MATHCOUNTS®

2019
■ Chapter Competition ■
Sprint Round
Problems 1–30

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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.

Total Correct	Scorer's Initials

Raytheon

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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 $x = 2$?
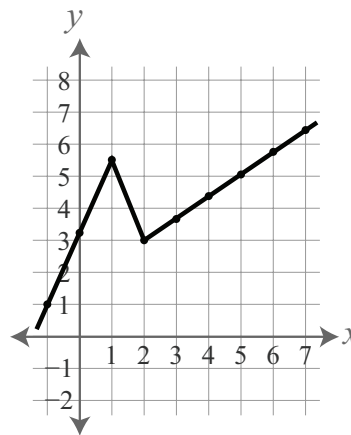
3. _____ Jaden writes down the following six integers: 1, 10, 101, 1010, 10101, 101010. What is the sum of the six integers Jaden has written?
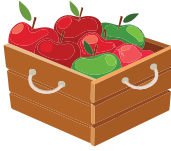
4. _____ What is the value of $8^2 - 6^2$?

5. _____ people 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. _____ heart-beats   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?
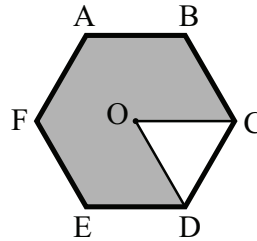
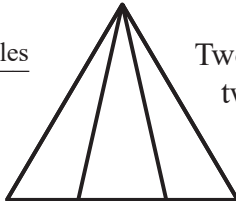9. _____ What is the median of the first five prime numbers?

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)

Pitch	Min Speed	Max Speed
Fastball	80	95
Slider	70	85
Curve	65	80
Knuckleball	55	70

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?

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7

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.
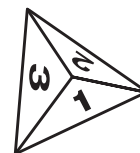
25. _____ cm A line bisecting the larger acute angle in a triangle with sides of length 33, 44 and 55 cm divides the opposite side into two segments. What is the length of the shorter segment of that side? Express your answer as a common fraction.

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?

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

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 $\dfrac{AP}{AB} = \dfrac{AQ}{AC} = \dfrac{1}{5}$. 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.
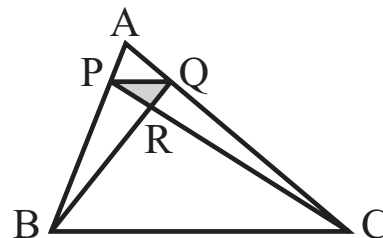
30. _____   If a, b and c are positive integers such that $\dfrac{1}{a} + \dfrac{1}{b} + \dfrac{1}{c} = \dfrac{6}{7}$, then what is $a + b + c$?