Minnesota State High School Mathematics League

2024-25 Sample Meet 2.2 , Individual Event A

15 minutes

Score	Check

1. $x =$ _____ Find the *positive* solution for x to
$$\frac{7}{x+3} = x - 3.$$

2. $a + b =$ _____ Real numbers a and b satisfy the equations $2a - b = 13$ and $2b - a = 4$. Determine $a + b$.

3. _____ How many integers values of x satisfy $|x| < \sqrt{2022}$?

4. $b - a =$ _____ Let $\lfloor A \rfloor$ denote the greatest integer less than or equal to A. All values of x such that $\left\lfloor 10^{\log_3 \sqrt{x}} \right\rfloor$ is a three digit integer lie in the interval $[a, b)$. Determine the minimum value of $b - a$.

5. $f(29) =$ _____ Suppose $f(x) = ax^2 + bx + c$, and let $g(x) = x + 6$. If $f(2) = 1$, $f(11) = g(11)$, and $f(23) = g(23)$, find $f(29)$.

Name: _____ Team: _____

Minnesota State High School Mathematics League

2024-25 Sample Meet 2.2 , Individual Event B

15 minutes

Score	Check

1. $BD =$ _____

Figure 1 shows isosceles triangle ABC, where $AB = BC = 15$ and $AC = 18$. The altitude from B hits $\overline{AC}$ at D. What is the length of $\overline{BD}$?

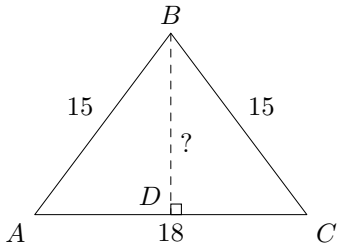


Figure 1

2. _____

Which is the greatest? Write option 1, 2, 3, or 4 as your answer.

1) $\sin \frac{\pi}{6}$ 2) $\cos \frac{\pi}{4}$ 3) $\cos \frac{5\pi}{6}$ 4) $\sin \pi$

3. $x + y =$ _____

(x, y) is the intersection of $\frac{3x}{y} - 4 = 11$ and $x - y = 44$. Determine the value of $x + y$.

4. $AB =$ _____

In right triangle ABC with hypotenuse $\overline{AC}$, $\sin A = \frac{1}{3}$ and $BC = 2\sqrt{2}$. What is the length of $\overline{AB}$?

5. $BC =$ _____

Let ABC be the triangle shown in Figure 5, with $AB = 12$ and $AC = 20$. Points D and E are chosen on $\overline{BC}$ so that $BD = EC = 5$. If $AD^2 + AE^2 = 384$, determine the length of $\overline{BC}$.

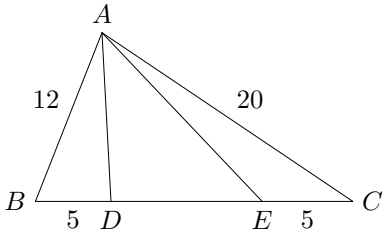


Figure 5

Name: _____ Team: _____

Minnesota State High School Mathematics League

2024-25 Sample Meet 2.2 , Individual Event C

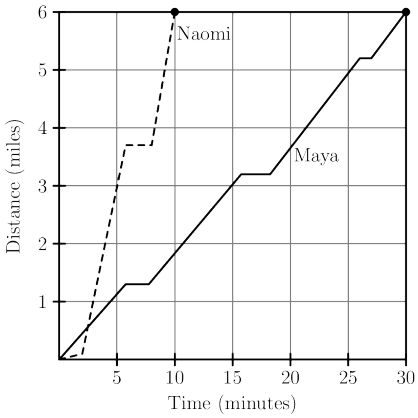
15 minutes

Score	Check

1. _____ A professional hockey league has teams in four divisions. Each division consists of 8 teams, and there are 20 players on each team. How many hockey players participate in this league?

2. _____ mph
[Source: AMC 8]

After school, Maya and Naomi headed to the beach, 6 miles away. Maya decided to bike while Naomi took a bus. The graph shows their journeys, indicating the time and distance traveled. What was the difference, in miles per hour, between Naomi's and Maya's average speeds?



3. _____ If A and B are natural number bases such that $263_A = 63_B$, where $A \geq 7$ and $B \geq 7$, what is the smallest possible value of $A + B$?

4. _____ % Kyle rolls two unusual (but fair) 10-sided dice, with faces numbered $1, 2, 3, \ldots, 10$, and examines the numbers rolled. What is the probability (expressed as a percentage) that the minimum of these two numbers is at most 3?

5. $m + n =$ _____ Abdul, Briana, Carmine, and Diego are four members of the Student Council. Every pair of members on the Student Council is together on one and only one committee. Each committee has exactly three members. If m is the smallest possible total number of members on the Student Council and n is the number of committees on the Student Council, determine the value of $m + n$.

Name: _____ Team: _____

Minnesota State High School Mathematics League

2024-25 Sample Meet 2.2 , Team Event

30 minutes

Score	Check

1. $AD =$ _____ Quadrilateral $ABCD$ is formed by joining isosceles triangles ABC and ACD as shown in Figure 1, where $AB = AC$ and $AD = CD$. If ABC has perimeter 17, ACD has perimeter 15, and $ABCD$ has perimeter 18, what is AD?

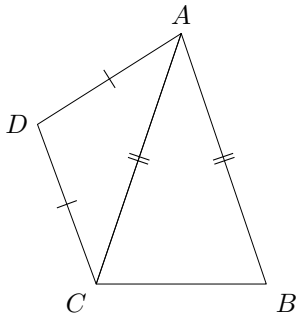


Figure 1

2. _____ For how many integer values of x is $|x - 2021| < 2022$?

3. _____ Suppose $\cos\theta = \tan\theta$. Determine the value of $\dfrac{1}{\sin\theta} + \cos^4\theta$.

4. $b =$ _____ Determine the number base b such that 169_b and 190_b are two consecutive perfect squares.

5. _____ The Twin Cities metro area consists of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties, shown in Figure 5. Each county is to be painted a solid color - orange, yellow, blue, or green - so that counties which touch are painted different colors, and colors can be used more than once. How many different colorings are possible?

Figure 5

6. _____ Find the sum of all values for a and b which make the following two systems equivalent, i.e. have the same solution set.

$$\left\{ \begin{array}{c} ax + 2y = b + 1 \\ x + y = 3 \end{array} \right\} \qquad \left\{ \begin{array}{c} 2x + y = a^2 + 2 \\ x + 3y = 3 \end{array} \right\}$$

Team: _____

Minnesota State High School Mathematics League

2024-25 Sample Meet 2.2 , Answers

Event A:

1. **4**
   (22-23 1D1, 90% correct)
2. **17**
   (21-22 3A1, 80% correct)
3. **89**
   (21-22 5T1, 89% correct)
4. **648**
   (20-21 SD3, 50% correct)
5. **31**
   (23-24 1D4, 2.8% correct)

Event B:

1. **12**
   (22-23 1B1, 81% correct)
2. **2**
   (21-22 1C2, 61% correct)
3. **66**
   (20-21 3A1, 54% correct)
4. **8**
   (20-21 5B1, 47% correct)
5. **21**
   (21-22 2B4, 9.4% correct)

Event C:

1. **640**
   (23-24 5C1, 93% correct)
2. **24**
   (20 AMC 8 #11, 54% correct)
3. **45**
   (21-22 SI8, 71% correct)
4. **51**
   (23-24 5C4, 20% correct)
5. **17**
   (20-21 5A4, 6.3% correct)

Team Event:

1. **4**
   (22-23 3T1, 98% correct)
2. **4043**
   (21-22 2T1, 83% correct)
3. **2**
   (20-21 1T6, 55% correct)
4. **16**
   (22-23 1T3, 42% correct)
5. **288**
   (22-23 5D3, 5.9% correct)
6. **-9**
   (20-21 ST5, 8.2% correct)