

Grade 5 Sample Instructional Math Task

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Grade 5 Sample Instructional Math Task

Collecting Basketball Cards

Kent and Allie collect basketball cards. Kent has twenty cards and Allie has thirty cards. Kent's mom says that if Kent helps take care of his little brother while she prepares dinner, she will give Kent five cards every Monday. Allie's mom says that if Allie helps fold the laundry, she will give Allie four cards every Monday. Allie tells Kent that she will always have more cards, but Kent isn't sure about that. Will Allie always have more basketball cards than Kent? Show all of your mathematical thinking.



Common Core Task Alignments Mathematical Practices: 1, 3, 4, 5, 6, 7 Grade 5 Content Standards: 5.OA.B.3

Task

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Kent and Allie collect basketball cards. Kent has twenty cards and Allie has thirty cards. Kent's mom says that if Kent helps take care of his little brother while she prepares dinner, she will give Kent five cards every Monday. Allie's mom says that if Allie helps fold the laundry, she will give Allie four cards every Monday. Allie tells Kent that she will always have more cards, but Kent isn't sure about that. Will Allie always have more basketball cards than Kent? Show all of your mathematical thinking.

Alternative Versions of the Task

More Accessible Version:

Kent and Allie collect basketball cards. Kent has ten cards and Allie has fifteen cards. Kent's mom says that if Kent helps take care of his little brother while she prepares dinner, she will give Kent five cards every Monday. Allie's mom says that if Allie helps fold the laundry, she will give Allie four cards every Monday. Allie tells Kent that she will always have more cards, but Kent isn't sure about that. Will Allie always have more basketball cards than Kent? Show all of your mathematical thinking.

More Challenging Version:

Kent and Allie collect basketball cards. Kent has twelve cards and Allie has thirty cards. Kent's mom says that if Kent helps take care of his little brother while she prepares dinner, she will give Kent twelve cards every Monday. Allie's mom says that if Allie helps fold the laundry, she will give Allie ten cards every Monday. Allie tells Kent that she will always have more cards, but Kent isn't sure about that. Will Allie always have more basketball cards than Kent? Show all of your mathematical thinking.

Common Core Content Standards and Evidence

5.OA Operations and Algebraic Thinking

Analyze patterns and relationships.

3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.



Exemplars Task-Specific Evidence

This task requires students to use two rules to generate two different numerical sequences. Students also need to extend the numerical sequences, and determine and compare the totals.

Underlying Mathematical Concepts

- Generate two numerical patterns using two given rules
- Comparison
- Number sense to 75

Possible Problem-Solving Strategies

- Model (manipulatives)
- Diagram/Key
- Table
- Number line
- Graph (Students may independently select graph paper.)

Possible Mathematical Vocabulary/Symbolic Representation

- Model
- Diagram/Key
- Table
- Graph
- Number line
- Pattern
- Sum/Total
- Day, week, month
- Ordinal numbers: 1st, 2nd, 3rd ...
- Greater than (>)/Less than (<)
- Multiples
- Variable
- Rules: (5 · d) + 20 = K, (4 · d) + 30 = A
- Per
- Axis
- Input/Output

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Possible Solutions

Original Version:

No, Allie is not correct.

	K	Kent		A	llie
Rule	Mondays	Total Cards	_	Mondays	Total Cards
d is Mondays		20	_		30
a is Allie	1	25	_	1	34
k is Kent	2	30	_	2	38
$(5 \cdot d) + 20 = k$	3	35		3	42
$(4 \cdot d) + 30 = a$	4	40	_	4	46
	5	45	_	5	50
	6	50	_	6	54
	7	55	_	7	58
75 > 74	8	60	_	8	62
	9	65		9	66
74 < 75	10	70		10	70
	11	75		11	74

More Accessible Version:

No, Allie is not correct.

More Challenging Version:

No, Allie is not correct.

Possible Connections

Below are some examples of mathematical connections. Your students may discover some that are not on this list.

- The patterns are Kent's cards +5 (multiples of 5), Allie's cards +4 (multiples of 4), Mondays +1.
- It will take 11 weeks for Kent to have more cards than Allie.
- Generalize and apply rules for any number of Mondays.
- Graph each person's cards to compare.
- Relate to a similar task and state a math link.
- Solve more than one way to verify the answer.
- At the 11th Monday Kent has a total of 75 cards.
- At the 11th Monday Allie has a total of 74 cards.
- Kent has 1 more card than Allie by the 11th Monday.



Grade 5 Sample Summative Assessment Math Task

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Grade 5 Sample Summative Assessment Math Task

A Stone Wall

Sarah wants to build a stone wall along one side of her garage. Sarah collects stones from the field behind her house. The first day, Sarah collects four small stones and five large stones. The second day, Sarah collects eight small stones and eight large stones. The third day, Sarah collects twelve small stones and eleven large stones. If this pattern continues, how many small and large stones does Sarah collect on the tenth day? Sarah realizes that she now has enough small and large stones for her stone wall. How many small and large stones does Sarah collect for the stone wall? Show all your mathematical thinking.

A Stone Wall

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> Common Core Task Alignments Mathematical Practices: 1, 3, 4, 5, 6, 7 Grade 5 Content Standards: 5.OA.B.3

Task

Sarah wants to build a stone wall along one side of her garage. Sarah collects stones from the field behind her house. The first day, Sarah collects four small stones and five large stones. The second day, Sarah collects eight small stones and eight large stones. The third day, Sarah collects twelve small stones and eleven large stones. If this pattern continues, how many small and large stones does Sarah collect on the tenth day? Sarah realizes that she now has enough small and large stones for her stone wall. How many small and large stones does Sarah collect for the stone wall? Show all your mathematical thinking.

Common Core Content Standards and Evidence

5.OA Operations and Algebraic Thinking

Analyze patterns and relationships.

3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.

Exemplars Task-Specific Evidence

This task requires students to identify apparent relationships between two numerical patterns to generate the rules. Students also need to extend the patterns and determine the total for a given term in the numerical sequence.

Underlying Mathematical Concepts

- Generate two numerical patterns using two given rules
- Skip counting
- Ordinal numbers
- Number sense to 220

Possible Problem-Solving Strategies

- Model (manipulatives)
- Diagram/Key
- Table
- Number line
- Graph (Students may independently select graph paper.)



Possible Mathematical Vocabulary/Symbolic Representation

- Model
- Diagram/Key
- Table
- Graph
- Number line
- Axis
- Pattern
- Multiples
- Input/Output
- Total/Sum
- Amount
- Odd/Even
- Greater than (>)/Less than (<)
- Day, week, month
- Monday, Tuesday ...
- Per
- Rules: $4 \cdot d = s$, $(3 \cdot d) + 2 = L$
- Variables
- Linear function
- Ordinal numbers: 1st, 2nd, 3rd ...
- Dozen

Possible Solutions

On the 10th day Sarah collects 40 small stones and 32 large stones. Sarah collects a total of 220 small stones and 185 large stones for the stone wall.





Possible Connections

Below are some examples of mathematical connections. Your students may discover some that are not on this list.

- Sarah has a total of 405 stones.
- Generalize rules and verify: $4 \cdot = s$, $(3 \cdot d) + 2 = L$ (d is day, s is small stones, l is large stones).
- Sarah collects stones for 1 week and 3 days.
- Graph the table.
- There are 36 more small stones on the 10th day than the 1st day.
- Relate to a similar task and state a math link.
- Solve more than one way to verify the answer.
- Sarah found the same number of small and large stones on the 2nd day.
- Sarah found a dozen small stones on the 3rd day.
- On the 10th day Sarah found 8 less large stones than small ones.



Novice Scoring Rationales

Criteria and Performance Level	Assessment Rationales	
Problem Solving Novice	The student's strategy of making a table with a column labeled walls, two columns labeled stone and stones, and a column labeled stone total to indicate the sum of stones per wall does not work to solve this task. The student's answer, "85 stones," is not correct.	
Reasoning Proof Novice	The student does not demonstrate understanding of the underlying concepts of the task. The student does not generate correct numerical patterns to determine the total number of stones collected for 10 days. The first stone column shows an add three pattern after the second row bur starts with 11 stones. The second stone column shows an add 10 pattern. It appears the student finds the sum for each of the two stone columns for each wall but only the first and sixth rows are correct using the student's data.	
Communication Practitioner	The student correctly uses the mathematical terms <i>table</i> , <i>total</i> .	
Connections Novice	The student solves the task and stops without making a mathematically relevant observation.	
Representation Apprentice	The student attempts to make a table that is appropriate to the task, but it is not accurate. The first column should be labeled days. The second column should be labeled small stones and follow a plus three pattern starting at day one. The third column should be labeled large stones and follow a plus four pattern from day one. Only two "walls" show correct stone total using the student's data.	



Novice

P/S	R/P	Com	Con	Rep	A/Level
Ν	Ν	Ρ	Ν	Α	Ν

I need to find how nany large and small stones sarah. collects. I will make a table.

Stone	stones	stone Total	Lanswer
11	10	21	Box
13	20	38	she needs
16	30	39	85 stones
19	40	69	
22	50	70	
25	60	85	J
	11 13 16 19	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$



Apprentice Scoring Rationales, Student 1

Criteria and Performance Level	Assessment Rationales
Problem Solving Practitioner	The student's strategy of making a table to show the days, small stones, large stones, and finding the total number of stones needed to build the wall works to solve this task. The student's answer, "405 is the answer," and, "on the tenth day the small stones is 40 and large stones is 32," is correct.
Reasoning Proof Apprentice	Although the student's reasoning is correct, her/his proof is unclear. It is not clear what the columns in her/his table represent. One has to assume the first column represents day data, the second column small stones data, and the third column large stones data. The one label, "large and small," is only centered on the second column and lacks the noun, stones. If the student had supplied more proof via her/his text, the solution could have been clearer.
Communication Practitioner	The student correctly uses the mathematical terms <i>tenth</i> , <i>day</i> , <i>total numbers</i> from the task. The student also correctly uses the mathematical term <i>table</i> .
Connections Novice	The student solves the task but does not make a mathematical connection.
Representation Apprentice	The student's use of a table is appropriate but not accurate. The first column is not labeled day. The second column is not labeled small stones and the third column is not labeled large stones.



Apprentice, Student 1

P/S	R/P	Com	Con	Rep	A/Level
Ρ	Α	Ρ	Ν	Α	Α

I need to find out how many large and small stones Sarah collects on the tenth day. I need to find out total numbers of Large and small stones She Collects on the tenth day. I will make a table





Apprentice Scoring Rationales, Student 2

Criteria and Performance Level	Assessment Rationales
Problem Solving Apprentice	The student's strategy of making a table to show the days, small stones, large stones, and total stones per day for 10 days works to solve the first part of the task. The student's answer for this part of the task, "on the 10th day she col- lected 40 SS and 32 LS" is correct. The student's strategy of finding the total amount of stones per day but not finding the total amount of small and large stones for 10 days does not work to solve the second part of this task. The student's answer, "and all together she collected 72 stones," is not correct.
Reasoning Proof Apprentice	The first part of the student's solution is constructed with adequate mathematical basis. The student generated two correct numerical patterns. The student's reasoning for the second part of the task is partially correct. The student finds the total amount of stones per day in the fourth column but not the total number of stones for all 10 days.
Communication Practitioner	The student correctly uses the mathematical terms 10th (tenth) and day, from the task. The student also correctly uses the mathematical term key. The student does not earn credit for the term <i>running total</i> . The fourth column of the table only shows the total amount of small and large stones per day.
Connections Practitioner	The student solves the task and makes a mathematically relevant connection. The student states, "if she looked 11 days she would have 44 little stones and 35 large stones."
Representation Apprentice	The student's use of a table is appropriate but not accurate. The fourth column should indicate 30 total stones for the fourth day instead of 32 stones.



Apprentice, Student 2

P/S	R/P	Com	Con	Rep	A/Level
Α	Α	Р	Ρ	Α	Α

Days	55	LS	RT	Key
1	4	5	9	(SS is small stones
2	8	8	16	SS is small stones LS is large stong RTis running
23	12	11	23	RTis nuning Total stones
4	16	14	32	
5	20	\7	37	Answe
6	24	20	44	On the loth day she called
М	98	23	51	4055 an
8	32	26	58	and all tugern
9	36	29	65	She com
10	40) 32	77	



(onnections

· if she looked 11 days she would have 44 little stones and 35 Large Stones



Criteria and Performance Level	Assessment Rationales
Problem Solving Practitioner	The student's strategy of making number lines to show days, small stones, large stones to the 10th day works to solve the first part of the task. The student's answer, "32 large stones, 40 small stones," is correct. The student correctly computes the total number of small and large stones Sarah collects. The student's answer, "405 total stones," is correct. The student correctly computes the total number of stones Sarah collects. The student's answer, "405 stones," is correct. The student's additional strategy of making a graph to show the number of small and large stones Sarah collects works to solve part of the task.
Reasoning Proof Practitioner	The student's solution is constructed with adequate math- ematical basis. The student's number lines representing small stones, and large stones supports understanding of generat- ing two numerical patterns. The student uses the number line data to support correct reasoning of finding the total stones Sarah collects for the wall.
Communication Practitioner	The student correctly uses the mathematical terms "10tH" (tenth), day, pattern, total from the task. The student also correctly uses the mathematical terms number lines, pattern, multiples, graph.
Connections Practitioner	The student makes the mathematically relevant observations, "the pattern is add 3," "the pattern is multiples of 4." The student also constructs a graph to represent the days, large and small stone patterns.
Representation Practitioner	The student's use of number lines is appropriate and accurate. The student provides all necessary labels and all entered data is correct.

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Practitioner, Student 1

P/S	R/P	Com	Con	Rep	A/Level
Ρ	Ρ	Ρ	Ρ	Ρ	Р





Practitioner, Student 1 (cont.)





Criteria and Performance Level	Assessment Rationales
Problem Solving Practitioner	The student's strategy of making a table to show days, small stones, large stones to the 10th day works to solve the first part of the task. The student's answer, "Sarah collects 40 small stone and 32 large stones," is correct. The student cor- rectly computes the total number of small and large stones Sarah collects. The student's answer, "Sarah collects 220 small stone and 185 large stones," is correct. (This student interprets the task as asking for the total number of small stones and then the total number of large stones instead of a total of 405 combined stones. Either answer is considered to be correct.)
Reasoning Proof Practitioner	The student's solution is constructed with adequate math- ematical basis. The student's table representing small stones, and large stones supports understanding of generating two numerical patterns. The student uses the table data to to support correct reasoning of finding the total stones Sarah collects for the wall.
Communication Practitioner	The student correctly uses the mathematical terms <i>tenth</i> , <i>day</i> , <i>pattern</i> , <i>total</i> from the task. The student also correctly uses the mathematical terms <i>table</i> , <i>multiples</i> , <i>more</i> . The student does not earn credit for the term <i>rule</i> , because the student did not note any rule in her/his solution.
Connections Practitioner	The student makes the mathematically relevant observations, "I saw a pattern, small stone +4 and a pattern on the large stone +3," "patterns day +1," "these are multiples," and, "I noticed that Sarah collects more small stones than large stones."
Representation Practitioner	The student's use of a table is appropriate and accurate. The student provides all necessary labels and all entered data is correct.

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Practitioner, Student 2

P/S	R/P	Com	Con	Rep	A/Level
Р	P P		Ρ	Ρ	Ρ





Practitioner, Student 2 (cont.)



Summative Assessment



Criteria and Performance Level	Assessment Rationales			
Problem Solving Practitioner	The student's strategy of making a table to show small stones, large stones to 10 days, a running total of small stones, large stones, and total stones; and then finding the total number of stones that are needed to make Sarah's wa works to solve this task. The student's answer, "She collects 40 SS and 32 LS she collected on the tenth Day," and, "Sar ah will need 405 stones for her garage wall. She collects 22 SS and 185 LS," is correct. The student also uses an alterna strategy of a graph for the first part of the task.			
Reasoning Proof Practitioner	The student's solution is constructed with adequate math- ematical basis. The student uses correct reasoning by gen- erating numerical patterns for small and large stones and finding the running total of small and large stones Sarah uses for the wall. The student correctly uses a graph to support her/his thinking.			
Communication Expert	The student correctly uses the mathematical terms total, tenth, day from the task. The student also correctly uses the mathematical terms table, key, running total, rule. The student correctly uses the symbolic notation $4n = SS$ and 3n + 2 = LS.			
Connections Practitioner	The student uses a graph as a second strategy to show the number of small and large stones for each of 10 days. The student also generalizes two rules, "If it told me to find the rule for the SS it would be $4n = SS$," and, "If it told me to find the rule for the LS it would be $3n + 2 = LS$." The student defines the variables in her/his key. The student does not earn Expert credit for the rules because she/he does not use the rules to verify her/his answer or to find the number of small and large stones collected for any of the days on her/his table or other days.			
Representation <i>Practitioner</i>	The student's use of a table is appropriate and accurate. The student provides all necessary labels and a key for the second, third, fourth, fifth, and sixth columns. All entered data is correct. The student's graph is also correct with the X and Y axis labeled and a key defines the \cdot and x as large and small stones.			

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Practitioner, Student 3

P/S	R/P	Com	Con	Rep	A/Level
Р	Ρ	Е	Ρ	Ρ	Р

I need to find out How many total small and large stories does Sarah collects For the Stone Wall? I will make a table And how many Stones shell have on the tenth Day?



rule for the LS it would be 3n+2=LS



Practitioner, Student 3 (cont.)

P/S	R/P	Com	Con	Rep	A/Level
Р	Ρ	Е	Р	Ρ	Ρ





Expert Scoring Rationales

Criteria and Performance Level	Assessment Rationales			
Problem Solving Expert	The student's strategy of making a table to show the large and small stones found on the 10th day and then totaling t large and small stones needed to make the stone wall work to solve this task. The student's answers, "on the 10th day she got 40 small and 32 large stones," and, "In all she got 220 small stones in all and 185 large stones in all," is correc The student uses alternate strategies of rules and graphs.			
Reasoning Proof Expert	The student justifies and supports her/his correct reason- ing by using a table to generate two numerical patterns and computation to find the total number of small and large stones Sarah collects for her wall. The student verifies her/his decisions by generalizing two rules and making a graph.			
Communication Expert	The student correctly uses the mathematical terms <i>tenth</i> , day, pattern from the task. The student also correctly uses the terms <i>table</i> , key, rules. The student correctly uses the symbolic notation $(3 \times D) + 2 = LG$, and $4 \times D = SM$.			
Connections Expert	The student makes mathematically relevant Practitioner observations, "Patterns, D = +1, LG = +3, SM = +4. (The student provides a key to define D, LG, and, SM). The student uses an alternate strategy of a graph to show the large and small stones collected each day for 10 days. The student makes Expert connections. The student generalizes two rules, $(3 \times D) + 2 = LG$, and $4 \times D = SM$, with the variables defined in a key. The student uses $(3 \times D) + 2 = LG$ to find the number of large stones for days 1, 5, 50, and 10. The student uses $4 \times D = SM$ to find the number of small stones for days 3, 8, 100, and 10. The student's rules verify that the totals for day 10 are correct. The student states, "my table is correct."			
Representation Expert	The student's table is appropriate and accurate. All labels are provided and the data is correct. The student uses the table to note two numerical patterns and then to generalize two rules used to extend the task to other days. The student's graph is also appropriate and accurate. The X and Y axis is labeled correctly and a key is provided to define large and small stones.			



Expert

P/\$	3	R/P	Com	Con	Rep	A/Level
Ε		Е	Е	Е	Е	Е

エト	reed to f	find out	how many stones she collects on
the	tenth	day and	I how many stones she uses in all.
ΤU	vill mc	ike a	- table. 24 94
Day		imal	31 136
- vy	5	4	Answers 69 220 Don the 10th +61
2	8	8	day she got 185
3	11	12	40 small \$
4	14	16	32 large
5	17	20	Stohes
6	20	24	OIN all She got 200 small
7	23	28	stones in all and
8	26	32	185 large stones
9	29	1 36	in all.
10	32	2 40	



Expert (cont.)

Potterns Key D=+1 LG=t3 SM=+4 D=Day Key LG=Large Stones SM=small stones D=Day



Summative Assessment



Expert (cont.)



Summative Assessment