

GRADE 5 MONTHLY PROBLEMS

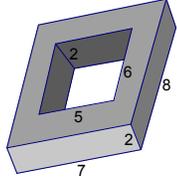
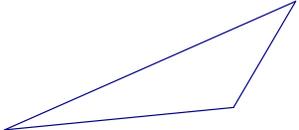
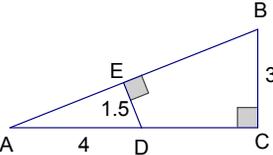
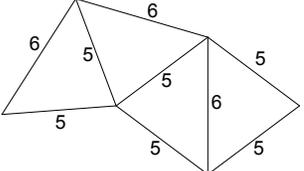
The math standards referenced in the Solutions are for the State of Minnesota. A Common Core alignment will be available soon, but the problems will work in any fifth grade classroom. Because the problems are designed to meet the needs of talented math students, they are also appropriate for older students.

Notes and Suggestions:

- The standards addressed by a problem may vary depending on the strategies that students choose.
- Some cells do not have standards listed. These problems may address more advanced standards. Problems from the "General" column may not be focused on specific standards.
- The problems vary substantially in difficulty. In general, they are quite challenging and will require time and persistence. Most students are unlikely to complete every problem within the month.
- When students solve a problem incorrectly, stress the importance of persistence!
- Some problems have many solutions. Others have no solution.
- Students should usually be able to work without direct instruction, but they may often get stuck. Encourage collaboration! Ask them to look up unfamiliar vocabulary.
- For most problems, students may decide whether to use a calculator. However, they should be able to justify their decision. Sometimes, they can learn a lot from solving them with and without!
- Some problems address content that students will not study until later in the school year. They may still attempt the problems using strategies that are based on what they already know.
- Avoid teaching rules and procedures before you discuss topics in class. If students don't know the rules, so much the better! Creating their own strategies will help them think more deeply.
- Many of these problems provide opportunities for mathematical communication, (even when the problem does not call for explanations). Consider having students write and submit their solution processes from time to time. Be sure to read their ideas carefully and offer one or two brief but thoughtful comments in response. This is very motivating!

Classroom teachers may freely copy and distribute these problems in their classroom. I ask only that you include my name and contact information as they appear at the bottom of each page. Please inform me of any typographical or mathematical errors by contacting me through 5280math.com. I would love to hear about how you are using the problems in your classroom, and I welcome your feedback and suggestions.

GRADE 5 APRIL PROBLEMS

	Number and Operation (NO)	Algebra (A)	Geometry and Measurement (GM)	Data and Probability; Ratios and Rates (DR)	General (G)
1	<p>Find the sum:</p> $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots + \frac{1}{1024}$ <p>(The dots mean to continue the pattern until you reach the final addend.)</p>	<p>Fiona Frog sits at the origin of a rectangular coordinate system. She jumps three times, randomly choosing between 1 unit left, right, up or down each time. How many different places can she land? Name their coordinates, and plot the points.</p>	<p>All faces of this figure except the top and bottom are rectangles. The units are centimeters. Find the volume and surface area.</p> 	<p>Using exactly ten "eighths" fractions between (and possibly including) 0 and 1, create a line plot for which the median is exactly halfway between the mode and the mean. What could the line plot be about?</p>	<p>How many different quadrilaterals can you make by joining two copies of this triangle side to side? Do any of the quadrilaterals have other names?</p> 
2	<p>Brookview Elementary school is having a field trip. Someone mistakenly reserves 15 school buses, which leaves the school 90 seats short. After quickly ordering 3 more buses, there are 39 empty seats. All of the buses have the same number of seats. How many people are riding the buses, and how many seats are on each bus?</p>	<p>Suppose that</p> $\begin{aligned} a + b &= c \\ b - c &= d \\ c + d &= e \\ d - e &= f. \end{aligned}$ <p>What is the value of f if $a = 3$ and $b = 4$? What is the value of f if $a = 21$ and $b = 39$? What is the pattern?</p>	<p>If $AD = 4$ in, $BC = 3$ in, and $ED = 1$ in, then find the length AB.</p> 	<p>Amanda, Caden, and Juan started eating a bowl of 420 pieces of popcorn at the same time. Amanda ate $\frac{2}{3}$ as fast as Caden, and Juan ate $2\frac{1}{2}$ times faster than Amanda did. How fast did Caden eat compared to Juan? (At what average) rate did each person eat if they finished the bowl in 6 minutes?</p>	<p>The difference of the squares of two consecutive numbers is 135. What are the numbers?</p> <p>The difference of the squares of two consecutive numbers is 270. What are the numbers?</p>
3	<p>Penny is going to visit her friend who lives $\frac{3}{5}$ of a mile from her. She has traveled $\frac{1}{2}$ a mile so far. What fraction of the distance has she traveled? Draw a number line that supports your answer.</p>	<p>Create a story to fit the equation</p> $n = x + 2 \cdot y + 3 \cdot z.$ <p>Be sure to explain clearly what each variable represents.</p>	<p>Copy the figure, and join two more of these triangular faces to complete a net. Describe the 3D shape that it will make. Count the number of faces, vertices, and edges. Calculate the surface area.</p> 	<p>Find the value of V.</p> $1\frac{1}{3} : 6 = V : 9$	<p>If you subtract 2 from 10 times a number, the answer is the same as when you add 1 to 4 times the same number. What is the answer if you subtract 6 from 12 times the number?</p>

GRADE 5 APRIL SOLUTIONS

	Number and Operation (NO)	Algebra (A)	Geometry and Measurement (GM)	Data and Probability; Ratios and Rates (DR)	General (G)
1	<p>The sum is $\frac{1023}{1024}$.</p> <p>Students may notice patterns:</p> <ul style="list-style-type: none"> The denominators are powers of 2: $2^1, 2^2, 2^3, 2^4$, etc. The numerator in each partial sum is always one less the denominator. Each time you add another fraction, the answer gets closer to 1, but it will never reach 1! <p>There may be many other patterns!</p> <p style="text-align: right;">5.1.3.4 5.1.3.3</p>	<p>Fiona Frog can land in 16 different locations: (3,0) (-1,2) (1,2) (-2,1) (0,1) (2,1) (-3,0) (-1,0) (1,0) (3,0) (-2,-1) (0,-1) (2,-1) (-1,-2) (1,-2) and (-3,0).</p> <p>What if she jumps 4 times? 5 times?</p> <p style="text-align: right;">5.2.1.2</p>	<p>Volume: 52 cubic centimeters</p> <p>Surface area: 156 square centimeters.</p> <p style="text-align: right;">5.3.2.2 5.3.2.3</p>	<p>A possible solution:</p> <p>In this graph, the mode is $\frac{3}{8}$, the median is $\frac{1}{2}$, and the mean is $\frac{5}{8}$.</p> <p>The line plot could be about the fraction of shots made by ten people shooting 8 free throws each. (It might also be about something measured in inches, cups, etc.)</p> <p style="text-align: right;">5.4.1.1 5.1.2.3 5.1.3.3 5.1.3.4</p>	<p>Six</p> <p>The top three quadrilaterals are parallelograms. The others are kites. (You can create the top three shapes by rotating the triangle around the midpoint of each side. The bottom three come from reflecting the triangle over each side.)</p>
2	<p>There are 735 riders and 43 seats per bus. Sample strategy:</p> <p>Adding three more buses changes the situation from a 90-seat deficit to a 39-seat surplus, which is a change of $90 + 39 = 129$ seats. These seats are accounted for by three new buses, so each bus must have $129 \div 3 = 43$ seats. 18 buses hold $18 \cdot 43 = 774$ people, but 39 of the seats are empty, so there must be $774 - 39 = 735$ riders.</p> <p style="text-align: right;">5.1.1.2 5.1.1.4</p>	<p>$f = -7$ when $a = 3$ and $b = 4$. $f = -60$ when $a = 21$ and $b = 39$.</p> <p>f will always equal the opposite of the sum of a and b. Some students may be able to explain why this happens.</p> <p style="text-align: right;">5.2.3.3 5.2.3.1</p>	<p>AB = 8 inches</p> <p>Hint in case students have been stuck for a while: Draw the segment \overline{BD}, and look at triangle ABD. (Find bases and heights for it.)</p> <p>Triangle ABD has a base of 4 in and a height of 3 in, so its area is $3 \cdot 4 \div 2 = 6 \text{ in}^2$. However, if AB is its base, then the height of triangle ABD is 1.5 in. In order for the area to be 6 in^2, AB must equal 8 in (so that $8 \cdot 1.5 \div 2 = 12 \div 2 = 6$).</p> <p style="text-align: right;">5.3.2.1</p>	<p>Caden ate $\frac{3}{5}$ as fast as Juan.</p> <p>Amanda ate 14 pieces per minute. Caden ate 21 pieces per minute. Juan ate 35 pieces per minute.</p> <p>These are called <i>average</i> rates in the problem, because the kids probably did not eat at constant rates.</p> <p>There are <i>many</i> ways to solve this problem. Encourage students to share their strategies.</p> <p style="text-align: right;">5.1.1.4</p>	<p>$68^2 - 67^2 = 4624 - 4489 = 135$</p> <p>There is no solution to the second question. (The square of an even number is even; the square of an odd number is odd; and difference between an odd number and an even number is always odd.)</p> <p>There is an interesting pattern for the first part! Could you use it to find the answer more easily?</p> <p>$2^2 - 1^2 = 3$ $3^2 - 2^2 = 5$ $4^2 - 3^2 = 7$ $5^2 - 4^2 = 9$ $6^2 - 5^2 = 11$ etc.</p>
3	<p>Penny has traveled $\frac{5}{6}$ of the distance. One way to show this is with a number line labeled in units of 1 tenth.</p> <p>If you think of $\frac{3}{5}$ as 1 whole, then $\frac{1}{2}$ is $\frac{5}{6}$ of that whole.</p> <p style="text-align: right;">5.1.2.3 5.1.2.4</p>	<p>A sample story:</p> <p>If x is the number of free throws, y is the number of 2-point shots, and z is the number of 3-point shots made by a basketball team during a game, then n is the number of points scored.</p> <p>It is important to remember about the order of operations!</p> <p style="text-align: right;">5.2.3.2 5.2.2.1</p>	<p>Hints: (1) Fold your net to be sure it works. (2) The height of each face is a whole number. You can find it by making an accurate drawing.</p> <p>The 3D shape: two triangular pyramids joined at their bases (which are equilateral triangles). There are 6 faces, 5 vertices, and 9 edges. The height of each triangle is 4 units, so the area of each triangle is $6 \cdot 4 \div 2 = 12$ square units. The surface area is $12 \cdot 6 = 72$ square units.</p> <p style="text-align: right;">5.3.1.2 5.3.1.1 5.3.2.1 5.1.3.4</p>	<p>$V = 2$</p> <p>Two of many strategies:</p> <ul style="list-style-type: none"> 9 is 1.5 times greater than 6. What is 1.5 times greater than $1 \frac{1}{3}$? Half of $1 \frac{1}{3}$ is $\frac{2}{3}$. Add this to $1 \frac{1}{3}$ to get 2. Multiply $1 \frac{1}{3}$ and 6 both by 3 to get the equivalent ratio $4 : 18$, which simplifies to $2 : 9$. <p style="text-align: right;">5.1.1.4 5.1.3.1</p>	<p>0</p> <p>The number is $\frac{1}{2}$, because 2 subtracted from 10 times the number is $5 - 2 = 3$, and 1 added to 4 times the number is $2 + 1 = 3$. Therefore, 6 subtracted from 12 times the number is $6 - 6 = 0$.</p>