

# MATHCOUNTS®

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## 2022 STATE COMPETITION Target Round Problems 1–8

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### DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of eight problems, which will be presented in pairs. Work on one pair of problems will be completed and answers will be collected before the next pair is distributed. The time limit for each pair of problems is six minutes. The first pair of problems is on the other side of this sheet. When told to do so, turn the page over and begin working. This round assumes the use of calculators, and calculations also may be done on scratch paper, but no other aids are allowed. 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 problem sheets. If you complete the problems before time is called, use the time remaining to check your answers.



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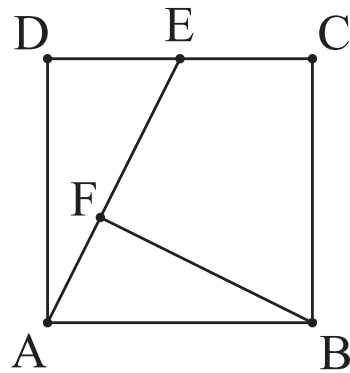
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1. \_\_\_\_\_ cards Riley has a stack of ten cards. On the  $n$ th card,  $n$  consecutive letters starting with the  $n$ th letter of the alphabet are printed. For example, on the first card, the letter A is printed. On the second card, the letters BC are printed. On the third card, the letters CDE are printed and so on. How many cards have the letter F printed on them?

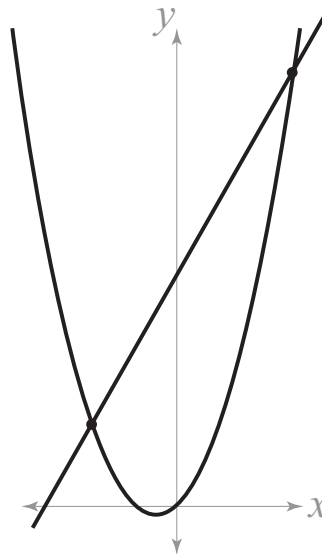
2. \_\_\_\_\_  $\text{cm}^2$  ABCD is a square with side length 2 cm. E is the midpoint of CD, and BF is perpendicular to AE. What is the area of ECBF? Express your answer as a decimal to the nearest tenth.



3. \_\_\_\_\_ families The table shows the percent of families in Mathville that have 0, 1, 2, 3 and 4 or more children. If there are a total of 10,250 families, how many are there with no children?

Number of children	0	1	2	3	4+
% of total families	$x$	20	18	10	6

4. \_\_\_\_\_ The graph of the line  $y = 3x + a$  intersects the graph of the parabola  $y = x^2 + x$  in two points. If the distance between these points is  $3\sqrt{30}$ , what is the value of  $a$ ? Express your answer as a common fraction.



5.           skeins     A polypay sheep produces an average 9.9 pounds of wool annually. This wool is cleaned, spun into yarn and then packaged into skeins of 175 yards of yarn each. One pound of wool makes 10.95 miles of yarn. If farmer Bill has a flock of 200 polypay sheep, to the nearest thousand skeins, how many skeins of yarn is his flock expected to produce in one year? (1 mile = 1760 yards)

6.           subsets     How many different subsets of  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$  contain at least one element in common with each of the sets  $\{2, 4, 6, 8, 10, 12\}$ ,  $\{3, 6, 9, 12\}$  and  $\{2, 3, 5, 7, 11\}$ ?

7. \_\_\_\_\_ questions

The figure shows the responses for Ashley, Bernard and Clive on a True/False quiz where T and F represent a response of true and false, respectively. It is known that Ashley and Bernard each got exactly 7 questions correct. How many questions did Clive answer correctly?

	#1	#2	#3	#4	#5	#6	#7	#8
Ashley	F	F	T	T	T	T	F	T
Bernard	T	F	F	T	T	T	F	T
Clive	T	T	F	F	T	T	T	F

8. \_\_\_\_\_

The polynomial  $p(x) = x^2 + ax + b$  has positive integer coefficients  $a$  and  $b$ . If  $p(60)$  is a perfect square and the equation  $p(x) = 0$  has two distinct integer solutions, what is the least possible value of  $b$ ?