

Minnesota State High School Mathematics League

2024-25 Sample Meet 3.1, Individual Event A

15 minutes

Score	Check

1. _____ What is the 22nd term in the arithmetic sequence $1, 3, 5, 7, 9, \dots$, where each term after the first increases by exactly 2?

2. $uv =$ _____ Suppose $u = 1 + 4i$ and $v = 1 - 4i$ are complex numbers, where i is the imaginary unit (so $i^2 = -1$). What is uv ?

3. $m + n =$ _____ We can write

$$\frac{(\sqrt{13})^3 - (\sqrt{10})^3}{\sqrt{13} - \sqrt{10}} = m + \sqrt{n}$$

where m and n are positive integers and n is square-free. Find $m + n$.

4. _____ Find the sum of all the *real* solutions of the equation

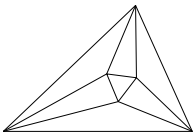
$$x^4 - 4x^2 + 12x - 9 = 0.$$

5. _____ What is the sum of all the integers n satisfying

$$\sqrt{n} + \frac{2}{\sqrt{n}} < 4?$$

Name: _____

Team: _____



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2024-25 Sample Meet 3.1, Individual Event B

15 minutes

Score	Check

1. $AM =$ _____

Figure 1 shows right triangle ABC with legs \overline{AB} of length 6 and \overline{BC} of length 16. \overline{AM} is a median of $\triangle ABC$, so $BM = CM$. Find the length of \overline{AM} .

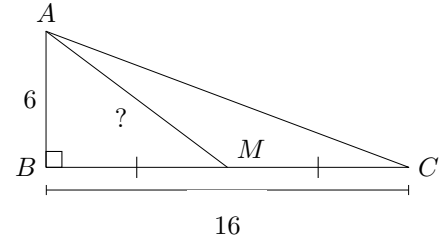


Figure 1

2. _____

In Figure 2, $ABCD$ is a kite with $AC = 4.8$ and $BD = 5$. What is the area of the kite?

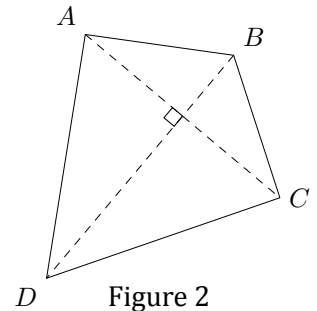


Figure 2

3. $m + n =$ _____

The point $(1, -2)$ is rotated 270° clockwise about the point $(1, 4)$. Its new position has coordinates (m, n) . Find $m + n$.

4. $\theta =$ _____^o

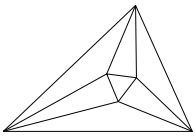
Find θ , if $\tan 2\theta = \cot \theta$ and $90^\circ < \theta < 180^\circ$.

5. $\text{round}(EF) =$ _____

In $\triangle ABC$, $\angle A = 15^\circ$. Points D and F are chosen on AB (with D closer to A and F closer to B), and point E is chosen on \overline{AC} , so that $\angle AED = \angle CEF$ and $\angle AFE = \angle BFC$. If $AD = 20$ and $\angle ADE = 120^\circ$, find the length of \overline{EF} , rounded to the nearest integer.

Name: _____

Team: _____



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2024-25 Sample Meet 3.1, Individual Event C

15 minutes

Score	Check

1. _____ colors Yushuo has a drawer full of socks. Every morning she grabs four at random, knowing that she will have a matching pair to put on her feet. What is the greatest number of colors of socks she could have in her drawer?

2. _____ How many numbers between 300 and 400 (inclusive) are divisible by 7?

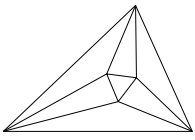
3. _____ Andrew, Bailin, Carol, and Dariyah always sit together in the back row at the movie theater. In how many ways can they be seated so that Andrew and Bailin sit next to each other?

4. $m + n =$ _____ A three-digit number $\underline{A}\underline{B}\underline{C}$ is randomly selected. The probability that its digits are strictly increasing (i.e. that $1 \leq A < B < C \leq 9$) can be written as $\frac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

5. _____ Let $k = 2^{2009} + 2009^2$. Find the units digit (i.e. ones' place) of $k^{2009} + 2009^k$.

Name: _____

Team: _____



Minnesota State High School Mathematics League

2024-25 Sample Meet 3.1, Team Event

30 minutes

Score	Check

1. $a + b =$ _____ Suppose a and b are positive integers, $a^3 + b^3 = 8288$, and $a^2 + b^2 = 259 + ab$. What is $a + b$?

2. _____ Determine the coefficient of x^5 when $(2x^2 - x)^4$ is expanded.

3. _____ Sides of the rectangle $ABCD$ are trisected as shown in Figure 3, and isosceles right triangles are constructed facing inwards with hypotenuses \overline{EF} , \overline{GH} , \overline{IJ} , and \overline{KL} . Find the perimeter of rectangle $PQRS$.

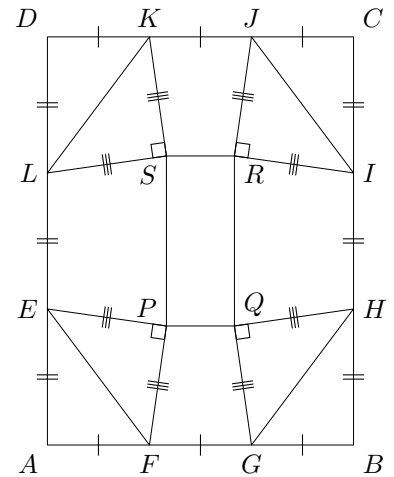


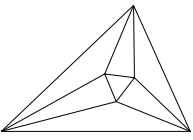
Figure 3

4. _____ Fourteen players enter a ping-pong tournament. The first round consists of seven matches, with each player in a match. How many ways can the players be matched against one another?

5. $m + n =$ _____ We can write $\sin 10^\circ \cos 20^\circ \cos 40^\circ = \frac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

6. _____ days An apartment building is being built by 150 equally efficient workers. At the end of each day 4 workers quit, and the building is eventually completed 8 days later than expected. In total, how many days did it take to complete the building?

Team: _____



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2024-25 Sample Meet 3.1, Answers

Event A:

1.

43

(21-22 4C1, 90% correct)

2.

17

(22-23 3C1, 75% correct)

3.

153

(22-23 SI5, 88% correct)

4.

-2

(20-21 4A3, 24% correct)

5.

66

(20-21 4A4, 20% correct)

Event B:

1.

10

(23-24 2B1, 91% correct)

2.

12

(20-21 3B1, 68% correct)

3.

11

(21-22 2C1, 60% correct)

4.

150

(22-23 3C3, 36% correct)

5.

13

(22-23 5B4, 2.9% correct)

Event C:

1.

3

(22-23 5C2, 80% correct)

2.

15

(23-24 SI2, 30% correct)

3.

12

(21-22 5C2, 24% correct)

4.

82

(22-23 5C3, 9.9% correct)

5.

2

(08-09 5D4)

Team Event:

1.

32

(21-22 4T1, 93% correct)

2.

-8

(20-21 SI3, 79% correct)

3.

140

(23-24 1T6, 64% correct)

4.

135135

(20-21 5C4, 7.2% correct)

5.

9

(23-24 2T6, 18% correct)

6.

25

(21-22 4C4, 5.6% correct)