Dog Years Dilemma

Trina was playing with her new puppy last night. She began to think about what she had read in a book about dogs. It said that for every year a dog lives it actually is the same as 7 human years. She looked at her 4 1/2 month old puppy and wondered how many human years old her puppy was?

Using as much math language and good reasoning as you can, figure out how many human years old Trina's puppy is?

Grade Levels 6 - 8

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Context

Trina, one of my sixth grade students, called me one night all excited because she knew she had a math "dilemma" for the class. I was pleased that she recognized that a fair amount of mathematics was necessary to solve this problem and that it would be challenging for the class to solve. I actually was surprised at how difficult the problem was for my students. We were working on adding and subtracting fractions, so this problem dealing with fractions was quite timely. My students had enough mathematics to solve the problem, but used many different strategies because it was a problem that they had never encountered before.

What This Task Accomplishes

At first, the task reads fairly simple. However, many students could not think of a way to get started, so this task makes students persevere. It also makes them try different approaches as they begin sorting out the problem. It makes many students begin converting fractions to decimals, so they can work with a calculator.

What the Student Will Do

Some students wanted to figure out the equivalent in dog age of one human day. They knew that months had different days, but they figured they would be very close. Some that got really frustrated rounded 4 1/2 months to six months and found 3 1/2 years old in dog age. This was reasonable, but I encouraged them to try to get a more accurate answer. Because we do a lot of problem solving with charts, some kids made a chart and found that very successful for this problem, although it might not have been as successful with other fractional parts of a year.

Time Required for Task

60 minutes

It took 45 minutes to solve the problem and another 15 minutes to pull their answers together and report.

Interdisciplinary Links

This problem can lead very nicely to a discussion of different life spans and conjectures about why some animals live longer than others.

Teaching Tips

I let my students work in pairs to solve this problem. You might ask your students to think about how graphing could lead them to a solution.

Suggested Materials

- Paper
- Pencil
- Calculator

Possible Solutions

(4.5 months/12) x 7 years = 31.5/12 years = 2.625 years = 2 5/8 years

Benchmark Descriptors

Novice
This student has set up the facts that s/he knows about the calendar and is trying different algorithms to solve the problem with little or no reasoning. There is no evidence of a strategy and no explanation of the reasons for the algorithms tried. There is no mathematical representation.

Apprentice
This student uses a strategy that would work, but uses faulty reasoning in changing a decimal fraction of a year to months. S/he correctly divides to find the dog age equivalent to one human month. However, s/he incorrectly assumes that .6 of a year is six months. The rest of the solution is based on that faulty reasoning.

Practitioner
This student's strategy shows s/he has an understanding of the problem and the major concepts necessary for a solution. Their chart shows equivalent dog years for fractions of human years. This strategy of taking half of each human year leads to a solution of this problem (it may not have gotten a solution to other age puppies). There is effective mathematical reasoning. The student sees that halving the human age would also halve the dog years. The explanation is clear and the chart is appropriate use of mathematical representation. The student also uses correct mathematical notation.

Expert

This student shows a deep understanding of the problem including the ability to identify the appropriate mathematical concepts. This student realizes that no matter how old the dog is, you need to multiply the age by seven. S/he realizes that the age of the dog is 4.5/12 of a year. Since s/he is unfamiliar with multiplying fractions, s/he used his/her knowledge of the fraction line as division and found the decimal equivalent of 4.5/12. This is a very efficient and sophisticated strategy that employs refined and complex reasoning. There is a clear and effective explanation and the student reached for a generalization that would solve any month old dog. The graph also actively communicates how to estimate the dog age of any living dog.

Novice

4 ½ months = 4.5

12 months in a year

1 year = 7 dog years

165 day in a year

$$\begin{array}{r} {\scriptstyle 3} \\ 4.5 \\ \times\ 7 \\ \hline 31.5 \end{array}$$

The student has a partially useful strategy and shows some understanding here.

$$\begin{array}{r} 23\text{R}4 \\ 7\overline{)165} \\ 14 \\ \hline 25 \\ 21 \\ \hline 4 \end{array}$$

$4\frac{1}{4}$

The use of these algorithms shows a lack of reasoning, as the student is unable to proceed toward a solution

$$\begin{array}{r} {\scriptstyle 2}\quad 41 \\ 4.5\overline{)165} \\ 180 \\ \hline 85 \\ 45 \\ \hline 40 \end{array}$$

40

$4\frac{1}{2}$

Apprentice

7÷12 = .5833333 - I rounded up to .6 about 6 months a month

This approach would have worked.

People Years	Dog Years
1	7
1 month	6 months
2 months	1 year
3 months	1 year 6 months
4 months	2 years
4½ months	2 years 3 months

This shows faulty reasoning.

Due to faulty reasoning, the rest of the approach is flawed.

Although incorrect, this table does show the student's solution.

EXPLANATION

Some basic math language is used to communicate.

First I divided 12 by 7(12π), and got .5833333, which I rounded up to .6 or about 6 dog months for every 1 people month

Mo months Dog People
6 DM=1PM

Then all I did was multiply 6 (how many dog months for people month) by 4(how old the dog is) and got 24 months. I know that one year has 12 months in it and 12 multipled by 2 is 24 so 24 months($\frac{24}{12}$) is equal to 2 years. Then all I needed to figer out was how many dog months in 2 a month. Since then are 6 dog months in one people months and half of 6 is 3 Half a people month must be equel to 3 dog month. Trina's puppy is 26 months 3 months old.

Practitioner

This table is labeled and communicates the student's solution.

The student provides supporting computation assisting in communication.

dog years	human years Months
7 years =	1 year
$3\frac{1}{2}$ years =	6 months
$1\frac{3}{4}$ years =	3 months
$\frac{7}{8}$ of a year	$1\frac{1}{2}$ months

$1\frac{3}{4} = \frac{6}{8}$

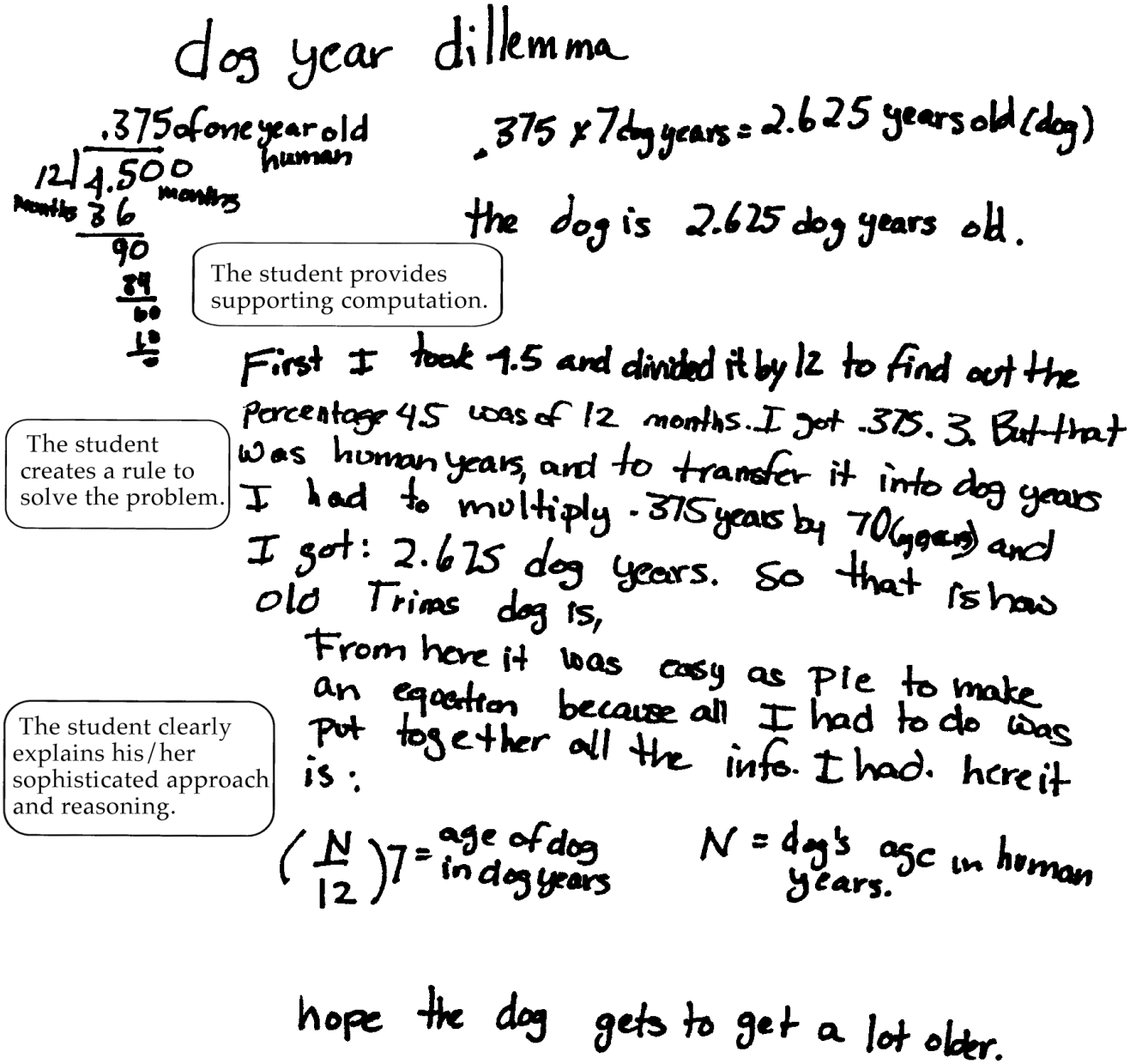
$+ \frac{7}{8} = \frac{7}{8}$

$1\frac{13}{8} = \frac{25}{8}$ answer

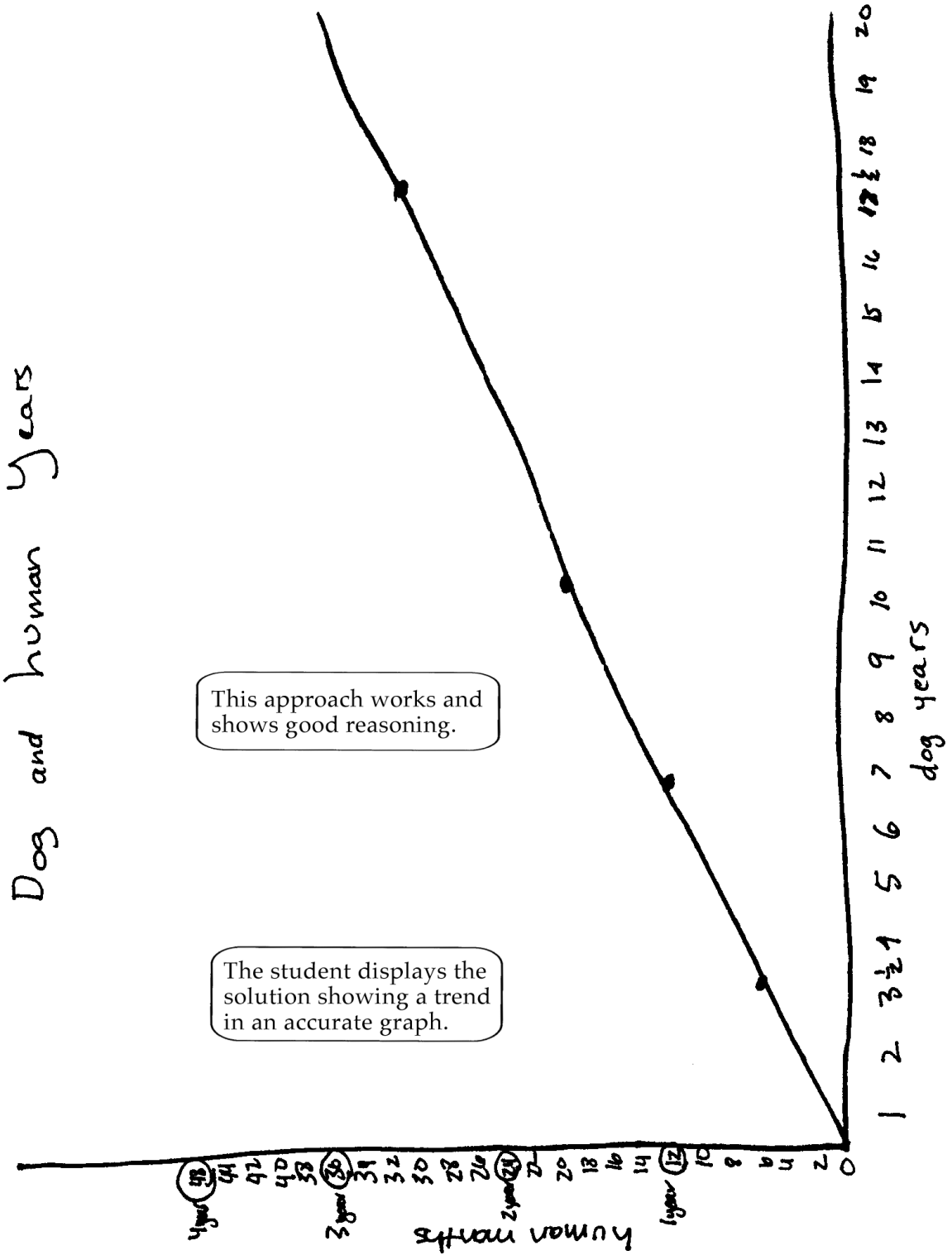
I made this chart by knowing that if 1 human year is 7 dog years. Then a half of a human year(6 months) will be half of the 7 dog years($3\frac{1}{2}$ dog years). After that I cut the $3\frac{1}{2}$ dog years and the 6 months in half and did the same thing over again. Then I solved this problem by adding $1\frac{3}{4}$ dog years with $\frac{7}{8}$ of a dog year because $1\frac{3}{4}$ dog years is 3 human months and $\frac{7}{8}$ of a dog year is $1\frac{1}{2}$ human months. If you add The human months together you will get $4\frac{1}{2}$, which is how old the puppy is in human months, the dog is $2\frac{5}{8}$ dog years.

The student obtains a correct solution.

Expert



Expert



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