{13}$ E. NOTA

Tiebreakers

TB 1. Find the sum of the digits in the expansion of $10^{57} - 1$.

TB 2. If $a = 3b, b = 2c,$ and $c = 3d$, then $a + b + c = kd$, where k is a number. Find k.

TB 3. If $a * b = (2b - a)^{-2}$, evaluate $4 * (5 * 2)$