# MATHCOUNTS®

## 2025 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. 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.

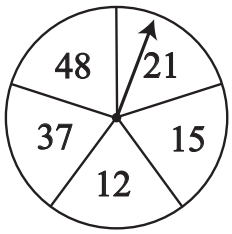
| Total Correct | Scorer's Initials |
|---|---|
| | |
| | |

1. _____ What is the value of $2 + (2 \times 2) + (2 \times 2 \times 2)$?

2. _____ The value of a word is the sum of the values of all letters in the word. The value of each vowel (A, E, I, O, U) is 8 and the value of each consonant is 5, so the value of the word HAPPY is $5 + 8 + 5 + 5 + 5 = 28$. What is the value of the word MATHCOUNTS?

3. _____ What value of $x$ satisfies $x \times y = 36$, if $y = 12$?

4. _____ The fair spinner shown is divided into five equal sections. What is the probability that the spinner will land on a multiple of 6? Express your answer as a common fraction.




5. _____ years Ed is two years older than Al. Ben is five years younger than Al. How many years older than Ben is Ed?

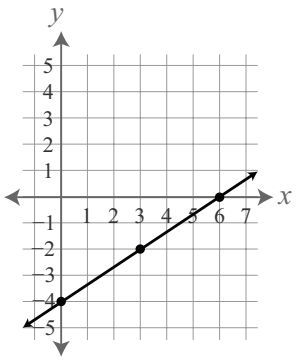
6. _____ If $\frac{12-\heartsuit}{3}=1$, what is the value of $\heartsuit$?

7. _____ $cm^2$ A rectangle has a width of 10 cm and a length of 15 cm. If each side is doubled in length, what is the area of the new rectangle?

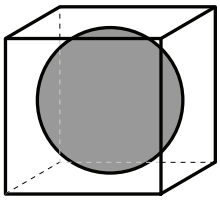
8. _____ If Andrea randomly chooses two distinct elements from the set {1, 2, 3, 4}, what is the sum of the least possible and greatest possible products?

9. _____ For the function represented in the graph and table, what is the integer value of $y$ when $x = 12$?

| $x$ | $y$ |
|---|---|
| 0 | −4 |
| 3 | −2 |
| 6 | 0 |

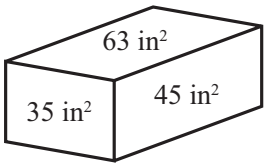



10. _____ $cm^3$ A sphere is inscribed in a cube with an edge length of 6 cm. What is the volume of this sphere if $V_{sphere}=\frac{4}{3}\pi r^3$? Express your answer in terms of $\pi$.



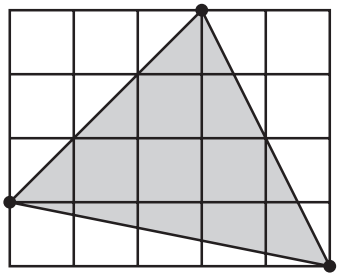
11. _____ If the arithmetic mean of 15, 7, 12, 5 and $x$ is 10, then what is the value of $x$?

12. _____ $in^3$ This rectangular prism has integer edge lengths, and the three distinct faces of the prism have areas 35 $in^2$, 45 $in^2$ and 63 $in^2$, what is the volume of the prism?




13. _____ ways If only nickels, dimes and quarters are available, how many different ways are there to choose a combination of coins totaling 30 cents?

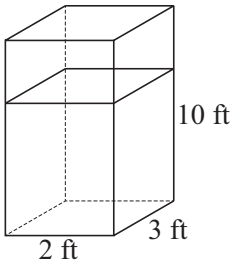
14. _____ $cm^2$ Each of the 20 small squares in the figure to the right has an area of 1 square centimeter. What is the number of square centimeters in the area of the shaded region?



15. _____ In a bag, there are 12 purple, 7 green, 11 blue and 3 pink marbles. If you select two marbles at random from the bag, without replacement, what is the probability that you will choose first a pink marble and then a purple marble? Express your answer as a common fraction.

16. _____ $ft^3$

A water tank in the shape of a rectangular prism has dimensions of 10 feet by 3 feet by 2 feet and is oriented with the top and bottom surfaces being level. At 11:00 a.m., the water level is at 70% of the tank's height. The water begins draining from the bottom of the tank at a constant rate. At noon the water level is down to 40% of the tank's height. At 1:00 p.m., how many cubic feet of water are left in the tank?




17. _____

The prime factorization of 2025 can be written in the form $a^b \times c^d$. What is the sum of $a + b + c + d$?

18. _____

Vera begins at the center square in the grid shown and moves from square to square in such a way that she only moves to a square that shares a side with her current square and she visits each square exactly once. What is the sum of the four possible distinct values for the sum of the first four squares she will have occupied, including the 5?

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

19. _____

The average of ten numbers is 9.5. If 1 is added to the first number, 2 is added to the second, 3 is added to the third and so on until 10 is added to the tenth, what is the average of the 10 new numbers?

20. _____

If $m$ and $n$ are positive integers such that $m^n = 64$, what is the sum of all possible values of $m + n$?

21. _____ cm

Atem has 5 different sized matchsticks whose lengths are positive integer number of centimeters. No three can be arranged to form the sides of a triangle. What is the least possible sum of the lengths of all Atem's matchsticks?

22. _____

Suppose $x$ is a real number such that $2^x = x + 3$. What is the value of the expression below?

$$\frac{2^{2^x}}{x+3}$$

23. _____

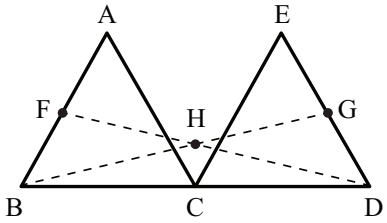
When $\sqrt{6+2\sqrt{5}}$ is written in simplest radical form as $a + \sqrt{b}$, where $a$ and $b$ are positive integers, what is the value of $a + b$?

24. _____ ordered pairs

How many ordered pairs of positive integers $(m, n)$ are there with $n \leq 10$ and where $\frac{2}{3} \leq \frac{m}{n} < 1$?

25. _____ inches

Equilateral triangles ABC and CDE have side length 14 inches. Segment AE is parallel to segment BD, and points B, C and D are collinear. Points F and G are the midpoints of segments AB and DE, respectively. Segments FD and GB intersect at point H. What is HC? Express your answer in simplest radical form.



26. _____ ordered triples

How many ordered triples of odd positive integers $(a, b, c)$ are there for which $a + b + c = 49$ and $a < b < c$?

27. _____

Let $2^n$ be the greatest power of 2 that divides the expression shown. What is the value of $n$?

$$1 \times 2 \times 3 \times 4 + 2 \times 3 \times 4 \times 5 + 3 \times 4 \times 5 \times 6 + \cdots + 25 \times 26 \times 27 \times 28$$

28. _____

What is the first non-zero digit of $\sqrt{75^2 + 1}$ that appears after the decimal point?

29. _____ ordered pairs

How many ordered pairs of positive integers $(a, b)$ satisfy $\frac{7ab}{a+b} = 2025$?

30. _____ cm

Tetrahedron ABCD with volume 2025 $cm^3$ has segment BD perpendicular to plane ABC. Suppose that angle ABC = 90 degrees, angle DAB = 30 degrees and angle DCB = 60 degrees. What is BD? Express your answer in simplest radical form.

# Forms of Answers

The following list explains acceptable forms for answers. Coaches should ensure that Mathletes are familiar with these rules prior to participating at any level of competition. Competition answers will be scored in compliance with these rules for forms of answers.

**Units of measurement are not required in answers, but they must be correct if given.** When a problem asks for an answer expressed in a specific unit of measure or when a unit of measure is provided in the answer blank, equivalent answers expressed in other units are not acceptable. For example, if a problem asks for the number of ounces and 36 oz is the correct answer, 2 lbs 4 oz will not be accepted. If a problem asks for the number of cents and 25 cents is the correct answer, $0.25 will not be accepted.

**The plural form of the units will always be provided in the answer blank, even if the answer appears to require the singular form of the units.**

**Geometric figures may not be drawn to scale and lengths of geometric figures should be assumed to be measured in "units"** unless otherwise stated.

**All answers must be expressed in simplest form.** A "common fraction" is to be considered a fraction in the form $\pm\frac{a}{b}$, where $a$ and $b$ are natural numbers and GCF($a$, $b$) = 1. In some cases the term "common fraction" is to be considered a fraction in the form $\frac{A}{B}$, where $A$ and $B$ are algebraic expressions and $A$ and $B$ do not share a common factor. A simplified "mixed number" ("mixed numeral," "mixed fraction") is to be considered a fraction in the form $\pm N\frac{a}{b}$, where $N$, $a$ and $b$ are natural numbers, $a < b$ and GCF($a$, $b$) = 1. Examples:

*Problem:* What is 8 ÷ 12 expressed as a common fraction? *Answer:* $\frac{2}{3}$ *Unacceptable:* $\frac{4}{6}$

*Problem:* What is 12 ÷ 8 expressed as a common fraction? *Answer:* $\frac{3}{2}$ *Unacceptable:* $\frac{12}{8}$, $1\frac{1}{2}$

*Problem:* What is the sum of the lengths of the radius and the circumference of a circle with diameter $\frac{1}{4}$ unit expressed as a common fraction in terms of π? *Answer:* $\frac{1+2\pi}{8}$

*Problem:* What is 20 ÷ 12 expressed as a mixed number? *Answer:* $1\frac{2}{3}$ *Unacceptable:* $1\frac{8}{12}, \frac{5}{3}$

**Ratios should be expressed as simplified common fractions** unless otherwise specified. Examples:

*Acceptable Simplified Forms:* $\frac{7}{2}$, $\frac{3}{\pi}$, $\frac{4-\pi}{6}$ *Unacceptable:* $3\frac{1}{2}$, $\frac{\frac{1}{4}}{3}$, 3.5, 2:1

**Radicals must be simplified.** A simplified radical must satisfy: 1) no radicands have a factor which possesses the root indicated by the index; 2) no radicands contain fractions; and 3) no radicals appear in the denominator of a fraction. Numbers with fractional exponents are *not* in radical form. Examples:

*Problem:* What is $\sqrt{15} \times \sqrt{5}$ expressed in simplest radical form? *Answer:* $5\sqrt{3}$ *Unacceptable:* $\sqrt{75}$

**Answers to problems asking for a response in the form of a dollar amount or an unspecified monetary unit (e.g., "How many dollars...," "How much will it cost...," "What is the amount of interest...") should be expressed in the form ($) *a.bc* or *a.bc* (dollars), where *a* is an integer and *b* and *c* are digits.** The *only* exceptions to this rule are when $a$ is zero, in which case it may be omitted, or when $b$ and $c$ both are zero, in which case they both may be omitted. Answers in the form ($) $a.bc$ or $a.bc$ (dollars) should be rounded to the nearest cent unless otherwise specified. Examples:

*Acceptable Forms:* 2.35, 0.38, .38, 5.00, 5 *Unacceptable:* 4.9, 8.0

**Do not make approximations for numbers** (e.g., π, $\frac{2}{3}$, $5\sqrt{3}$) in the data given or in solutions unless the problem says to do so.

**Do not perform any intermediate rounding** (other than the "rounding" a calculator does) when calculating solutions. All rounding should be done at the end of the computation process.

**Scientific notation** should be expressed in the form $a \times 10^n$ where $a$ is a decimal, $1 \le |a| < 10$, and $n$ is an integer. Examples:

*Problem:* What is 6895 expressed in scientific notation? *Answer:* $6.895 \times 10^3$

*Problem:* What is 40,000 expressed in scientific notation? *Answer:* $4 \times 10^4$ *or* $4.0 \times 10^4$

**An answer expressed to a greater or lesser degree of accuracy than called for in the problem will not be accepted. Whole-number answers should be expressed in their whole-number form.** Thus, 25.0 will not be accepted for 25, and 25 will not be accepted for 25.0.