

## Barnyard Buddies

A farmer has 8 cows and 10 chickens. The farmer counts all the cow and chicken legs. How many legs are there all together? Show all your mathematical thinking.

## Barnyard Buddies

### Common Core Task Alignments

Mathematical Practices: 1, 2, 3, 4, 5, 6, 7, 8

Grade 2 Content Standards:

2.OA.A.1

### Task

A farmer has 8 cows and 10 chickens. The farmer counts all the cow and chicken legs. How many legs are there all together? Show all your mathematical thinking.

## Common Core Content Standards and Evidence

### 2.OA Operations and Algebraic Thinking

*Represent and solve problems involving addition and subtraction.*

1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

### Exemplars Task-Specific Evidence

This task requires students to add, combine or count on numbers and to have number sense to 52. Students need to recognize how many legs a cow has and how many legs a chicken has.

### Underlying Mathematical Concepts

- One to four (one cow to four legs)
- One to two (one chicken to two legs)
- Combining
- Addition/Counting on
- Number sense to 52

### Possible Problem-Solving Strategies

- Tally chart
- Table
- Diagram/Key

### Possible Mathematical Vocabulary/Symbolic Representation

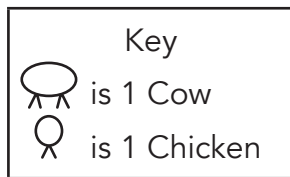
- Tally chart
- Table
- Diagram/Key
- Pair
- Per
- Pattern

### Possible Mathematical Vocabulary/Symbolic Representation (cont.)

- Multiple
- More than (>)/Greater than (>)/Less than (<)
- Equivalent/Equal to
- Dozen
- Halves, half of, two halves, one-half
- Odd/Even

### Possible Solutions

There are 52 legs all together.



$$\begin{array}{r} 32 \\ + 20 \\ \hline 52 \end{array}$$

Chickens	1	2	3	4	5	6	7	8	9	10
Legs	2	4	6	8	10	12	14	16	18	20

Cows	1	2	3	4	5	6	7	8
Legs	4	8	12	16	20	24	28	32

### Possible Connections

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

- The farmer saw 12 more cow legs than chicken legs (one dozen more).
- Two legs is a pair.
- The farmer saw fewer cows, but the most legs are cow legs.
- The number of chicken legs is half the number of cow legs.
- Patterns: Cow legs +4 (an even pattern), Chicken legs +2 (an even pattern).
- Relate to a similar task and state a math link.
- Solve more than one way to verify the answer.

# Novice Scoring Rationales

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Apprentice</i>	The student's strategy of using a diagram to show four legs for each cow leads to solving only part of the problem. The student's flaw in reasoning is that she/he does not include four legs on each cow and fails to include ten chickens in total legs. The student's answer, "32 legs," is not correct.
<b>Reasoning Proof</b> <i>Apprentice</i>	The student's reasoning has gaps. The student does not define the cows, and the counting of the legs by four does not match the indicated legend—the numbers written in the cow's heads. You have to assume that the last cow is missing two legs and is not a chicken.
<b>Communication</b> <i>Novice</i>	The student uses no mathematical language.
<b>Connections</b> <i>Novice</i>	The student solves the problem and does not make a connection.
<b>Representation</b> <i>Apprentice</i>	The student's diagram is appropriate to the task but not accurate. Cows three and five are missing a leg. Cow eight is missing two legs. There is no key, label or scribing to indicate that the student is diagramming cows.

# Novice

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

I will make them



32 legs

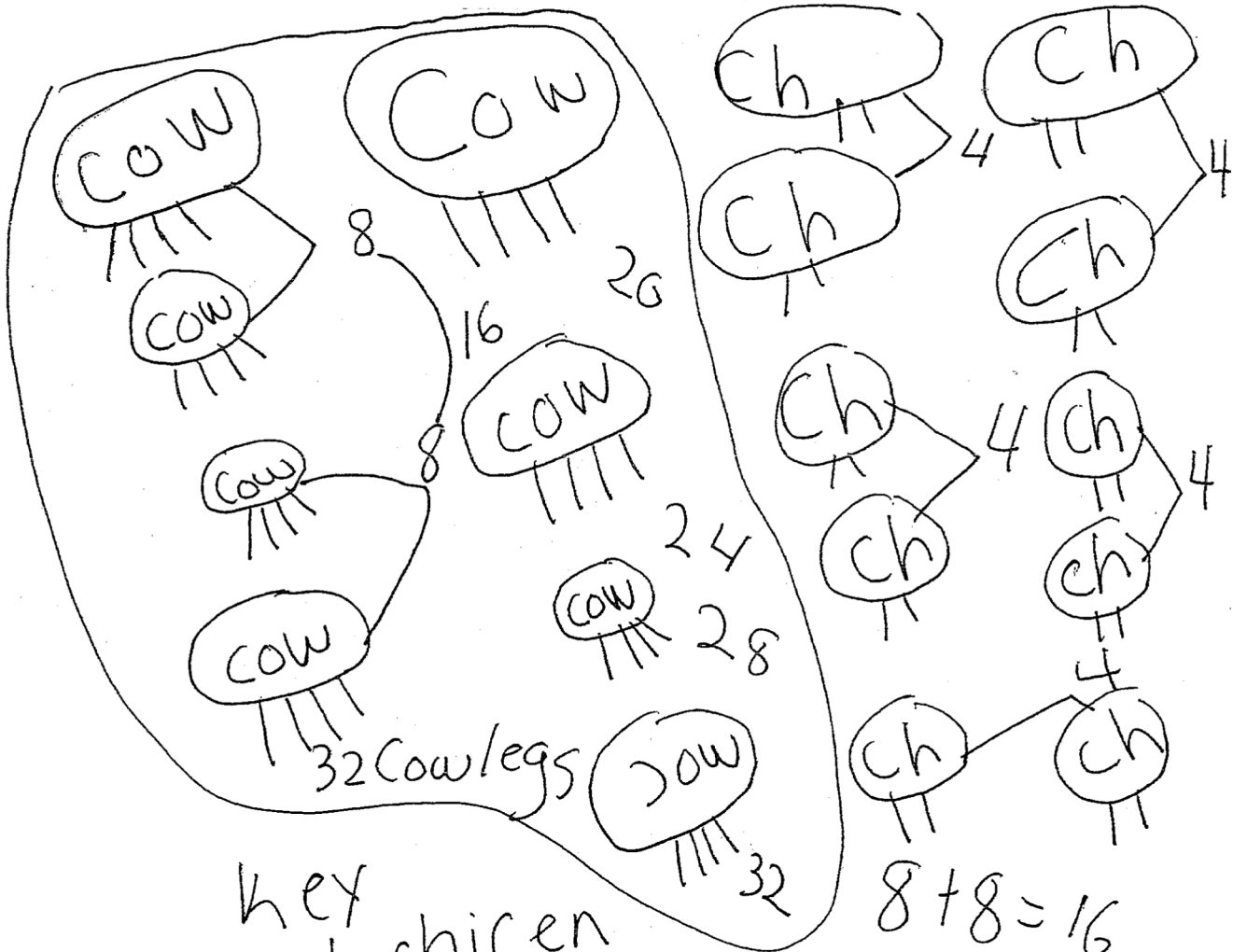
That is a lot of legs

# Apprentice Scoring Rationales, Student 1

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Apprentice</i>	The student's strategy of using a diagram to show four legs for each cow and two legs for each chicken works to solve this problem. The student does not clearly state a correct answer. Most teachers have students highlight, underline, circle, box, etc. the answer.
<b>Reasoning Proof</b> <i>Practitioner</i>	The student's diagrams support their understanding of the underlying mathematical concepts of the problem.
<b>Communication</b> <i>Apprentice</i>	The student correctly uses the mathematical term <i>key</i> .
<b>Connections</b> <i>Apprentice</i>	The student attempts to make a connection. The student attempts four tables but they are incorrect. It is difficult to determine what information the student is trying to represent.
<b>Representation</b> <i>Practitioner</i>	The student's diagrams are appropriate to the task and accurate. A key defines "ch" as chickens. Each cow is labeled. The student's tables are not appropriate or accurate to the problem. Only one representation has to be appropriate and accurate to earn a Practitioner.

# Apprentice, Student 1

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



key  
ch-chicken

$$32 + 20 =$$

$$32 + 10 = 42$$

$$42 + 10 = 52$$

$$8 + 8 = 16$$

$$16 + 4 = 20$$

legs

$$20 \text{ legs}$$

# Apprentice, Student 1 (cont.)

Cows	Legs
8	4
7	6
6	8
5	10
4	12
3	14
2	15
1	17

Ch	Legs
10	1
9	3
8	5
7	7
6	9
5	11
4	13
3	15
2	16
1	18



# Apprentice, Student 1 (cont.)

ch	Legs
10	1
9	2
8	3
7	4
6	5
5	6
4	7
3	8
2	9
1	10

Cow	Legs
8	1
7	2
6	3
5	4
4	5
3	6
2	7
1	8

## Apprentice Scoring Rationales, Student 2

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Practitioner</i>	The student's strategy of making tables of the cow and chicken legs for a total of 52 legs works to solve the problem. The student states a correct answer, 52 chicken's and cow's legs.
<b>Reasoning Proof</b> <i>Practitioner</i>	The student's solution clearly shows her/his reasoning and proof. The representations are linked to the text and the presentation is in logical order.
<b>Communication</b> <i>Apprentice</i>	The student correctly uses one mathematical term <i>table</i> .
<b>Connections</b> <i>Novice</i>	The student does not make any mathematically relevant observation about her/his solution.
<b>Representation</b> <i>Practitioner</i>	The student's tables are appropriate to the problem and accurate. Both tables have the necessary labels.

**Note:**

*The overall achievement level for this piece of student work falls under Exemplars exception to the rule category. If a student has all Apprentice scores or above, but a Novice in "Connections," the student may still receive an achievement level score of Apprentice. To learn more about Exemplars scoring, please refer to the section of your dashboard called "Tools for Success" and click on the link for "Using the Assessment Rubric."*

# Apprentice, Student 2

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

I will make a table.  
I need to find out how many cow legs and chicken legs all together

cow's	leg's
1	4
2	8
3	12
4	16
5	20
6	24
7	28
8	(32)

32 cow leg's  
52 Chicken's  
and cow's leg's

# Apprentice, Student 2 (cont.)

chickens	leg's
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	(20)

20 chicken's  
leg's

$$\begin{array}{r}
 32 \\
 20 \\
 \hline
 50 \\
 + 2 \\
 \hline
 52
 \end{array}$$

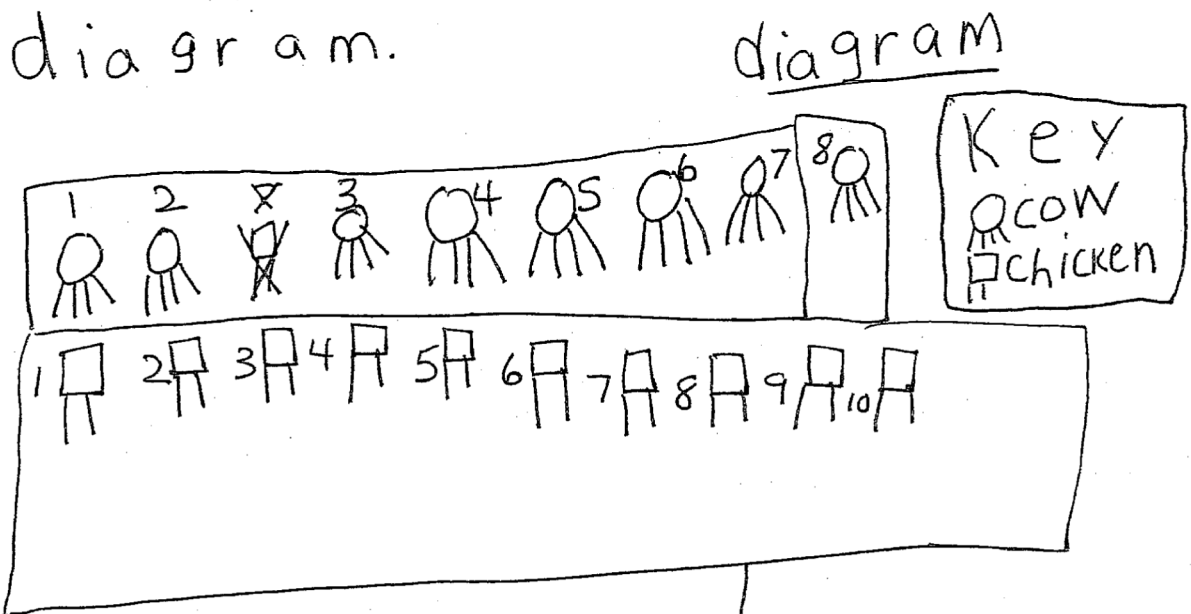
# Practitioner Scoring Rationales, Student 1

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Practitioner</i>	The student's strategy of using diagrams to show the eight cows and 10 chickens works to solve the problem. The student states a correct answer, "There are 52 legs in all."
<b>Reasoning Proof</b> <i>Practitioner</i>	Arguments are constructed with adequate mathematical basis. The student's correct reasoning is evident in the diagrams and key.
<b>Communication</b> <i>Practitioner</i>	The student correctly uses the mathematical terms <i>diagram</i> and <i>key</i> .
<b>Connections</b> <i>Practitioner</i>	The student makes the mathematically relevant observations, "cows count by 4 and chickens count by 2s."
<b>Representation</b> <i>Practitioner</i>	The student uses appropriate and accurate diagrams to represent the eight cows and 10 chickens. A key is used to define the cows and chickens.

# Practitioner, Student 1

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

I need to know how many legs are in all. I will make a diagram.



Answer: There are 52 legs in all.

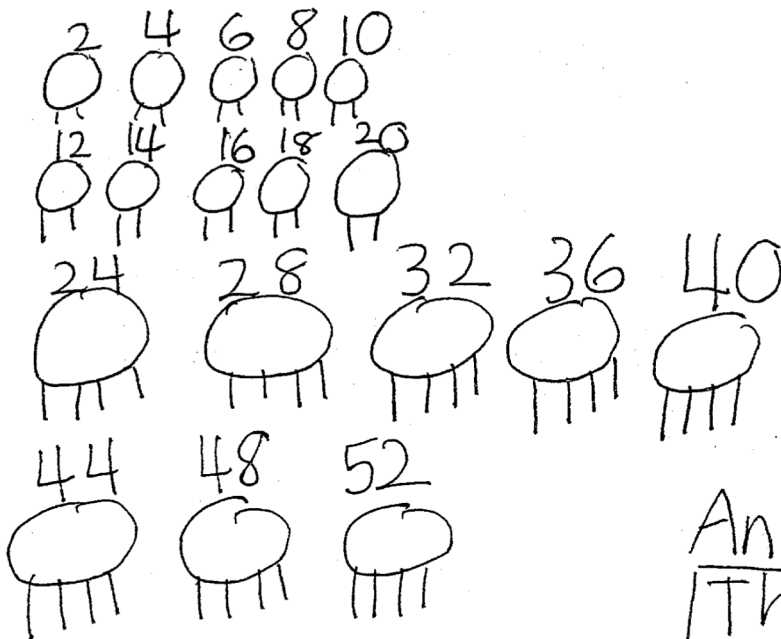
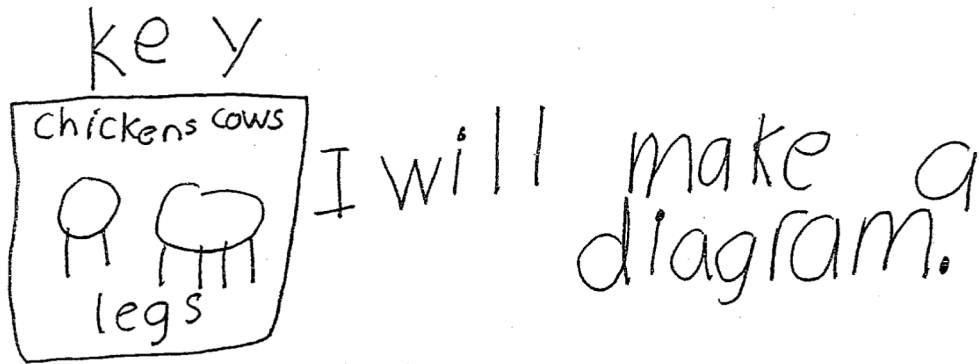
Cows count by 4  
and chickens  
count by 2s.

## Practitioner Scoring Rationales, Student 2

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Practitioner</i>	The student's strategy of making diagrams to show the number of legs on eight cows and 10 chickens works to solve the task. The student also makes an equation to find a total of 52 legs. The student does not earn Expert for verification because she/he does not compare the two totals of 52 legs.
<b>Reasoning Proof</b> <i>Practitioner</i>	The solution clearly shows the student's reasoning. The representations are linked to the text, results of computation are present, the answer is indicated, and the presentation is in logical order.
<b>Communication</b> <i>Practitioner</i>	The student correctly uses the mathematical terms <i>key</i> and <i>diagram</i> .
<b>Connections</b> <i>Practitioner</i>	The student solves the task and then uses a different process to solve the same task. The student uses a number sentence to find a total of 52 legs.
<b>Representation</b> <i>Practitioner</i>	The student's diagrams are appropriate to the task and accurate. A key defines the cow and chicken legs.

# Practitioner, Student 2

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



$$2 + 2 + 2 + 2 + 2 +$$
$$2 + 2 + 2 + 2 + 2 +$$
$$4 + 4 + 4 + 4 + 4 +$$
$$4 + 4 + 4 = 52$$

Answer box  
There are  
52 legs  
counted.



# Expert Scoring Rationales, Student 1

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Expert</i>	The student's strategy of making a diagram to show four legs on each cow and two legs on each chicken and finding a total of 52 legs works to solve the problem. The student then verifies her/his solution by making tables to find a total of 52 legs and stating, "I vaerified my work by solving it two ways."
<b>Reasoning Proof</b> <i>Expert</i>	The student's solution justifies and supports the decisions made and the conclusions reached.
<b>Communication</b> <i>Expert</i>	The student correctly uses the mathematical terms <i>key</i> , <i>diagram</i> , <i>pattern</i> , <i>more than</i> , <i>less than</i> , <i>table</i> .
<b>Connections</b> <i>Expert</i>	The student solves the problem and then uses a different process to verify her/his solution. The student uses a table to show the chicken legs and a table for the cow legs and states, "I vaerified my work by solving it two ways." (Expert Connection) The student makes a number of Practitioner Connections as well: The student makes the relevant observations, "Cow have more legs than chicken and chickens have less legs than cows." The student also identifies patterns. "I saw a couting by 4 Pattern and a couting by 2 Pattern."
<b>Representation</b> <i>Expert</i>	The student's diagrams and tables are appropriate to the task and accurate. A key and all necessary labels are provided. The student's representations are constructed to clarify/verify the solution.

# Expert, Student 1

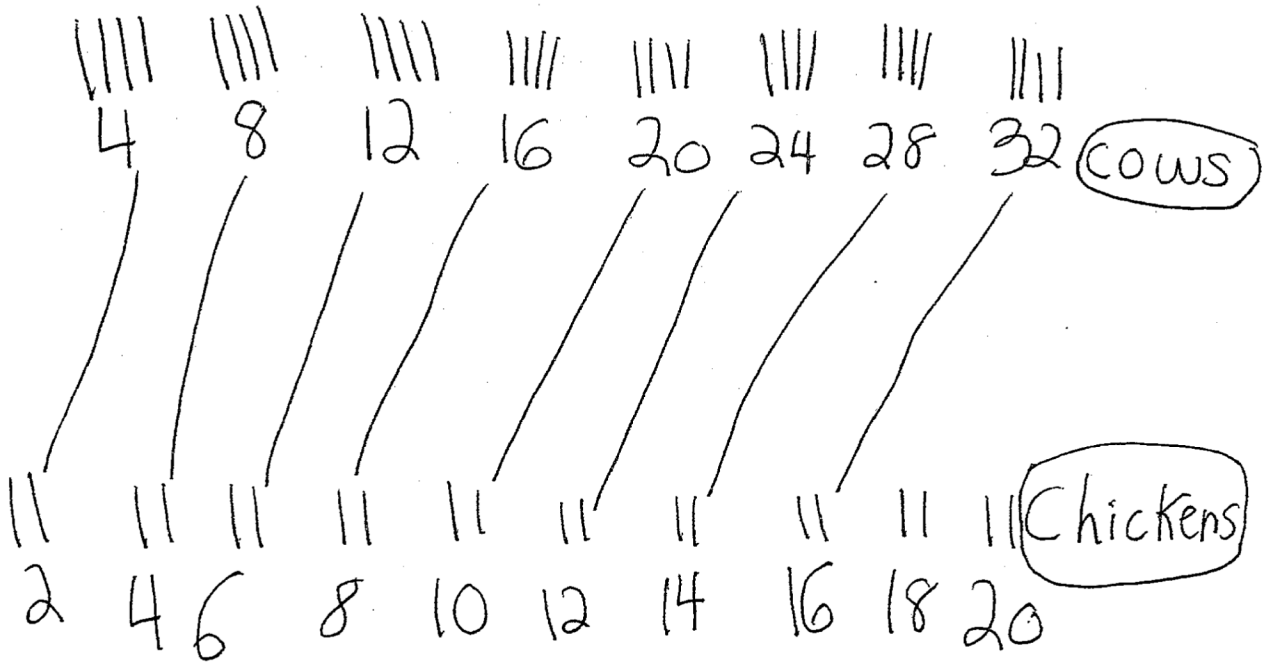
P/S	R/P	Com	Con	Rep	A/Level
E	E	E	E	E	E

I need to find out how many leg are in the Barn. I will make a Diagram.

Key

|||| Cow

|| Chicken



$$32 + 20 = 52$$

52 legs

## Expert, Student 1 (cont.)

I Saw a counting by 4 Pattern  
and a counting by 2 Pattern.

Cow have more legs Than  
Chicken and Chickens have  
less legs than Cows.

chickens	legs	I Vaerified my work by solving it two ways.	cows	legs
1	2			1
2	4		2	8
3	6		3	12
4	8		4	16
5	10	↖ tables →	5	20
6	12		6	24
7	14		7	28
8	16		8	32
9	18			
10	20			

$$20 + 32 = 52$$

## Expert Scoring Rationales, Student 2

<b>Criteria and Performance Level</b>	<b>Assessment Rationales</b>
<b>Problem Solving</b> <i>Expert</i>	The student's strategy of making a diagram to show four legs on each cow and two legs on each chicken and finding a total of 52 legs works to solve the problem. The student uses an alternate strategy to verify her/his solution.
<b>Reasoning Proof</b> <i>Expert</i>	The student's solution shows how the problem was solved and the reasoning used. The representations are linked to the text, results of computation are present, and the presentation is in logical order.
<b>Communication</b> <i>Expert</i>	The student correctly uses the mathematical terms <i>key</i> , <i>diagram</i> , <i>2nd</i> , <i>table</i> .
<b>Connections</b> <i>Expert</i>	The student solves the problem with a diagram and then uses a different process to solve the same problem. The student uses a table to verify her/his solution and states, "I know my answer is right because I did it two ways."
<b>Representation</b> <i>Expert</i>	The student's diagrams and tables are appropriate and accurate. A key and all necessary labels are provided. The student uses both representations to clarify her/his answer.

# Expert, Student 2

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

**Key**

- - chicken
- - cow
- 1 - leg

**Diagram**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩  
 2 4 6 8 10 12 14 16 18 20

① ② ③ ④ ⑤ ⑥ ⑦ ⑧  
 4 8 12 16 20 24 28 32

**Number Sentence**

$$\begin{array}{r} 32 \\ +20 \\ \hline 52 \end{array}$$

**Solution**

\*52\*

## Expert, Student 2 (cont.)

2nd Way Table

cow	leg
1	4
2	8
3	12
4	16
5	20
6	24
7	28
8	32

chicken	leg
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	20

32

32

+ 20

---

52

I know my answer is right because I did it two ways.