

WARNING!

The resource you are about to see may LOOK like an ordinary
word problem or story problem.

IT'S NOT

Exemplars are performance tasks... and they're far superior.

Exemplars are POWERFUL

They're real-world problems that KIDS get to decide how to solve. Our tasks are engineered to be solved in many different ways, so everyone can jump in and find a strategy that works for them. No hand-holding here. Kids get to think critically, be creative, and apply their math skills to authentic situations.

Exemplars are HIGHLY POTENT

In the real world, math is everywhere! When solving Exemplars tasks, kids exercise their ENTIRE brains by practicing things like:



Math Solutions are THE KEY

Are your students answer-getters? Not with Exemplars. Developing a mathematical solution is what builds lasting memories and a DEEP UNDERSTANDING of math concepts. And we'll teach you how to get there!

Ready to build confidence, unlock your students' inner mathematicians, and celebrate all those 'aha' moments?

Let's Go!

A Guide to Exemplars Resources

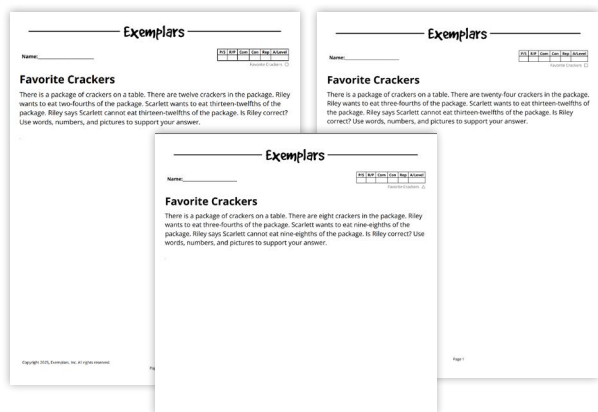
Exemplars problem-solving performance tasks are thoughtfully written and classroom-tested. Our rich tasks may be used for assessment, instruction, professional development, or to build a thinking classroom. Exemplars is the perfect supplement to your curriculum!

Tasks Include:

Differentiated Versions

Standard Version

More Challenging Version



More Accessible Version

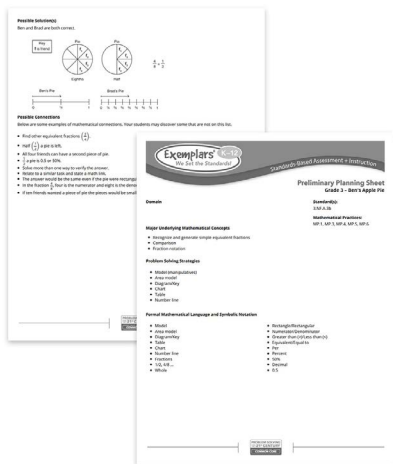
Engagement Images (to pique student curiosity)



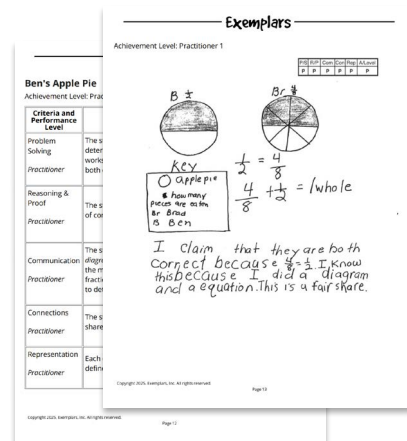
Standards-Based Math Rubric

Standards-Based Math Rubric		Standards-Based Math Rubric			
Practitioner	Problem Solving	Problem Solving	Reasoning & Proof	Connections	Representation
Practitioner	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.
Expert	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.	An efficient strategy is chosen and applied. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem. The student uses a variety of strategies to solve the problem.

Lesson Planning Sheets and Possible Solutions

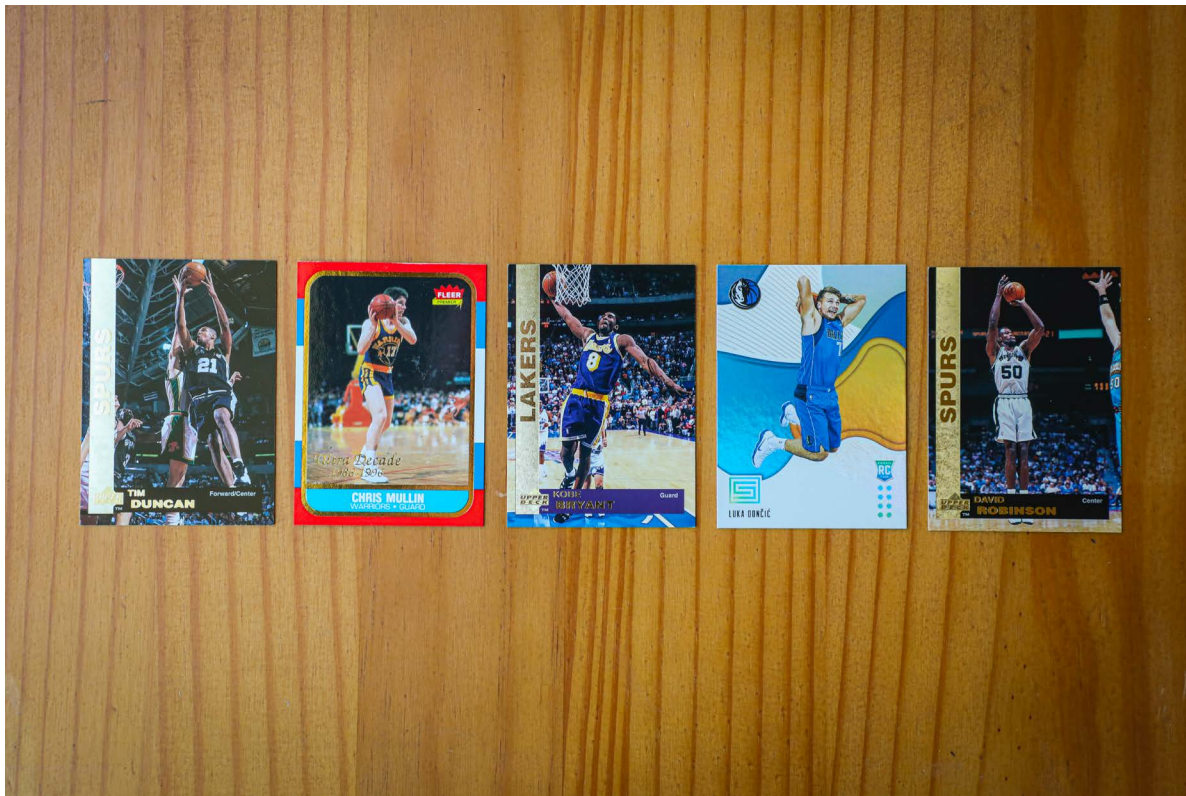


Scored Student Work Samples (examples of math solutions at 4 performance levels)



Engagement Image to Launch Task

Teachers use this resource to pique student curiosity.



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.

Collecting Basketball Cards

Common Core Task Alignments

Mathematical Practices: 1, 3, 4, 5, 6, 7

Grade 5 Content Standards:
5.OA.B.3

Task

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: $(5 \cdot d) + 20 = K$, $(4 \cdot d) + 30 = A$
- Per
- Axis
- Input/Output

Possible Solutions

Original Version:

No, Allie is not correct.

Rule	Kent		Allie	
	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
$(5 \cdot \mathbf{d}) + 20 = \mathbf{k}$	3	35	3	42
$(4 \cdot \mathbf{d}) + 30 = \mathbf{a}$	4	40	4	46
	5	45	5	50
	6	50	6	54
	7	55	7	58
	8	60	8	62
	9	65	9	66
	10	70	10	70
	11	75	11	74

$$75 > 74$$

$$74 < 75$$

More Accessible Version:

No, Allie is not correct.

More Challenging Version:

No, Allie is not correct.

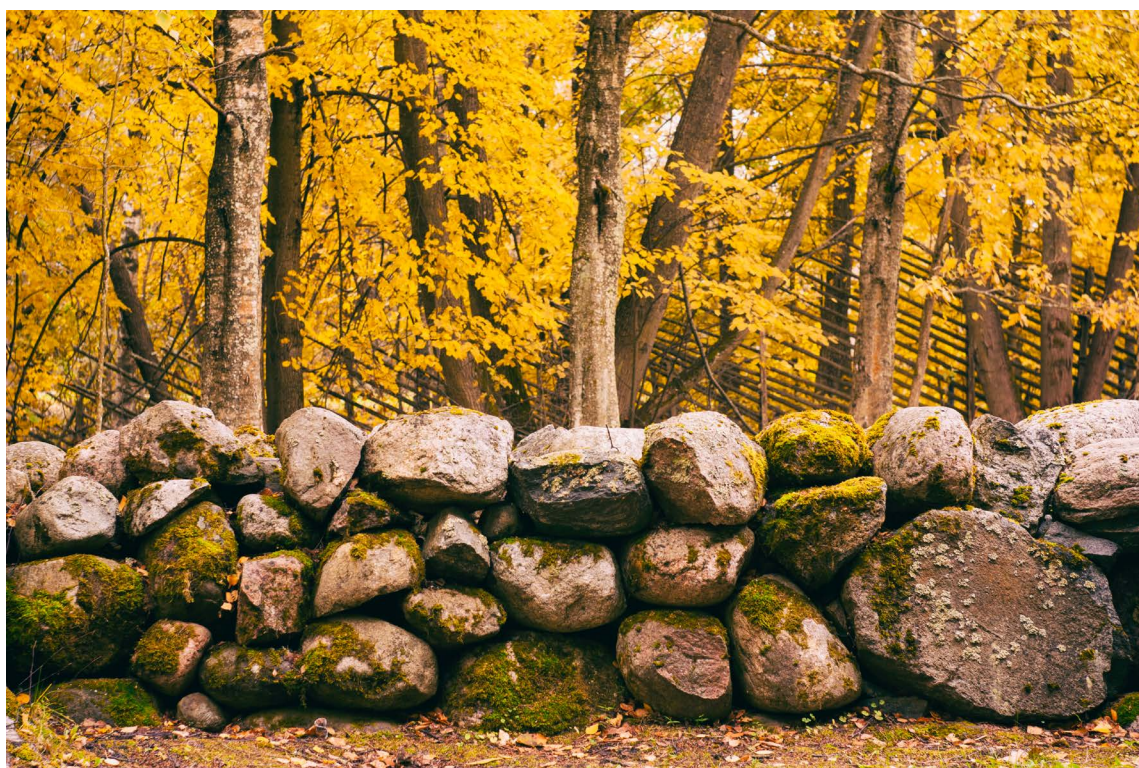
Possible Connections

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.

Engagement Image to Launch Task

Teachers use this resource to pique student curiosity.



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

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

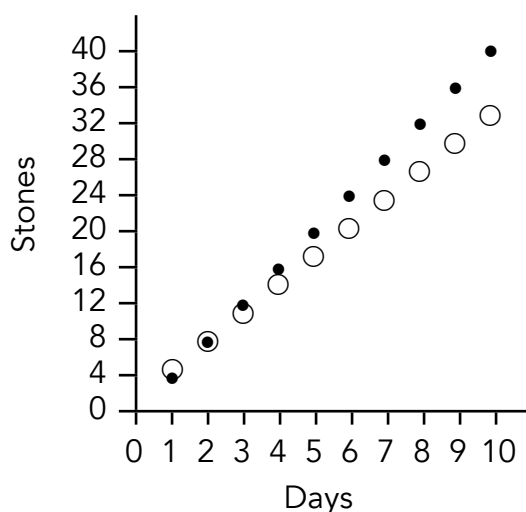
- Model
- Diagram/Key
- Table
- Graph
- Number line
- Axis
- Pattern
- Multiples
- Input/Output
- Total/Sum
- Amount
- Odd/Even
- Greater than (>)/Less than (<)
- Day, week, month
- Monday, Tuesday ...
- Per
- Rules: $4 \cdot d = s$, $(3 \cdot d) + 2 = L$
- Variables
- Linear function
- Ordinal numbers: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

Key	
●	is small stones
○	is large stones

Rule	
d	is day
s	is small stone
L	is large stone
$4 \cdot d = s$	
$(3 \cdot d) + 2 = L$	



24		
60		38
60	210	60
+ 76	+ 10	+ 87
210	220	185

Day	Small Stones	Large Stones
1	4	5
2	8	8
3	12	11
4	16	14
5	20	17
6	24	20
7	28	23
8	32	26
9	36	29
10	40	32

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: $4 \cdot d = s$, $(3 \cdot d) + 2 = L$ (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 <i>Novice</i>	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 <i>Novice</i>	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 but 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 <i>Practitioner</i>	The student correctly uses the mathematical terms <i>table</i> , <i>total</i> .
Connections <i>Novice</i>	The student solves the task and stops without making a mathematically relevant observation.
Representation <i>Apprentice</i>	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
N	N	P	N	A	N

I need to find how many large and small stones Sarah collects. I will make a table.

wall	Stone	stones	stone total
1	11	10	21
2	13	20	38
3	16	30	39
4	19	40	69
5	22	50	70
6	25	60	85

answer
Box
she needs
85 stones

Apprentice Scoring Rationales, Student 1

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Practitioner</i>	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 <i>Apprentice</i>	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 <i>Practitioner</i>	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 <i>Novice</i>	The student solves the task but does not make a mathematical connection.
Representation <i>Apprentice</i>	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
P	A	P	N	A	A

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

answer
405 is
the answer
on the
tenth day
the
Small
stones is
40 and
Large
stones is
32

$$\begin{array}{r} 1 \\ + 220 \\ 185 \\ \hline 405 \\ \text{total} \\ 405 \end{array}$$

	large	small
1	4	5
2	8	8
3	12	11
4	16	14
5	20	17
6	24	20
7	28	23
8	32	26
9	36	29
10	40	32

Apprentice Scoring Rationales, Student 2

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Apprentice</i>	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 collected 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 <i>Apprentice</i>	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 <i>Practitioner</i>	The student correctly uses the mathematical terms <i>10th</i> (tenth) and <i>day</i> , from the task. The student also correctly uses the mathematical term <i>key</i> . 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 <i>Practitioner</i>	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 <i>Apprentice</i>	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
A	A	P	P	A	A

Days	SS	LS	RT
1	4	5	9
2	8	8	16
3	12	11	23
4	16	14	32
5	20	17	37
6	24	20	44
7	28	23	51
8	32	26	58
9	36	29	65
10	40	32	72

Key

SS is small stones
LS is large stones
RT is running total stones

Answer

on the 10th day she collected 40 SS and 32 LS and all together she collected 72 stones

Connections

- if she looked 11 days she would have 44 little stones and 35 large stones

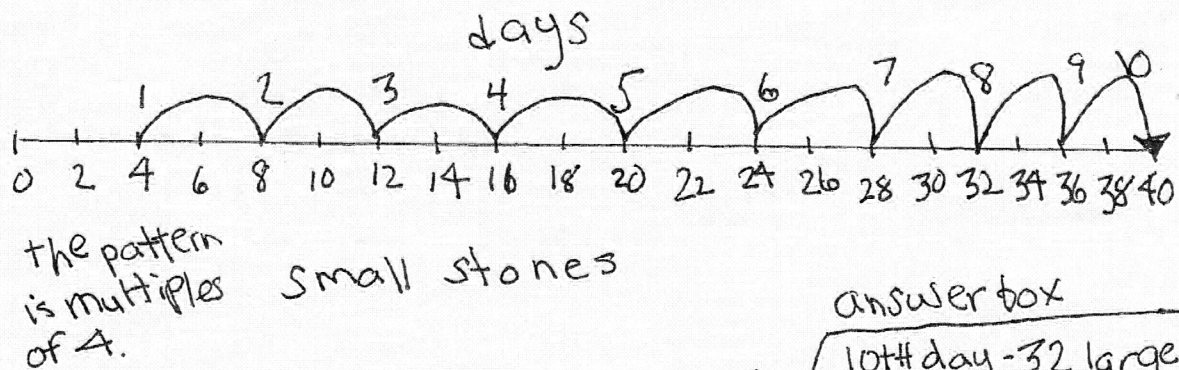
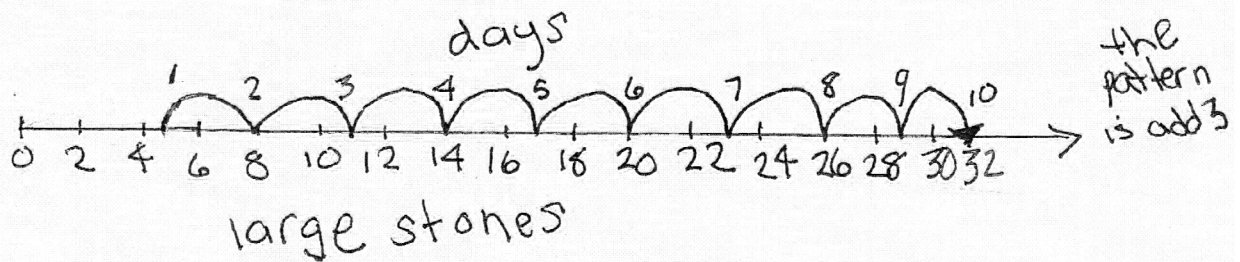
Practitioner Scoring Rationales, Student 1

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Practitioner</i>	<p>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.</p>
Reasoning Proof <i>Practitioner</i>	<p>The student's solution is constructed with adequate mathematical basis. The student's number lines representing small stones, and large stones supports understanding of generating two numerical patterns. The student uses the number line data to support correct reasoning of finding the total stones Sarah collects for the wall.</p>
Communication <i>Practitioner</i>	<p>The student correctly uses the mathematical terms "10th" (<i>tenth</i>), <i>day</i>, <i>pattern</i>, <i>total</i> from the task. The student also correctly uses the mathematical terms <i>number lines</i>, <i>pattern</i>, <i>multiples</i>, <i>graph</i>.</p>
Connections <i>Practitioner</i>	<p>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.</p>
Representation <i>Practitioner</i>	<p>The student's use of number lines is appropriate and accurate. The student provides all necessary labels and all entered data is correct.</p>

Practitioner, Student 1

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

I have to find the small and large stones. Sarah picks on the 10th day and how many total stones Sarah picks. I will make number lines.



$$55 + 110 + 20 = 185 \text{ large stones}$$

$$60 + 160 = 220 \text{ Small stones}$$

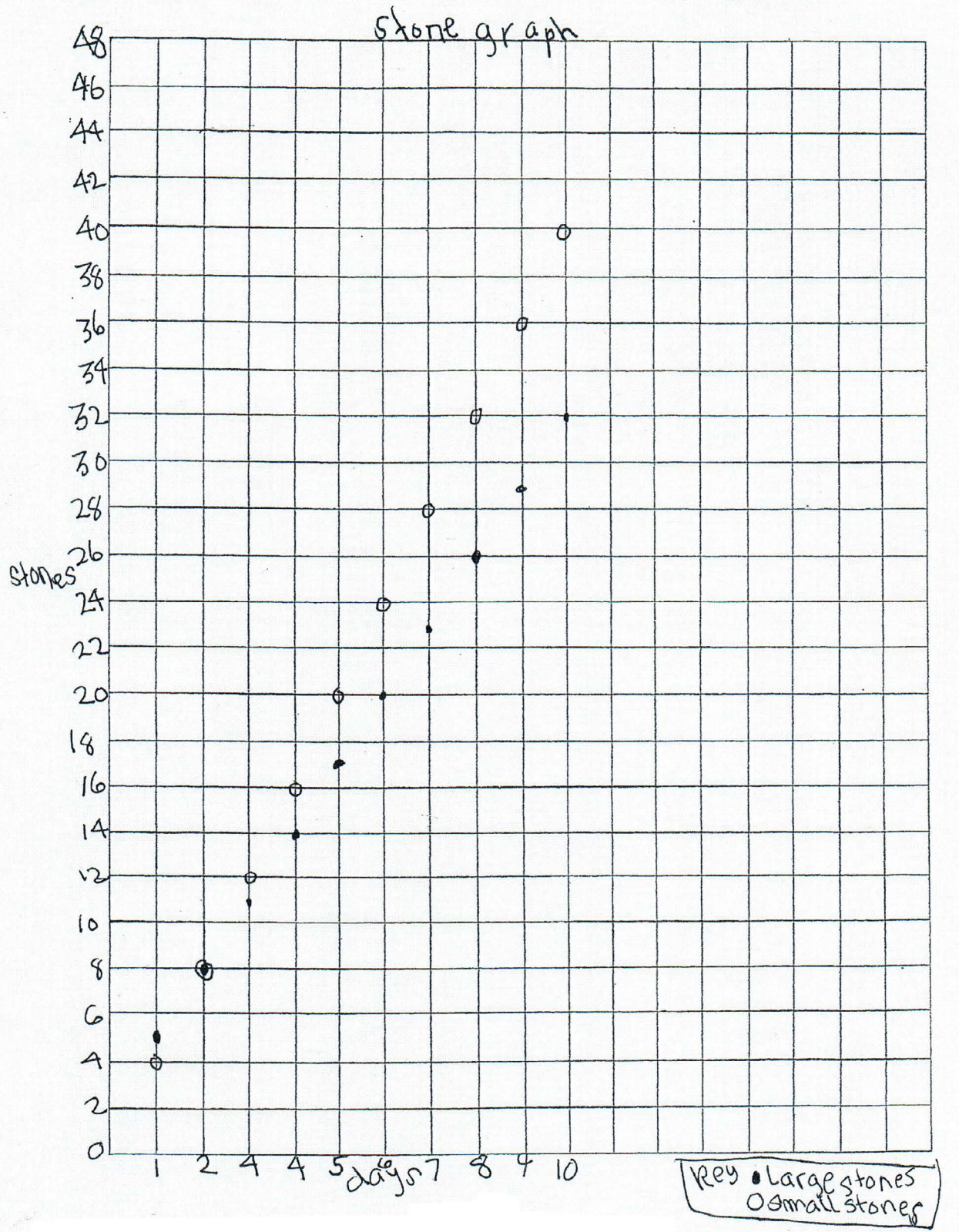
$$185 + 220 = 300 + 100 + 5 = 405 \text{ stones}$$

I can graph the days and stones.

answer box

10th day - 32 large stones
40 small stones
405 total stones

Practitioner, Student 1 (cont.)



Practitioner Scoring Rationales, Student 2

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Practitioner</i>	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 correctly 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 <i>Practitioner</i>	The student's solution is constructed with adequate mathematical 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 <i>Practitioner</i>	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 <i>Practitioner</i>	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 <i>Practitioner</i>	The student's use of a table is appropriate and accurate. The student provides all necessary labels and all entered data is correct.

Practitioner, Student 2

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

I need to find out how many larg and small stone Sarah collects on the tenth day. I need to find out the total number of large and small stones Sarah collects. I will make a table and find a rule.

day	Small stones	large Stone
1	4	5
2	8	8
3	12	11
4	16	14
5	20	17
6	24	20
7	28	23
8	32	26
9	36	29
10	40	32

sarah
collects
40 small
stone and
32 large
stones

Practitioner, Student 2 (cont.)

$$\begin{array}{r}
 4 \\
 8 \\
 12 \\
 16 \\
 20 \\
 24 \\
 28 \\
 32 \\
 36 \\
 +40 \\
 \hline
 220
 \end{array}$$

Patterns
day +1
small
stones +4
large
stones +5
these are
multiples

$$\begin{array}{r}
 5 \\
 8 \\
 11 \\
 4 \\
 17 \\
 20 \\
 23 \\
 26 \\
 29 \\
 +32 \\
 \hline
 185
 \end{array}$$

$$\begin{array}{r}
 220 \\
 +185 \\
 \hline
 405
 \end{array}$$

answer
Sarah
collects
220 small
stone and
185 large
stones

Connections

① I saw a Pattern.
small Stone +4 and
a Pattern on the large
Stone +3.

I noticed that Sarah
collects more small
stones than large stones
the total of small
stones is 220 and large
stone 185.

Practitioner Scoring Rationales, Student 3

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Practitioner</i>	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 wall works to solve this task. The student's answer, "She collects 40 SS and 32 LS she collected on the tenth Day," and, "Sarah will need 405 stones for her garage wall. She collects 220 SS and 185 LS," is correct. The student also uses an alternate strategy of a graph for the first part of the task.
Reasoning Proof <i>Practitioner</i>	The student's solution is constructed with adequate mathematical basis. The student uses correct reasoning by generating 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 <i>Expert</i>	The student correctly uses the mathematical terms <i>total</i> , <i>tenth</i> , <i>day</i> from the task. The student also correctly uses the mathematical terms <i>table</i> , <i>key</i> , <i>running total</i> , <i>rule</i> . The student correctly uses the symbolic notation $4n = SS$ and $3n + 2 = LS$.
Connections <i>Practitioner</i>	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.

Practitioner, Student 3

P/S	R/P	Com	Con	Rep	A/Level
P	P	E	P	P	P

I need to find out How many total small and large stories does Sarah collect for the Stonewall? I will make a table And how many Stones she'll have on the tenth Day?

Stone table

days	SS	LS	Rt for LS	Rt for SS	Rt
1	4	5	5	4	9
2	8	8	13	12	25
3	12	11	24	24	48
4	16	14	38	40	78
5	20	17	55	60	115
6	24	20	75	84	159
7	28	23	98	112	210
8	32	26	124	144	268
9	36	29	153	180	333
10	40	32	185	220	405

Key
SS - small stones
LS - large stones
Rt - Running total

Ans: She collects 40 SS and 32 LS she collected on the tenth day

Ans: Sarah will need 405 stones for her garage wall. she collects 220 SS and 185 LS

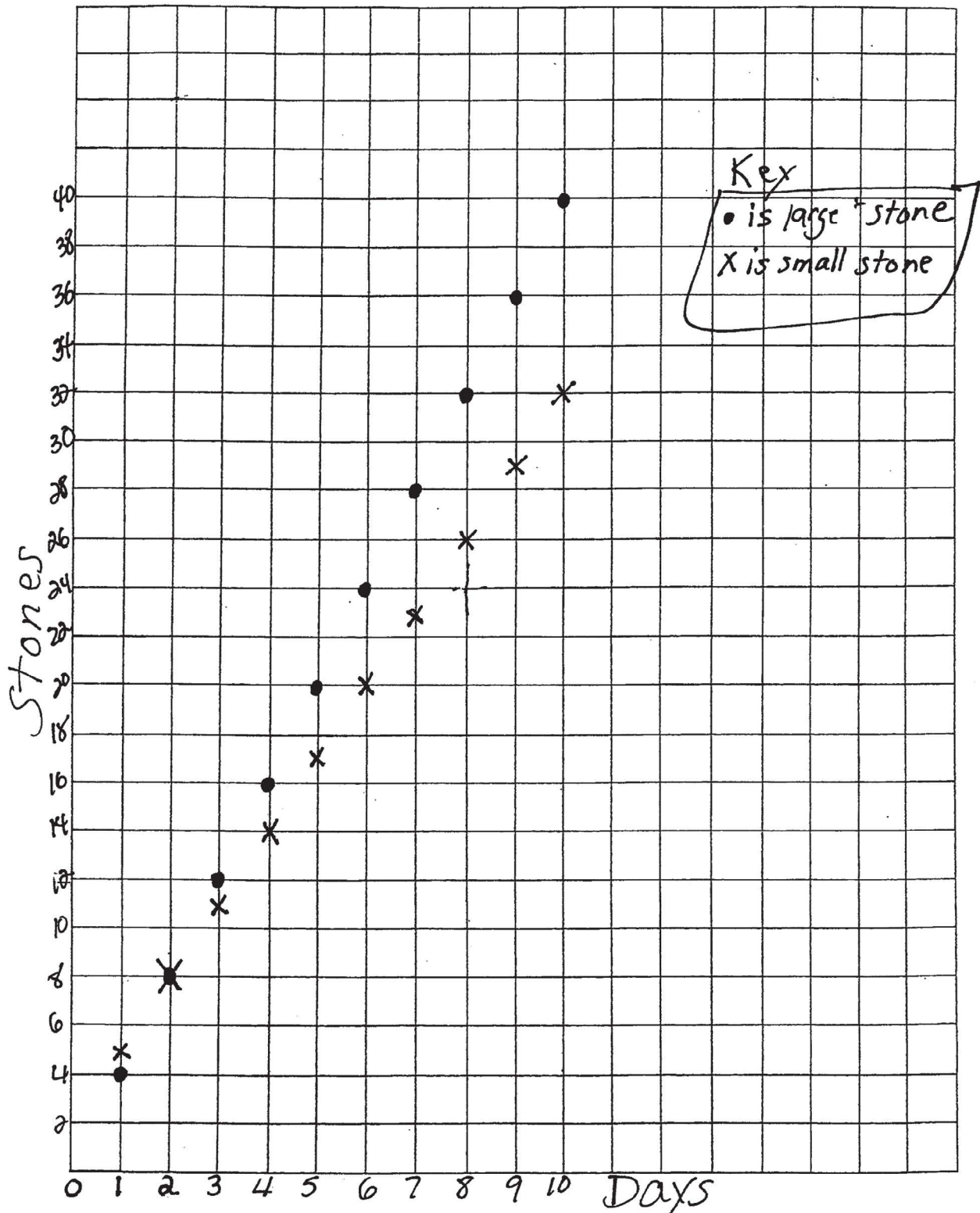
Connections:

If it told me to find the rule for the SS it would be $4n = SS$

If it told me to find the rule for the LS it would be $3n + 2 = LS$

Practitioner, Student 3 (cont.)

P/S	R/P	Com	Con	Rep	A/Level
P	P	E	P	P	P



Expert Scoring Rationales

Criteria and Performance Level	Assessment Rationales
Problem Solving <i>Expert</i>	The student's strategy of making a table to show the large and small stones found on the 10th day and then totaling the large and small stones needed to make the stone wall works 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 correct. The student uses alternate strategies of rules and graphs.
Reasoning Proof <i>Expert</i>	The student justifies and supports her/his correct reasoning 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 <i>Expert</i>	The student correctly uses the mathematical terms <i>tenth</i> , <i>day</i> , <i>pattern</i> from the task. The student also correctly uses the terms <i>table</i> , <i>key</i> , <i>rules</i> . The student correctly uses the symbolic notation $(3 \times D) + 2 = LG$, and $4 \times D = SM$.
Connections <i>Expert</i>	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 <i>Expert</i>	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/S	R/P	Com	Con	Rep	A/Level
E	E	E	E	E	E

I need to find out how many stones she collects on the tenth day and how many stones she uses in all. I will make a table.

Day	Large stones	small stones
1	5	4
2	8	8
3	11	12
4	14	16
5	17	20
6	20	24
7	23	28
8	26	32
9	29	36
10	32	40

Answers

① On the 10th day she got $\begin{array}{r} 24 \\ 31 \\ 69 \\ +61 \\ \hline 185 \end{array}$

40 small &
32 large
stones

② In all she got 220 small stones in all and 185 large stones in all.

$$\begin{array}{r} 24 \\ 31 \\ 69 \\ \hline 136 \\ 220 \end{array}$$

Expert (cont.)

Patterns

$$D = +1$$

$$LG = +3$$

$$SM = +4$$

Key

LG = Large stones

SM = small stones

D = Day

Rules

Large stones

$$(3 \times D) + 2 = LG$$

$$3 \times 1 + 2 = 5$$

$$3 \times 5 + 2 = 17$$

$$3 \times 50 + 2 = 152$$

$$3 \times 10 + 2 = 32$$

my table is correct

Small stones

$$4 \times D = SM$$

$$4 \times 3 = 12$$

$$4 \times 8 = 32$$

$$4 \times 100 = 400$$

$$4 \times 10 = 40$$

Expert (cont.)

