
MATHCOUNTS®

2020
■ Chapter Competition ■
Countdown Round
Problems 1–80

**This booklet contains problems to be used
in the Countdown Round.**

Raytheon

**2020 MATHCOUNTS
National Competition Sponsor**

TITLE SPONSORS

Raytheon Company

NATIONAL SPONSORS

Northrop Grumman Foundation
U.S. Department of Defense STEM
National Society of Professional Engineers
3Mgives
Texas Instruments Incorporated
CNA Insurance
Art of Problem Solving
NextThought

FOUNDING SPONSORS: National Society of Professional Engineers, National Council of Teachers of Mathematics and CNA Insurance

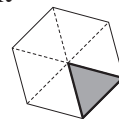
Copyright MATHCOUNTS, Inc. 2019. All rights reserved.

1. _____ (%) The Sharks have a win-loss record of 36-14. What percent of the games played have the Sharks won?
2. _____ (minutes) How many minutes are there in half of a day?
3. _____ A certain gameboard consists of an $n \times n$ array of squares. Vijay places a token on every square that does not border an edge of the board. If Vijay uses exactly 169 tokens, what is the value of n ?
4. _____ What is the greatest common factor of the first 100 positive prime numbers?
5. _____ (weeks) This week, Rudy began saving his \$5 weekly allowance to buy a new gaming system. How many weeks worth of allowance must Rudy save to buy a gaming system that costs \$299?
6. _____ (cm) Triangle ABC has perimeter 24 cm and area 20 cm^2 . Triangle DEF is similar to triangle ABC and has area 45 cm^2 . What is the perimeter of triangle DEF, in centimeters?
7. _____ (minutes) If Colin can wrap a gift in 18 seconds, how many minutes will it take him to wrap 100 gifts?
8. _____ What number is halfway between $\frac{3}{7}$ and $\frac{6}{7}$? Express your answer as a common fraction.
9. _____ For what value of k does the straight line passing through the points $(4k + 1, 3k + 2)$ and $(3k + 2, 2k + 1)$ have slope 2?
10. _____ (feet) George has five ribbons, each 4 feet 8 inches in length. What is the combined length of George's ribbons? Express your answer to the nearest foot.
11. _____ What is the value of the expression $(1 - 8) \div (2 - 7) + (3 - 6) \div (4 - 5)$? Express your answer as a decimal to the nearest tenth.
12. _____ Carl received a text notifying him that the release date for "102 Dachshunds" would be 102 days from the notification date. If the movie release day will be a Saturday, on what day of the week did Carl receive the text?
13. _____ (blue marbles) A jar contains 8 red, 10 green, 36 yellow and some blue marbles. If the ratio of green to blue marbles is 5:12, how many blue marbles are in the jar?
14. _____ (units²) What is the area of the triangle with side lengths 5, 5 and 6, in square units?
15. _____ If $a * b = a^2 - b$, what is the value of $12 * 12$?

16. _____ (members) A math club for seventh and eighth graders starts with 14 seventh graders and 8 eighth graders. Each week, 3 new seventh graders and 4 new eighth graders join the club. What will be the total number of members when the club has an equal number of seventh graders and eighth graders?
17. _____ (cm²) What is the surface area, in square centimeters, of a cube with volume 1000 cm³?
18. _____ What is the product of the least common multiple and the greatest common factor of 10 and 15?
19. _____ The product of three distinct prime numbers is 130. What is the greatest of the three prime numbers?
20. _____ (costumes) How many distinct Halloween costumes can be made by choosing one of three different capes, one of two different wigs and two of four different accessories?
21. _____ (dollars) Courtney has ten nickels, ten dimes and ten quarters. If she has no other coins, what is the total value of her coins, in dollars?
22. _____ (posts) A fence that is 33 feet long is held up by a number of posts. There must be a post at each end of the fence, and consecutive posts cannot be more than 6 feet apart. What is the minimum number of posts needed to hold up this fence?
23. _____ What is the value of the expression $1.2 \times 1.2 + 1.2 \div 1.2 - 1.2$? Express your answer as a decimal to the nearest hundredth.
24. _____ (integers) A three-digit positive integer is *pristine* if all three of its digits are distinct prime numbers. How many three-digit positive integers are pristine?
25. _____ What is the product of 42 and 48?
26. _____ (ft²) A rectangle is twice as long as it is wide. If its perimeter is 18 feet, what is its area, in square feet?
27. _____ (dollars) Tom can pay for phone service at a rate of \$45 per month or \$500 per year. How many dollars will Tom save by choosing the cheaper payment plan for one year of service?
28. _____ (inches) Two brothers, Timmy and Jimmy, have heights totaling 12 feet. If Timmy is 6 inches taller than Jimmy, what is Timmy's height in inches?

29. _____ (marbles) Nathan lost his marbles. He found 30 of them, which was $\frac{1}{3}$ of the number that he started with. How many marbles did he have to begin with?
30. _____ (points) Through the first 81 games of an 82-game basketball season, Michael averaged 29 points per game. Assuming Michael has played in all 81 games, how many points must he score in the final game to average 30 points per game for the season?
31. _____ What is the value of 150% of 50% of 100?
32. _____ If $2x = 15.6$, what is the value of x ? Express your answer as a decimal to the nearest tenth.
33. _____ (miles) Dana's car averages 28 miles per gallon of gas, and it currently contains 1 gallon of gas. If Dana adds \$10.00 worth of gas, sold for \$2.50 per gallon, how many miles can he expect to drive before running out of gas?
34. _____ What is the greatest common factor of 36, 54, 66 and 17?
35. _____ (dollars) Liam pays \$60.00 for a sweater that is on sale for 25% off its original price. How many dollars did the sweater originally cost?
36. _____ If $x = 9$, what is the value of the expression $2x \cdot 5x$?
37. _____ The points A and B are located on a number line with coordinates -8 and 32 , respectively. If the point P is located between A and B so that the ratio of AP to PB is 1:4, what is the coordinate of point P?
38. _____ What is the value of $((2 + 3) \times 5) - (2 + 3 \times 5)$?
39. _____ (minutes) Marcus can walk 15 blocks in one hour. How many minutes does it take him to walk 50 blocks?
40. _____ What is $\frac{1}{3}$ of $2\frac{1}{3}$? Express your answer as a common fraction.
41. _____ (dollars) Adrienne and Michelle split a \$20 payment that they receive for doing some extra chores. Since Adrienne did three times the work that Michelle did, Adrienne's share of the payment is three times Michelle's share. How many dollars is Michelle's share?

42. _____ (mi/h) Tina drove 140 miles in $2\frac{1}{2}$ hours. What was her average speed, in miles per hour?
43. _____ (%) Richard bakes a pie. He gives his mom half of the pie. He gives his dad a quarter of the pie. What percentage of the pie is left?
44. _____ The product of two consecutive negative integers is 42. What is their sum?
45. _____ (in²) The perimeter of a rectangle is 20 inches. If the length of the rectangle is 7 inches, what is the area of the rectangle, in square inches?
46. _____ What is the value of $\frac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{\frac{5}{2} + \frac{5}{3} + \frac{5}{4}}$? Express your answer as a common fraction.
47. _____ (albums) Bobbie has 260 photos that she would like to put into physical photo albums. Each album can hold up to 50 photos. What is the fewest number of albums Bobbie will need?
48. _____ Two integers that add to 15 differ by 3. What is the product of the two integers?
49. _____ (degrees) If angle A is an acute angle, what is the absolute difference between the degree measures of the supplement of A and the complement of A, in degrees?
50. _____ If a and b are positive integers such that $a^2 + b^2 = 197$, what is the value of $a + b$?
51. _____ (cm²) Right triangle ABC is similar to triangle XYZ. The legs of triangle ABC have lengths of 3 cm and 4 cm. The hypotenuse of triangle XYZ is 15 cm long. What is the area, in square centimeters, of triangle XYZ?
52. _____ (feet) The lowest point in Death Valley is Badwater at 282 feet below sea level. The highest point in the surrounding mountains is Telescope Peak at 11,043 feet above sea level. How many feet higher is Telescope Peak than Badwater?
53. _____ If a is a positive integer such that $a = \sqrt{(-16) \times (-16) \times (-16) \times (-16)}$, what is the value of \sqrt{a} ?
54. _____ (inches) A regular hexagon, with perimeter 30 inches, is divided into six congruent equilateral triangles as shown. What is the perimeter of the gray triangle, in inches?



55. _____ If $a + b$ is twice $a - b$ and $ab \neq 0$, what is the ratio of b to a ? Express your answer as a common fraction.
56. _____ One-half of the students in Mr. Meyer's class are boys, and one-third of the students in Ms. Sanchez's class are boys. If both classes have the same number of students, what fraction of the two classes combined are boys? Express your answer as a common fraction.
57. _____ (units) The area of a certain triangle is numerically equal to five times the length of its base. What is the height of the triangle, in units?
58. _____ What is the sum of all of the integers a that satisfy the equation $a = a^3$?
59. _____ If the line $y = 2x - 6$ intersects the line $x = 10$ at the point $(10, b)$, what is the value of b ?
60. _____ (pages) It takes Ty 4 hours 30 minutes to read his favorite book, reading at a constant rate of 100 pages every 50 minutes. How many pages are in Ty's favorite book?
61. _____ (ounces) Reuben had 15 ounces of fudge. He gave half of the fudge to his sister. How many ounces of fudge did he keep? Express your answer as a decimal to the nearest tenth.
62. _____ If x is a number such that $2x + 5 = 9$, what is the value of the expression $(2x + 6)(2x + 7)$?
63. _____ What is the least positive integer that is even and is a perfect square and is divisible by 3?
64. _____ Last night $\frac{5}{8}$ of the students in the dorm looked at Facebook, $\frac{3}{8}$ looked at Twitter, and $\frac{1}{4}$ looked at both. What fraction of the students looked at neither? Express your answer as a common fraction.
65. _____ If $5y = -60$, what is the value of y ?
66. _____ What is the greatest common factor of 78 and 90?

67. (\$) Clara buys a bunch of bananas at the grocery store. If the total is \$2.54 and she pays with a \$5 bill, how much change should she get back, to the nearest cent?
68. What is the value of $\frac{20^{20}}{20^{19} + 20^{19} + 20^{19} + 20^{19}}$?
69. (eggs) Jadon buys three large cartons of eggs. Each carton holds $1\frac{1}{2}$ dozen eggs. How many eggs does he buy in all?
70. (units²) What is the area, in square units, of a rectangle whose perimeter is 14 units and whose side lengths are prime numbers?
71. Brent flips three fair coins in succession. Given that the first coin lands heads, what is the probability that all his coins will land heads? Express your answer as a common fraction.
72. What is the value of the sum $\frac{1}{3} + \frac{2}{3} + \frac{4}{3} + \frac{5}{3} + \frac{7}{3} + \frac{8}{3}$?
73. Jin has scores of 80, 91 and 96 on his tests this term. What is the lowest score that he can get on the next test that will raise his average to at least 90?
74. If $\sqrt{x} + \sqrt{36} = \sqrt{64}$, what is the value of x ?
75. What is the smallest perfect square divisible by at least three distinct prime numbers?
76. What is the smallest value of n with the property that $1 + 2 + 3 + \dots + n$ is a two-digit number whose digits are equal?
77. What is the greatest prime number less than 50 that can be written in the form $4n + 1$, where n is a positive integer?
78. (zeros) How many zeros appear at the end of the product of the first 2020 primes?
79. What is the units digit of $2020^0 + 2020^1 + 2020^2 + 2020^3 + \dots + 2020^{2020}$?
80. (\$) Paul paid for a sandwich with a \$5 bill and received three pennies, two dimes and one quarter in change. What was the cost of the sandwich, to the nearest cent?