

Valid and Invalid Approaches to Problem Solving

5.PS.19 Differentiate between valid and invalid approaches

When solving math problems, it is often helpful to have an organized problem-solving plan. The four-step plan below can be used to solve any problem and will help you identify a valid problem solving approach.

<p>1. Explore</p> <ul style="list-style-type: none"> • Read the problem carefully. • What facts do you know? • What do you need to find out? • Is enough information given? • Is there extra information? 	<p>2. Plan</p> <ul style="list-style-type: none"> • How do the facts relate to each other? • Plan a strategy for solving the problem. • Estimate the answer.
<p>3. Solve</p> <ul style="list-style-type: none"> • Use your plan to solve the problem. • If your plan does not work, revise it or make a new plan. • What is the solution? 	<p>4. Examine</p> <ul style="list-style-type: none"> • Reread the problem. • Does the answer fit the facts given in the problem? • Is the answer close to my estimate? • Does the answer make sense? • If not, solve the problem another way.

EXAMPLE 1

Identify whether Anna or Chris used a valid problem-solving approach to solve the problem below. Explain your reasoning.

John took a survey of 200 students at his school to see what their favorite food in the cafeteria was. The table shows his results.

Favorite Food	
Food	Number of Students
pizza	75
macaroni and cheese	35
hot dogs	55
hamburger	20
chicken sandwich	15

How many more students say that pizza is their favorite than those who say that hamburgers are their favorite?

ANNA		CHRIS	
Explore	The only necessary information is the number of students who chose pizza and the number of students who chose hamburgers.	Explore	The necessary information is the total number of students, the number of students who chose pizza, and the number of students who chose hamburgers.
Plan	Subtract the number of students who chose hamburgers from the number of students who chose pizza. Estimate: $70 - 50 = 20$	Plan	Add the number of students who chose pizza and hamburgers, then subtract from the total number of students. Estimate: $200 - 100 = 100$
Solve	$75 - 50 = 25$ 25 more students chose pizza than hamburgers.	Solve	$75 + 20 = 95$ $200 - 95 = 105$ 105 more students chose pizza than hamburgers.
Examine	Compared to the estimate, the answer is reasonable. Since $25 + 50 = 75$, the answer is correct.	Examine	Compared to the estimate, the answer is reasonable. Since $105 + 95 = 200$, the answer is correct.

Anna used a valid problem-solving approach since she followed the four-step plan. She understood the problem correctly and devised a valid approach for subtracting to find the correct answer. Chris misinterpreted the problem and used information that was not necessary in finding the solution. His plan was to add, rather than subtract the number of students who chose pizza and hamburgers.

EXERCISES

Identify whether each problem-solving approach is valid or invalid. Explain your reasoning.

- Kathy wants to take a fruit salad to a picnic she is attending. The recipe she wants to make calls for: 4 apples, 6 walnuts, 3 bananas, 1 pineapple, 2 pears, and 6 oranges. How many pieces of fruit does Kathy need to buy at the store?

Problem-Solving Approach:

Explore: We know how much of each item Kathy needs for the fruit salad.

Plan: Add all the ingredients to find the total number of items needed.

Solve: $4 + 6 + 3 + 1 + 2 + 6 = 24$ items Kathy needs from the store.

Examine: The answer makes sense because there were a lot of things that Kathy needed for the recipe, so 24 seems like a good answer.

2. Nate wants to buy a new computer that costs \$598.76. Each week he mows 4 lawns and makes \$57. How many weeks will he have to save up in order to earn enough money to buy the computer?

Problem-Solving Approach:

Explore: We know how much Nate makes per week and how much he needs to buy the computer.

Plan: Divide the cost of the computer by the amount earned per week to find the total number of weeks. Estimate: $\$600 \div \$60 = 10$ weeks

Solve: $598.76 \div 57 = 10.5$ weeks, so Nate will have to save his earnings for 10.5 weeks, or 11 weeks to be sure he has enough for the computer.

Examine: Compared to the estimate, the answer is reasonable. Since $\$57 \times 11 = \627 , which is more than the cost of the computer, the answer is correct.

3. Complete the pattern: 3, 6, 9, 12, __

Problem-Solving Approach:

Explore: We have a pattern of numbers and need to find the next number in the pattern.

Plan: Since the numbers increase, subtract each number from the previous number to find the pattern. Then use the pattern to identify the next number.

Solve: $12 - 9 = 3$, $9 - 6 = 3$, and $6 - 3 = 3$, so each number increases by 3. Add 3 to the last number to find the next number, $12 + 3 = 15$.

Examine: Check the solution by using addition and the pattern of adding 3, $3 + 3 = 6$, $6 + 3 = 9$, $9 + 3 = 12$, $12 + 3 = 15$. The answer is correct.

4. How many years are there between the oldest and youngest states listed in the table?

State	Year it Became a State
California	1850
Hawaii	1959
New York	1788
Ohio	1803
Wyoming	1890

Problem-Solving Approach:

Explore: We know the year each state became a state and need to find the difference in the ages of the youngest and oldest states.

Plan: Find the approximate age of each state, and subtract the youngest from the oldest.

Solve: CA: $2006 - 1850 = 156$, HI: $2006 - 1959 = 47$, NY: $2006 - 1788 = 218$, OH: $2006 - 1803 = 203$, WY: $2006 - 1890 = 116$; Ohio is the oldest state, and Hawaii is the youngest state, so subtract their ages, $203 - 47 = 156$ years.

Examine: Check the solution by adding. Since $47 + 156 = 203$, the answer is correct.