2019
□ Chapter Competition □ Sprint Round
Problems 1–30

HONOR PLEDGE
I pledge to uphold the highest principles of honesty and integrity as a Mathlete®. I will neither give nor accept unauthorized assistance of any kind. I will not copy another’s work and submit it as my own. I understand that any competitor found to be in violation of this honor pledge is subject to disqualification.

Signature __________________________________________ Date __________

Printed Name _______________________________________

School _____________________________________________

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of 30 problems. You will have 40 minutes to complete all the problems. You are not allowed to use calculators, books or other aids during this round. If you are wearing a calculator wrist watch, please give it to your proctor now. Calculations may be done on scratch paper. All answers must be complete, legible and simplified to lowest terms. Record only final answers in the blanks in the left-hand column of the competition booklet. If you complete the problems before time is called, use the remaining time to check your answers.

In each written round of the competition, the required unit for the answer is included in the answer blank. The plural form of the unit is always used, even if the answer appears to require the singular form of the unit. The unit provided in the answer blank is the only form of the answer that will be accepted.
1. The square root of $n$ is 4. What is the value of $n$?

2. For the function graphed here, what is the integer value of $y$ when $x = 2$?

3. Jaden writes down the following six integers: 1, 10, 101, 1010, 10101, 101010. What is the sum of the six integers Jaden has written?

4. What is the value of $8^2 - 6^2$?

5. A survey of 100 people, each of whom owns a dog or a cat or both, showed that 63 own a dog and 58 own a cat. Based on these results, how many of the people surveyed own both a cat and a dog?
6. __________ apples

There are six apples in a bin, four bins in a bundle and two bundles in a crate. How many apples are in a crate?

7. __________ nickels

Dwight has nine coins consisting of only pennies and nickels. If the total value of the coins is 29 cents, how many nickels does Dwight have?

8. __________ heartbeats

After a brisk workout, Felicia counts 32 heartbeats in 15 seconds. Based on this count, what is Felicia’s expected number of heartbeats in one minute?

9. __________

What is the median of the first five prime numbers?

10. __________

If 108 is 90% of $x$, what is the value of $x$?
11. ____________ Regular hexagon ABCDEF with center O is shown. What fraction of the area of hexagon ABCDEF is shaded? Express your answer as a common fraction.

12. ____________ Two times a number divided by eight equals two. What was the original number?

13. _______ triangles Two distinct segments are drawn inside a triangle from one vertex to two points on the opposite side as shown. What is the total number of triangles of any size in the resulting figure?

14. _______ mi/h The table shows the minimum and maximum speeds of four types of baseball pitches. What is the absolute difference between the minimum speed of a fastball and the maximum speed of a knuckleball?

**Baseball Pitch Speeds** (mi/h)

<table>
<thead>
<tr>
<th>Pitch</th>
<th>Min Speed</th>
<th>Max Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastball</td>
<td>80</td>
<td>95</td>
</tr>
<tr>
<td>Slider</td>
<td>70</td>
<td>85</td>
</tr>
<tr>
<td>Curve</td>
<td>65</td>
<td>80</td>
</tr>
<tr>
<td>Knuckleball</td>
<td>55</td>
<td>70</td>
</tr>
</tbody>
</table>

15. _______ zeros Kris multiplies the first six positive prime numbers together. How many zeros follow the last non-zero digit of the product?
16. ______ mi/h  Carmichael’s favorite race car driver completes 10 laps in 10 minutes. If one lap is 2.5 miles long, what was the average speed of the driver, in miles per hour?

17. _________ The two solutions of the equation \( x^2 + ax + 14 = 0 \) are \( x = 2 \) and \( x = 7 \). What is the value of \( a \)?

18. _________ Cal crosses out \( n \) randomly selected days from the seven consecutive days on her calendar, shown here. What is the minimum value of \( n \) that guarantees she crosses out three consecutive days?

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

19. _________ Let \( p \ominus q = \sqrt{p^2 - q^2} \), and let \( p \oplus q = \sqrt{p^2 + q^2} \). What is the value of \( (3 \oplus 4) \oplus (20 \ominus 16) \)?

20. _________ km/h  Jones is chasing a car 800 meters ahead of him. He is on a horse moving at 50 km/h. If Jones catches up to the car in 4 minutes, how fast was the car moving?
21. After a hockey game, each member of the losing team shook hands with each member of the winning team. Afterwards, each member of the winning team gave a fist-bump to each of her teammates. Each team has 20 players. If \( n \) handshakes occurred and \( m \) fist-bumps occurred, what is the value of \( n + m \)?

22. Diana has two fair spinners. The sectors of the first are numbered with the prime numbers less than 10. The sectors of the second are numbered with the positive perfect squares less than 40. On each of the spinners, all sectors have equal area. What is the probability that if both spinners are spun, the selected numbers on the two are not relatively prime? Express your answer as a common fraction.

23. If \( A \) represents a digit such that the sum of the two-digit numbers \( 2A \), \( 3A \) and \( 4A \) is the three-digit number \( 10A \), what is the value of \( A \)?

24. A fair tetrahedral die, whose faces are numbered 1, 2, 3 and 4 is rolled three times. What is the probability that the sum of the numbers rolled is 7? Express your answer as a common fraction.

25. cm A line bisecting the larger acute angle in a triangle with sides of length 33, 44 and 55 cm divides the opposite side into two segments. What is the length of the shorter segment of that side? Express your answer as a common fraction.
26. __________ ways  In the grid shown, how many ways are there to spell the word “QUEUE” by moving one square at a time either horizontally or vertically, and provided squares may be revisited?

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E U E U E
U E U E U
E U Q U E
U E U E U
E U E U E
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27. __________ mi/h  The Millers went on a weekend outing 180 miles from their home. The average speed to their destination was 20 mi/h less than the average speed returning home. If the travel time for the entire trip was 7.5 hours, what was the Millers’ average speed to their destination?

28. __________  The least common multiple of the consecutive positive integers from 20 through \( k \) is greater than one billion. Assuming that \( k > 20 \), what is the least possible value of \( k \)?

29. __________  In triangle ABC, shown here, P and Q lie on sides AB and AC, respectively, so that \( \frac{AP}{AB} = \frac{AQ}{AC} = \frac{1}{5} \). Segments PC and QB intersect at R. What is the ratio of the area of triangle PQR to the area of triangle ABC? Express your answer as a common fraction.

30. __________  If \( a, b \) and \( c \) are positive integers such that \( \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{6}{7} \), then what is \( a + b + c \)?