

1998 MCTM Elementary Mathematics Contest — Sample Test

Grades 4-6

sponsored by the
Missouri Council of Teachers of Mathematics



1998 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.

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4th Grade Concepts

1. A bag contains 20 gumballs. If there are 8 red, 7 white, and 5 green, what is the least number of gumballs one must pick from the bag to be assured of getting one of each color?

2. On the answer sheet, draw all lines of symmetry for the given square:



3. What would you key into a calculator to find the value of n? $2,395 + n = 76,924$

4. Eight students advance to the second round of competition in a mathematics contest in which exactly the top 5% were permitted to advance. How many students participated in the contest?

5. Find the smallest whole number for P which will make the following inequality true? $\frac{6}{P} < 1$

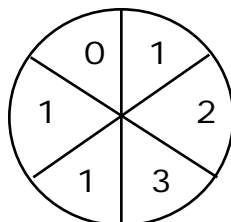
6. If $A = 7$, $B = 5$, and $C = 9$, how much is $A - C + B$?

7. What number is missing in this sequence? 16, 11, ?, 1, -4, ...

8. Assume the following shape is created using 9 toothpicks. On the answer sheet, draw the shape that is created when you move just 3 toothpicks to get exactly 5 triangles.



9. What is the probability of spinning a number greater than 1?

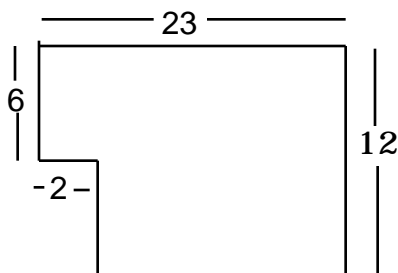


10. What is the smallest possible sum for all Wednesday dates in February?

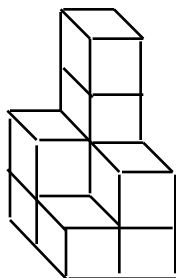
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4th Grade Problem Solving

1. Alan, Bob, Chris, and Kim are four children in a family. Their ages are 5, 8, 11, and 13. Kim and the 8-year old are sisters. Alan is 6 years older than Bob. Who is the oldest?
2. Using the digits 5, 6, 8, and 9 exactly once each to make two 2-digit numbers, what is the largest possible difference of these two numbers?
3. A board 112 cm long is cut into two pieces so that one piece is 3 times as long as the other. How long is each piece?
4. Assume the dimensions of a rectangle with area 24 in^2 are whole numbers. What are the dimensions of this rectangle, when it's perimeter is as large as possible?
5. Shannon surveyed 13 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?
6. Alice is taller than Hilda, Joan is taller than Alice, and Jill is taller than Hilda. Compare Jill's and Joan's heights: Jill's height ? Joan's height
A. < B. = C. > D. can't determine
7. Eight baseball teams entered a tournament. If each team plays every other team one time, how many different games will be scheduled?
8. If it takes a machine $\frac{2}{3}$ of a minute to produce one item, how many items will it produce in 2 hours?
9. What is the perimeter of the figure below?



10. How many cubes are required to build the structure shown below?



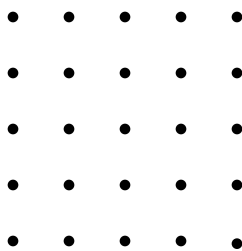
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5th Grade Concepts

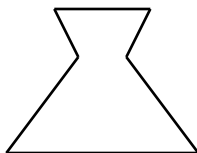
1. What is the probability of rolling an 11 as the sum of numbers shown on the top faces of two regular (six-sided) number cubes, when the cubes have the following numbers on their faces?

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

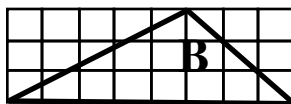
2. The cafeteria gathered data to find out which meal the students liked best. Name the mathematical term that describes the difference between the smallest number of votes for a meal and the largest number of votes for a meal?
3. In a group of 40 students taking mathematics or science, exactly 28 are taking mathematics and exactly 24 are taking science. How many are enrolled in both mathematics and science?
4. List the three smallest positive whole numbers which have exactly four different positive divisors each.
5. Find the number of diagonals in a hexagon.
6. Draw a figure on the geoboard which touches the pegs, has an area of 5, and has a perimeter of 12.



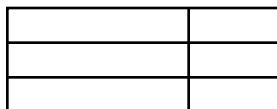
7. List all prime factors of 180.
8. What is the name of this concave polygon?



9. What is the area of triangle B?

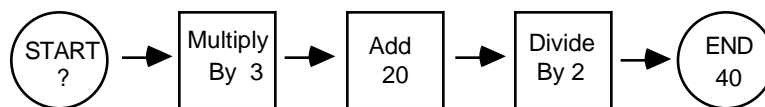


10. How many rectangles are in this figure?



5th Grade Problem Solving

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



2. The sum of three consecutive prime numbers is 97. What is the largest of the primes?
3. Keisha has an equal number of quarters, dimes, nickels, and pennies. The total value of all of her coins is \$6.56. How many coins does she have in total?
4. A farmer needs to fence a rectangular piece of land. She wants the length of the field to be 80 feet longer than the width. If she has 1080 feet of fencing, what should the dimensions of the field be?
5. Suppose some towns wish to string fiber-optic cables so that each town is connected with every other town by exactly one cable. Then two towns require 1 connecting cable; three towns require 3 connecting cables; and four towns require 6 connecting cables. How many connecting cables are required for 6 towns?
6. Pat intended to multiply a number by 6 but instead divided by 6. Pat then meant to add 14 but instead subtracted 14. After these mistakes, the result was 16. If the correct operations had been used, the value produced would have been ...
- A. less than 40.
 B. between 400 and 600.
 C. between 600 and 800.
 D. between 800 and 1000.
 E. greater than 1000.
7. You buy a used CD player from your older brother for \$20. Then you sell it to a friend for \$30. You buy it back for \$40 and sell it to your brother for \$50. How much profit have you made?
8. The product of the page numbers on two facing pages in a book is 9702. What is the larger page number?
9. What is the largest sum possible using the digits 3, 4, 5 and 6 in the problem below?

$$\frac{\square}{\square} + \frac{\square}{\square}$$

10. Using the most powerful telescope ever made, scientists happened to observe a class of young aliens on a planet millions of light years away. On the blackboard, the teacher had written these equations:

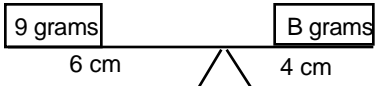
$$13 + 15 = 31, \quad 10 \times 10 = 100, \quad 6 \times 3 = 24$$

How many fingers did they have?

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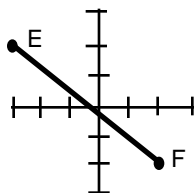
6th Grade Concepts

1. If the number \underline{N} is between and not including 0 and 1, then which of the following statements is(are) true?
 I. $\underline{N} \cdot \underline{N} > 1$ II. $\underline{N} \cdot \underline{N} > 0$ III. $\underline{N} \cdot \underline{N} > \underline{N}$
 A. I only B. II only C. III only D. I and II only E. II and III only

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

3. Write the next two numbers in this sequence: 41, 33, 24, 14, ____, ____ .

4. If point E has coordinates (-3,2) and point F has coordinates (2,-2), then what is the length of segment EF?



5. Which of the following is equal to $(4^5)^3$
 A. $4 \times 5 \times 3$ B. $(5 \times 5 \times 5 \times 5)^3$ C. $(4)^8$ D. $4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$ E. $(4)^{15}$

6. List three fractions that are between $\frac{3}{4}$ and $\frac{4}{5}$ in size.

7. What is the area of a square in square inches if its perimeter is 10 feet?

8. Which measurement is more precise? eighth inch millimeter centimeter half inch

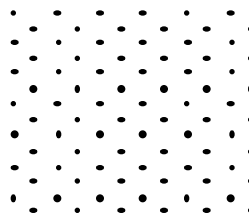
9. Write the number 182 in base twelve.

10. ? is to dollar as year is to ? .

- A. money ... calendar B. dime ... month C. penny ... century D. savings ... century

6th Grade Problem Solving

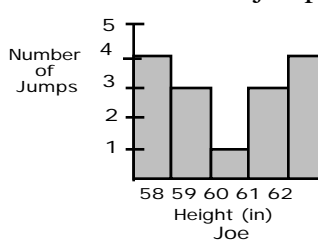
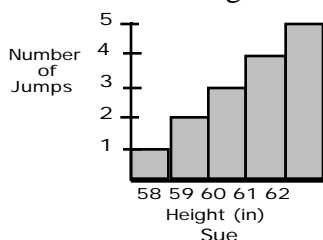
1. On the triangular (isometric) dot paper, draw a 3-dimensional "T"-shape made with 5 cubes for the top and 3 additional cubes for the stem of the "T".



2. Use the digits 1 through 6 exactly once each to find the largest product in the following arrangement of missing numerals.

$$\begin{array}{cccc} \square & \square & \square & \square \\ \times & & \square & \square \\ \hline \end{array}$$

(For problems 3 and 4) During practice for the Olympic high jump, Sue, Joe and Tanya completed 15 jumps each. The charts below illustrate the heights in inches of Sue's and Joe's jumps:



3. The median height for Sue's 15 jumps is ___? (less than, equal to, greater than) the median height for Joe's 15 jumps.
4. On the answer sheet, draw a chart for Tanya's 15 jumps, like those given above for Sue and Joe. Assume that the mean, median, and mode of heights for Tanya's 15 jumps were all three 60 inches.
5. The denominator of a fraction is 5 greater than the numerator. If the numerator and the denominator are each increased by 4, the resulting fraction is equivalent to $\frac{2}{3}$. What is the original fraction?
6. The ratio of chocolate to glazed donuts sold is 5 to 3. How many glazed donuts should be made on a morning when it is expected that 36 dozen donuts will be sold?
7. A real number divided by 6 twice yields a result that is between (but not including) 3 and 4. Describe the set of all possible values for the beginning number.
8. What was the input number of the function machine if the output number is -1?

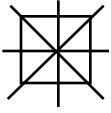
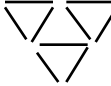
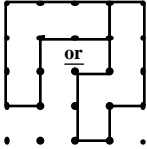
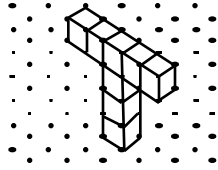
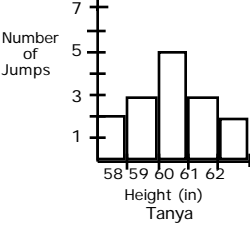
Input	Output
1	5
8	26
5	17
10	32
Function Machine	

9. David has \$200 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?

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



1998 MCTM Elementary Mathematics Contest — Sample Test Solutions

Grade 4	Grade 5	Grade 6
<p>Concepts</p> <p>1. 16</p>  <p>2.</p> <p>3. $76925 - 2395 =$ <u>or</u> 76925 enter 2395 -</p> <p>4. 160</p> <p>5. 7</p> <p>6. 3</p> <p>7. 6</p>  <p>8.</p> <p>9. $2/6$ <u>or</u> $1/3$ <u>or</u> 0.333 <u>or</u> 33.3%</p> <p>10. 46</p>	<p>Concepts</p> <p>1. $5/36$ <u>or</u> 0.1388 <u>or</u> 13.88%</p> <p>2. range</p> <p>3. 12</p> <p>4. 6 <u>and</u> 8 <u>and</u> 10</p> <p>5. 9</p>  <p>6. . . .</p> <p>7. 2 <u>and</u> 3 <u>and</u> 5</p> <p>8. hexagon</p> <p>9. 12 square units</p> <p>10. 18</p>	<p>Concepts</p> <p>1. B</p> <p>2. 13.5 grams</p> <p>3. 3 <u>and</u> -9</p> <p>4. 41 <u>or</u> 6.4</p> <p>5. E</p> <p>6. $31/40, 46/60, 47/60, 61/80, 63/80, \dots$</p> <p>7. 900 square inches</p> <p>8. millimeter</p> <p>9. 132 (base-12)</p> <p>10. C</p>
<p>Problem Solving</p> <p>1. Kim</p> <p>2. 42</p> <p>3. 84 cm <u>and</u> 28 cm</p> <p>4. 1 in by 24 in</p> <p>5. 4</p> <p>6. D</p> <p>7. 28</p> <p>8. 180</p> <p>9. 70</p> <p>10. 9</p>	<p>Problem Solving</p> <p>1. 20</p> <p>2. 37</p> <p>3. 64</p> <p>4. 230 ft by 310 ft</p> <p>5. 15</p> <p>6. E</p> <p>7. \$20</p> <p>8. 99</p> <p>9. $3 \frac{1}{4}$ <u>or</u> $13/4$</p> <p>10. 7</p>	<p>Problem Solving</p>  <p>1.</p> <p>2. 341,523</p> <p>3. ></p>  <p>4.</p> <p>5. $6/11$</p> <p>6. 162 donuts <u>or</u> 13 $\frac{1}{2}$ dozen</p> <p>7. all numbers between, but not including, 108 and 144</p> <p>8. -1</p> <p>9. \$267.65</p> <p>10. 325</p>