

1999 MCTM Elementary Mathematics Contest — Sample Test

Grades 4-6

sponsored by the
Missouri Council of Teachers of Mathematics



1999 Sample Test Questions and Solutions

Concepts Test: This test will attempt to assess knowledge of and about mathematics. Recall of facts and understanding of relationships will be essential. Items involving Numbers and Number Sense, Geometry (including visualization, transformations and Logo), Measurement, Data Analysis, and Probability and Statistics will be included in this section of the test.

Problem Solving Test: This test will assess higher order thinking skills. These items should require an application of mathematics utilizing both concepts and/or computation. A wide variety of problems can be expected, all of which can be solved utilizing problem solving strategies found in current literature. Expect to spend more time on some items of this test than on items on the Concepts Test.

Labels on Solutions: Solutions will require labels when they involve money (\$ or ¢), time (a.m. or p.m.), or measurement (cm, in, cm², ft & in, hours & minutes, weeks & days, ...).

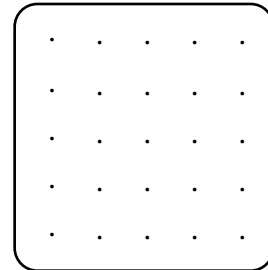
Student Tools: Each student needs to bring sharpened pencils, an in/cm ruler, and a calculator (optional). Fifth grade students should also bring a protractor; and sixth grade students should also bring a protractor and a compass.

Dr. Lynda M. Plymate
Department of Mathematics
Southwest Missouri State University
Springfield, MO 65804-0094
(417) 836-4152
e-mail: lsm953f@mail.smsu.edu
fax: (417) 836-5610

1999 MCTM Elementary Mathematics Contest — Sample Test

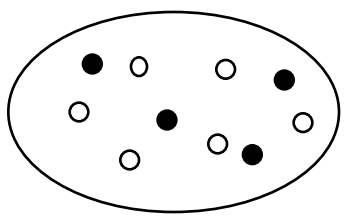
4TH Grade Concepts

1. A 2 liter soda bottle holds approximately ? .
A. 2 cups B. 1 gallon C. 2 quarts D. 3 pints
2. Find the smallest of the five consecutive numbers whose sum is 100.
3. In a group of 40 students taking mathematics or science, exactly 28 are taking mathematics and exactly 24 are taking science. How many are enrolled in both mathematics and science?
4. Eight students advance to the second round of competition in a mathematics contest in which exactly the top 2% were permitted to advance. How many students participated in the contest?
5. How many inches of ribbon are in $3\frac{1}{2}$ yards?
6. If $A = 5$, $B = -2$, and $C = 9$, how much is $A - C + B$?
7. On the geoboard on your answer sheet, connect pegs to create a non-rectangular parallelogram with area = 6 square units.



8. It is now 11:35 a.m. What time will it be in 45 minutes?
9. What number is missing in this sequence? 16, 11, ?, 1, -4, ...

10. Write the shaded part of this group as a fraction in simplest form, and as a decimal.

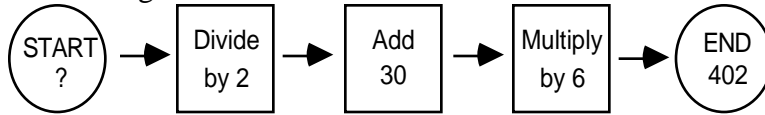


1999 MCTM Elementary Mathematics Contest — Sample Test

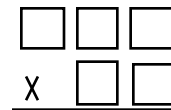
4TH Grade Problem Solving

1. Rectangular cards, 2 inches by 3 inches, are cut from a rectangular sheet, 2 feet by 3 feet. What is the greatest number of cards that can be cut from the sheet?

2. What number belongs in the START circle of this set of instructions?



3. Use the digits 1 through 5 exactly once each to find the largest product in the arrangement of missing numerals to the right.



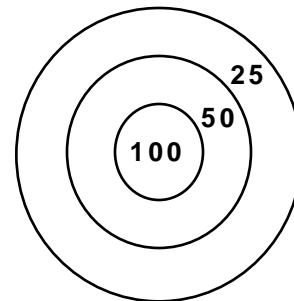
4. There are six brown socks and six black socks in a drawer. If you reach into the drawer blindfolded, what is the least number of socks you must pull out in order to be sure of getting a matching pair?

5. What is the probability of rolling an 11 as the sum of numbers shown on the top faces of two regular (six-sided) number cubes, when the cubes have the following numbers on their faces?

cube 1: 0, 1, 6, 7, 8, 9
cube 2: 1, 2, 10, 10, 10, 11

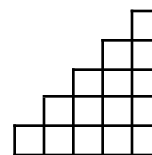
6. The sum of two numbers is 180. Their quotient is 4. What is the larger of the two numbers?

7. In the target shown to the right, the circles have radius = 1, 2, and 3, respectively. If you throw one dart and it hits the target, what is the probability that you score 100 points?



8. If it takes a machine $\frac{2}{5}$ of a minute to produce one item, how many items will it produce in 2 hours?

9. Juan is building a staircase out of blocks in the pattern shown to the right. How many blocks will it take to build a staircase that is 25 blocks high?



10. A theater owner took in \$188 from 82 customers one afternoon. Adult tickets cost \$3, and children's tickets cost \$2. How many adults attended?

1999 MCTM Elementary Mathematics Contest — Sample Test

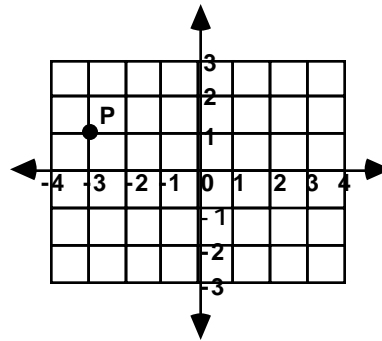
5TH Grade Concepts

1. In the addition problem at the right the letters represent individual digits and both IT and HI are 2-digit numbers. What is the value of HI?

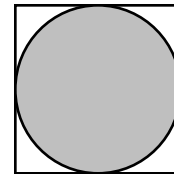
$$\begin{array}{r} \text{IT} \\ \text{IT} \\ \text{IT} \\ + \text{IT} \\ \hline \text{HI} \end{array}$$

2. Eight students advance to the second round of competition in a mathematics contest in which exactly the top 2% were permitted to advance. How many students participated in the contest?
3. Of three numbers, two are $\frac{1}{2}$ and $\frac{1}{3}$. What should the third number be so that the average of all three is 1?

4. Name the coordinates of point P.

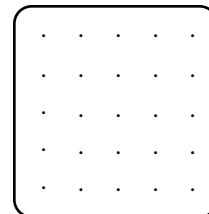


5. In the figure to the right, what fraction of the square is shaded?

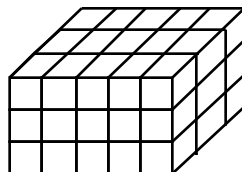


6. When the same whole number is added to both the numerator and denominator of $\frac{2}{5}$, the value of the new fraction is $\frac{2}{3}$. What number was added to both the numerator and denominator?
7. List the two smallest positive whole numbers which have exactly five different positive divisors each.

8. On the geoboard on your answer sheet, connect pegs to create an isosceles trapezoid with area = 9 square units.



9. How many small blocks make up this figure?



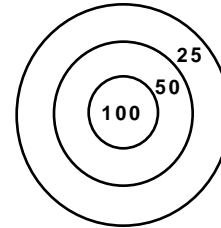
10. Which of the following fractional parts of a pizza is the greatest?

$$\frac{1}{3} \quad \frac{5}{9} \quad \frac{7}{18} \quad \frac{1}{2}$$

1999 MCTM Elementary Mathematics Contest — Sample Test

5TH Grade Problem Solving

1. A certain examination of 12 questions was graded by giving 10 points for each correct answer and then deducting 5 points for each incorrect answer. David attempted all 12 questions leaving no question unanswered, and scored a total of 75 points. How many wrong answers did he have?
2. A kangaroo chases a rabbit which starts 150 feet ahead of the kangaroo. For every 12-foot leap of the kangaroo the rabbit makes a 7-foot leap. How many leaps will the kangaroo have to make to catch up with the rabbit?
3. In the target shown to the right, the circles have radius = 1, 2, and 3, respectively. If you throw one dart and it hits the target, what is the probability that you score at least 50 points?

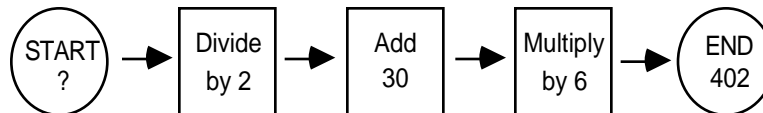


4. Keisha has an equal number of quarters, dimes, nickels, and pennies. The total value of all of her coins is \$9.02. How many coins does she have in total?
5.

0	->	1
1	->	3
5	->	11
3	->	7

 If the same rule is applied to every number, then $6 \rightarrow$.

6. What number belongs in the START circle of this set of instructions?



7. Shannon surveyed 14 of her classmates. Eight play on a softball team and 7 play on a soccer team. Two play on no team at all. How many of her friends play on both soccer and softball teams?
8. Use the digits 1 through 5 exactly once each to find the largest product in the following arrangement of missing numerals.

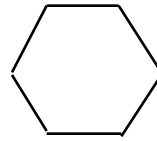
$$\begin{array}{r}
 \square \square \square \\
 \times \square \square \\
 \hline
 \end{array}$$

9. In a new version of the dating game, two of the three bachelors always lie while the other tells the truth. A woman asks questions of the men from behind a partition. She asks each man, "Which of you is the tallest?" Bachelor 1 replies, "Not me." Bachelor 2 replies, "I am." Bachelor 3 replies, "Not Bachelor 2." Who is the tallest?
10. John is covering his flower bed with mulch. The flower bed is in the shape of a circle with a diameter of 12 feet. He wants to put the mulch 2 inches deep all over the flower bed. How many bags of mulch does he need if one bag is 1 cubic foot of mulch?

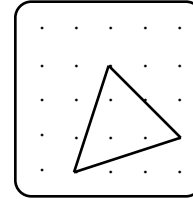
1999 MCTM Elementary Mathematics Contest — Sample Test

6TH Grade Concepts

1. On the answer sheet draw all lines of symmetry for the given regular hexagon:



2. On the geoboard to the right, find the area of the shape outlined.

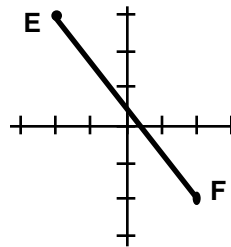


3. The figure below consists of 9 small squares and is called a “magic square” because the total of the numbers added horizontally, vertically, or diagonally are all equal. If the total of the two diagonal rows are subtracted from the total of the three horizontal rows, the result obtained will equal which of the following:

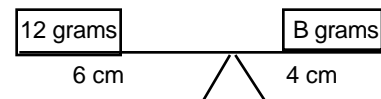
- A. two-thirds a diagonal row
- B. three-halves a diagonal row
- C. any vertical row
- D. double a horizontal row
- E. one-half a horizontal row

8	1	6
3	5	7
4	9	2

4. If point E has coordinates $(-4,6)$ and point F has coordinates $(4,-4)$, then what is the length of segment EF?



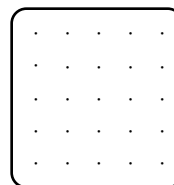
5. What weight should be placed on the scales at B to balance the scales?



6. Find the value of P to make the sentence true: $\frac{3}{P} + \frac{2}{9} = \frac{1}{3}$.

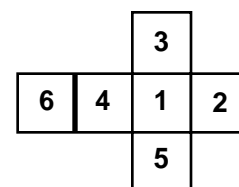
7. What is the least common multiple of 36 and 63?

8. On the geoboard on your answer sheet, draw a figure which touches the pegs, has an area of 5, and has a perimeter of 12.



9. How many positive factors of 36 are also multiples of 4?

10. When the figure to the right is folded to make a cube, what is the largest product of the numbers on parallel faces?



1999 MCTM Elementary Mathematics Contest — Sample Test

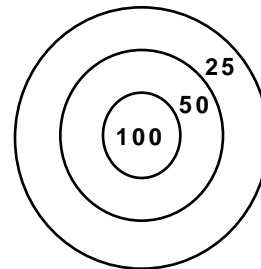
6TH Grade Problem Solving

1. What number belongs in the START circle of this set of instructions?



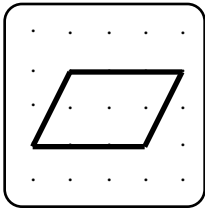
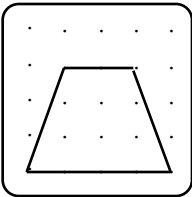
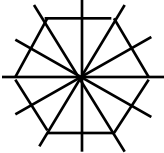
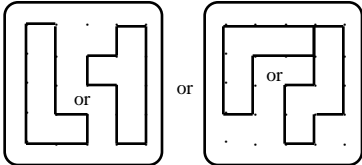
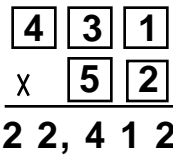
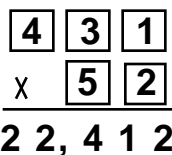
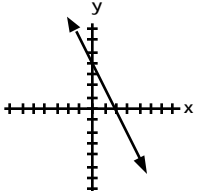
2. A certain examination of 12 questions was graded by giving 10 points for each correct answer and then deducting 5 points for each incorrect answer. David attempted all 12 questions leaving no question unanswered, and scored a total of 75 points. How many wrong answers did he have?
3. Use the coordinate axis system on the answer sheet to graph the set of all points (x, y) such that $4x + 2y = 8$.

4. In the target shown to the right, the circles have radius = 1, 2, and 3, respectively. If you throw one dart and it hits the target, what is the probability that you score exactly 50 points?



5. When multiplied out, 7^2 has a units digit of 9, 7^3 has a units digit of 3, and so forth. What is the units digit of 7^{10} ?
6. Container A is half full of water. Container B will hold 9 cups of water. When the contents of container A is poured into container B, container B is $\frac{2}{3}$ full. How much will container A hold?
7. In a new version of the dating game, two of the three bachelors always lie while the other tells the truth. A woman asks questions of the men from behind a partition. She asks each man, "Which of you is the tallest?" Bachelor 1 replies, "Not me." Bachelor 2 replies, "I am." Bachelor 3 replies, "Not Bachelor 2." Who is the tallest?
8. David has \$500 in a savings account. If his money earns 6% interest at the end of each year, how much money will he have in total after collecting his interest for the 5th year?
9. A large box is 150 cm long, 57 cm wide, and 54 cm high. Small boxes are 50 cm long, 19 cm wide, and 18 cm high. How many small boxes will fit inside the large box?
10. You have decided to play in a single-elimination tennis tournament. (In this type of tournament, each player is eliminated from further competition as soon as he or she loses a match.) If there are 76 participants, how many matches will need to be played to determine a champion?

1999 MCTM Elementary Mathematics Contest — Sample Test Solutions

Grade 4	Grade 5	Grade 6
<p>Concepts</p> <ol style="list-style-type: none"> C 18 12 400 126 -6  <ol style="list-style-type: none"> 12:20 p.m. 6 $\frac{2}{5}$ and 0.4 	<p>Concepts</p> <ol style="list-style-type: none"> 92 400 $\frac{13}{6}$ or $2\frac{1}{6}$ (-3,1) $\frac{7}{4}$ or 0.79 or 79% 4 16 and 81  <ol style="list-style-type: none"> 45 $\frac{5}{9}$ 	<p>Concepts</p>  <ol style="list-style-type: none"> 4 C 164 or 12.81 18 27 252  <ol style="list-style-type: none"> 3 15
<p>Problem Solving</p> <ol style="list-style-type: none"> 144 74  <ol style="list-style-type: none"> 3 $\frac{5}{36}$ or 0.139 or 13.9% 144 $\frac{1}{9}$ or 0.111 or 11.1% 300 325 24 	<p>Problem Solving</p> <ol style="list-style-type: none"> 3 30 $\frac{4}{9}$ or 0.444 or 44.4% 88 13 74 3  <ol style="list-style-type: none"> bachelor #1 19 	<p>Problem Solving</p> <ol style="list-style-type: none"> 74 3  <ol style="list-style-type: none"> $\frac{3}{9}$ or $\frac{1}{3}$ or 0.333 or 33.3% 9 12 cups bachelor #1 \$669.11 27 75