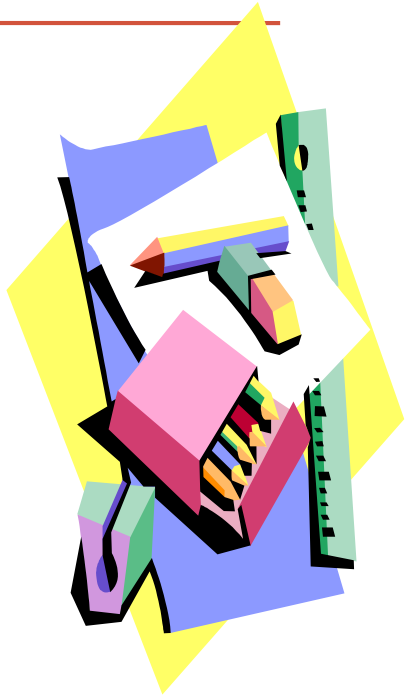
PROBLEM SOLVING STRATEGIES

Parent Symposium (Primary 3 & 4)

7 April 2018



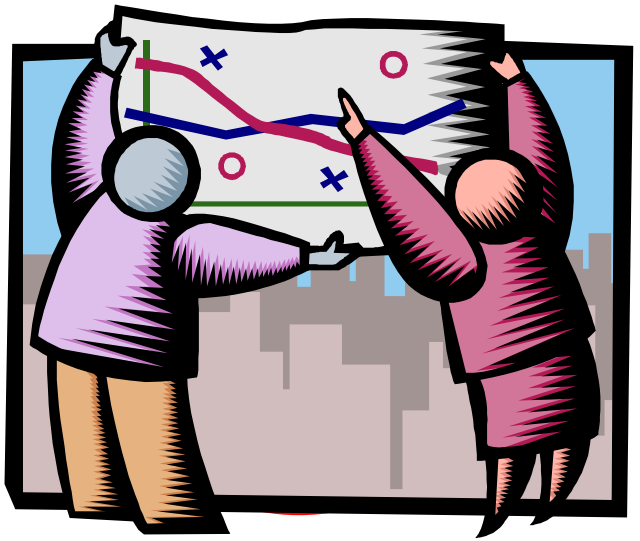
Outline

1. Problem solving process

2. Question Type
   - Unchanged total
   - Unchanged quantity
   - Number × value

Mathematics Curriculum

The primary aim of the Mathematics curriculum is to enable pupils to develop their ability in Mathematical **PROBLEM SOLVING**

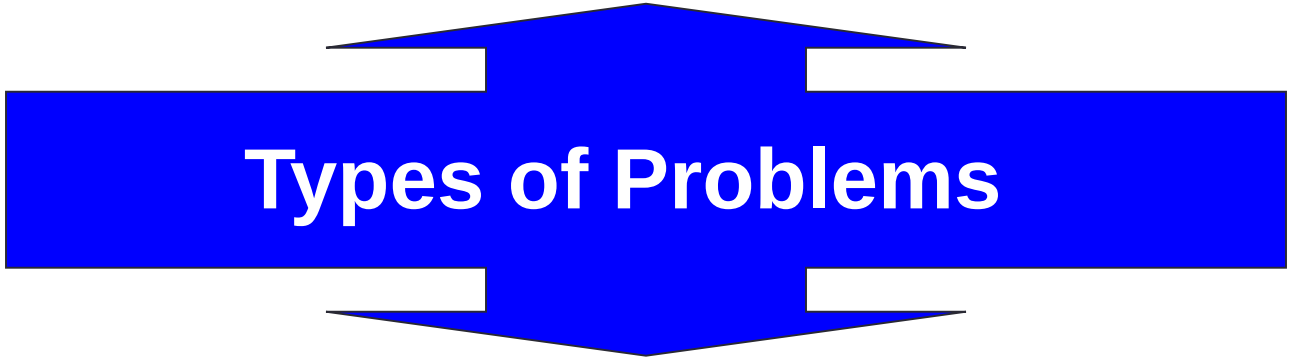


What Is Mathematical Problem Solving?

A process…...

where students use previously acquired knowledge, skills and understanding to satisfy the demands of a situation

Non-routine: a situation that cannot be resolved by merely applying a standard algorithm, formula or procedure, which is usually readily available to a problem solver



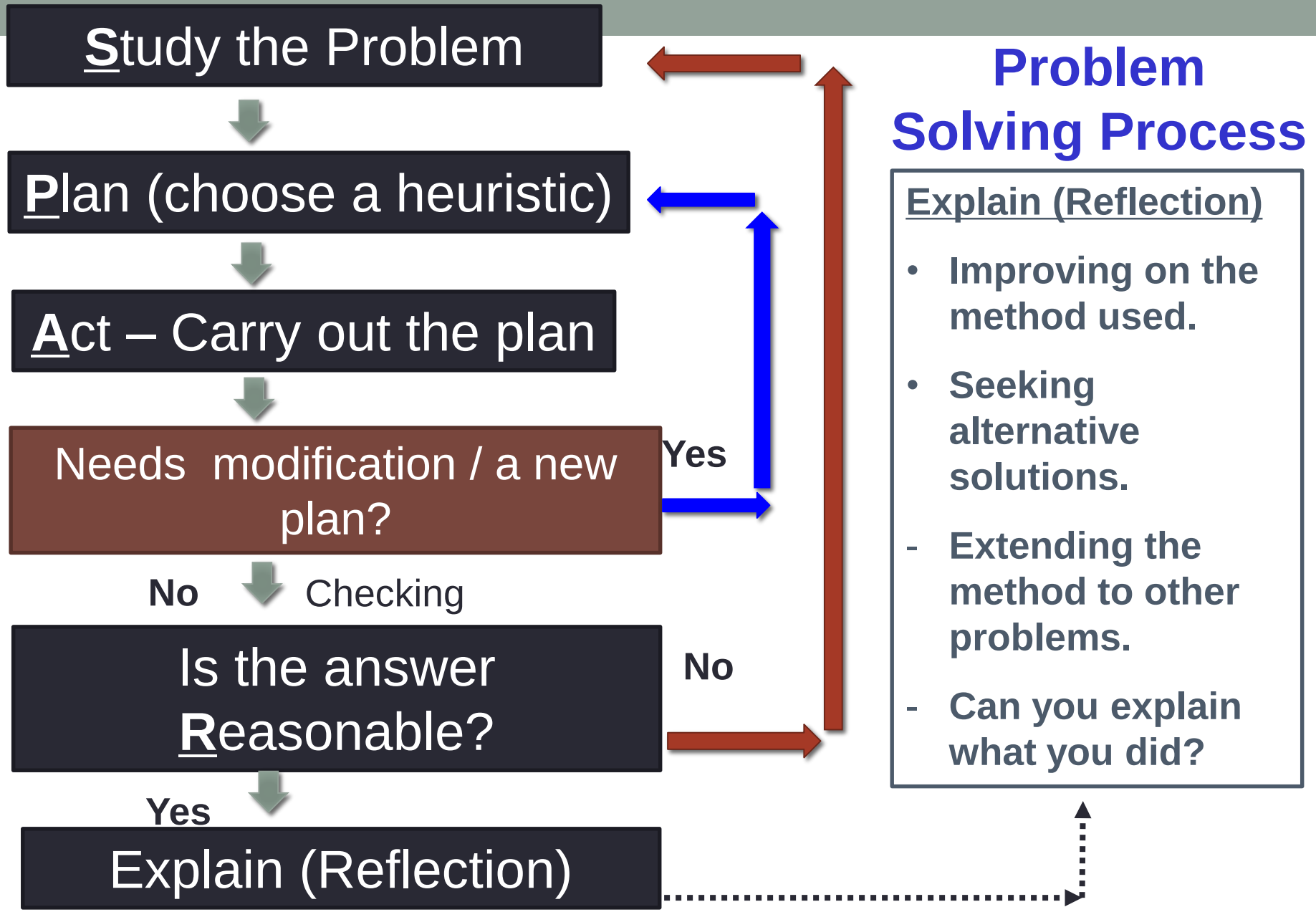
Routine: students can follow certain known algorithm, formula or procedure

Students sometimes find it difficult to understand a problem just by reading it. Therefore parents need to help their children understand the problem by:

- Asking guiding questions
- Transferring the information into symbols or diagrams

Problem Solving Process

- **S**tudy the problem
- **P**lan
- **A**ct
- **R**easonableness
- **E**xplain


Study the Problem
Plan (choose a heuristic)
Act – Carry out the plan
Needs modification / a new plan?
Yes
No
Checking
Is the answer Reasonable?
No
Yes
Explain (Reflection)
Problem Solving Process
Explain (Reflection)
• Improving on the method used.
• Seeking alternative solutions.
- Extending the method to other problems.
- Can you explain what you did?

Study the Problem

- Do you understand all the words used in the problem?
- What are you asked to find or show?
- Can you restate the problem in your own words?
- Can you think of a picture or diagram that may help you understand the problem?
- Is there enough information to enable you to find the solution?
- What information do you obtain from the problem?

Plan (Using Heuristics – Strategies in Problem Solving)

- Give a representation (draw a diagram, make a list, use equations)
- Make a calculated guess (guess & check, look for patterns, make suppositions)
- Go through the process (act it out, work backwards, before-after)
- Change the problem (restate the problem, simplify the problem, solve part of the problem)

(Source: Curriculum Planning & Development Division, MOE, Mathematics Syllabus Primary 2007)

Act

- Carry out your plan
- Check each step
- Ensure that the entire solution is written clearly by checking the following:
  - **S**how all the steps
  - **T**ransfer all numbers correctly
  - **U**se correct units
  - **N**eat

Reasonableness

- Does your answer make sense? Is it reasonable?
- Is there another method to find the solution?
- What worked? What didn’t ?

Explain

- Can you explain what you did earlier?

Unchanged Quantity

- Involve changes that take place externally
- However one quantity is unchanged after the change as it is not involved

Q1. John had 10 more erasers than Tim at first. After John had given 3 erasers away, he had twice as many erasers as Tim. How many erasers did John have at first?

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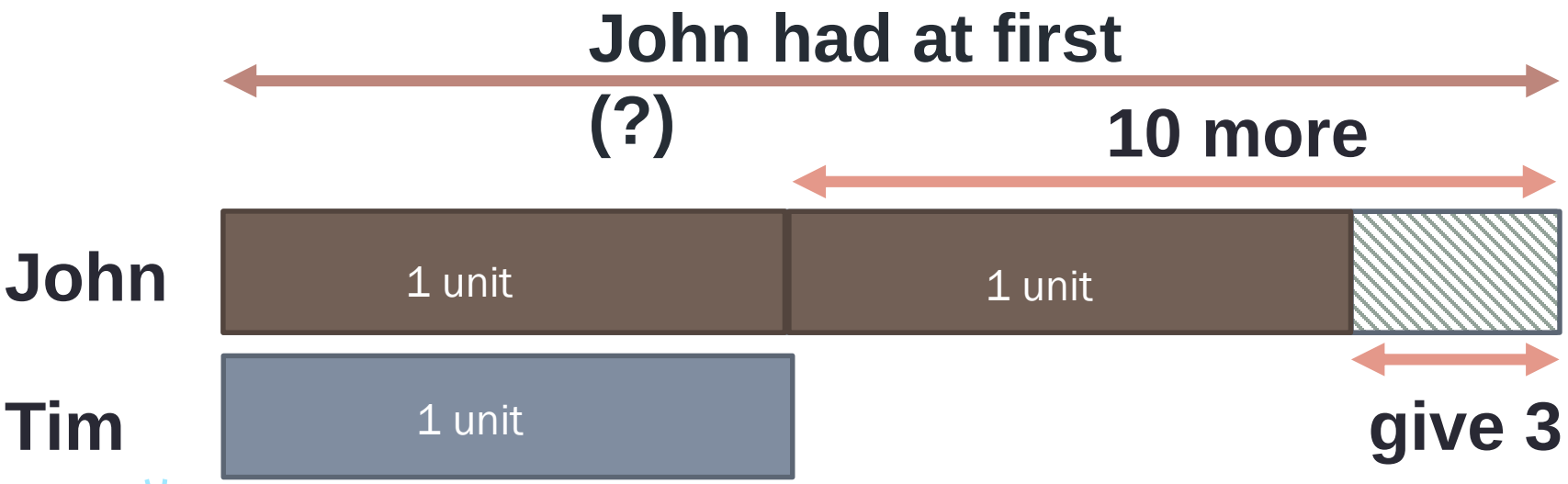
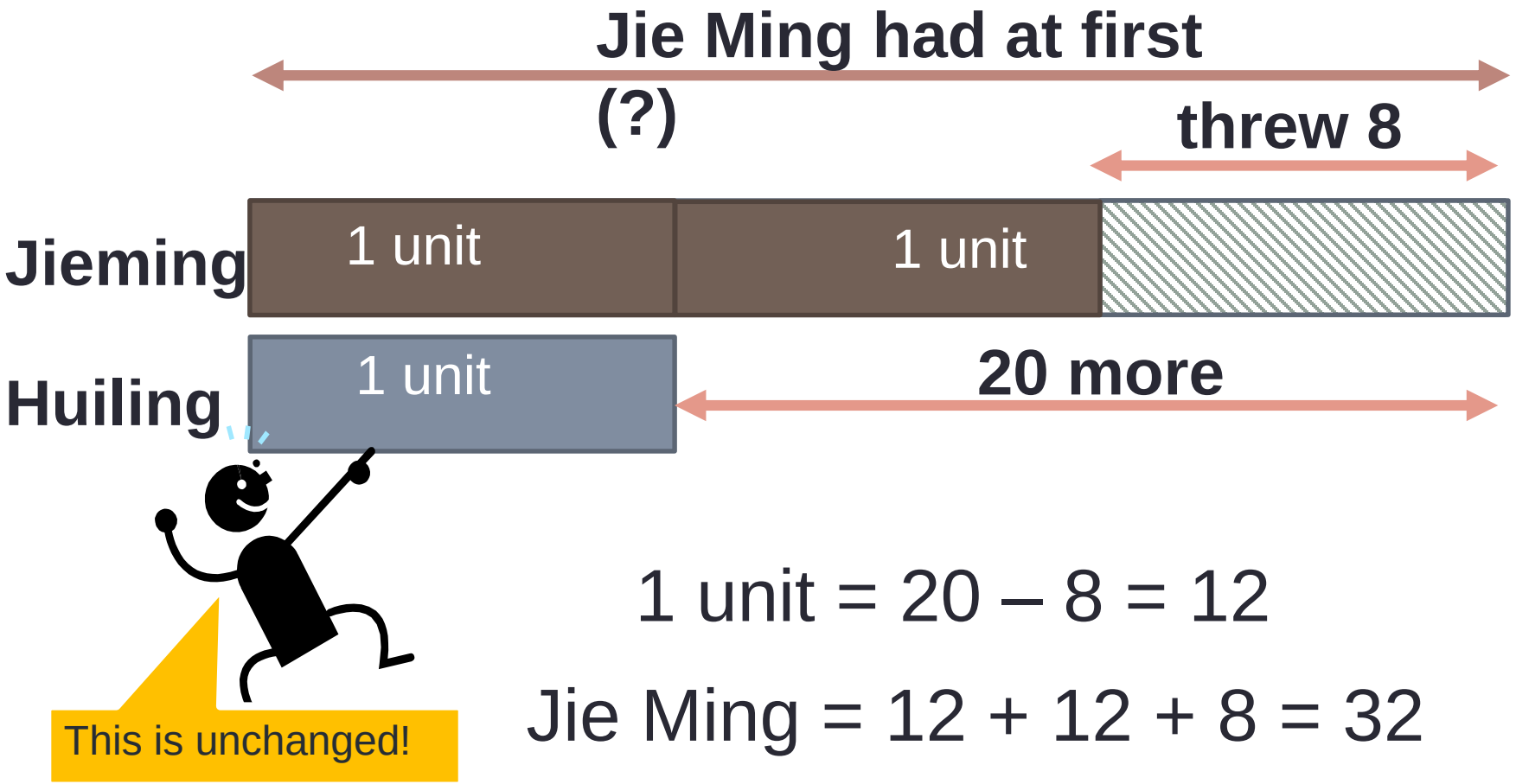


1 unit = 10 – 3 = 7

John = 7 + 7 + 3 = 17

Q2. Jie Ming had 20 more clips than Hui Ling at first. After Jie Ming threw away 8 damaged clips, he had twice as many clips as Hui Ling. How many clips did Jie Ming have at first?



1 unit = 20 – 8 = 12

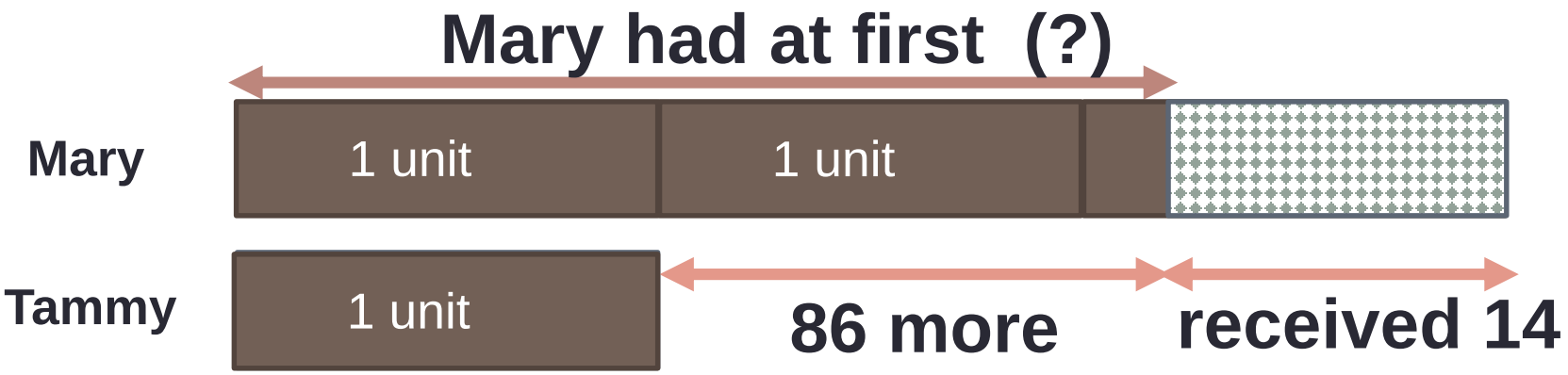
Jie Ming = 12 + 12 + 8 = 32

Q2. Jie Ming had 20 more clips than Hui Ling at first. After Jie Ming threw away 8 damaged clips, he had twice as many clips as Hui Ling. How many clips did Jie Ming have at first?

Q3. Mary had 86 more stamps than Tammy at first. After Mary received another 14 stamps, she had thrice as many stamps as Tammy. How many stamps did Mary have at first?

What is the difference between the two questions?
What is the similarity between the two questions?

Q3. Mary had 86 more stamps than Tammy at first. After Mary received another 14 stamps, she had thrice as many stamps as Tammy. How many stamps did Mary have at first?

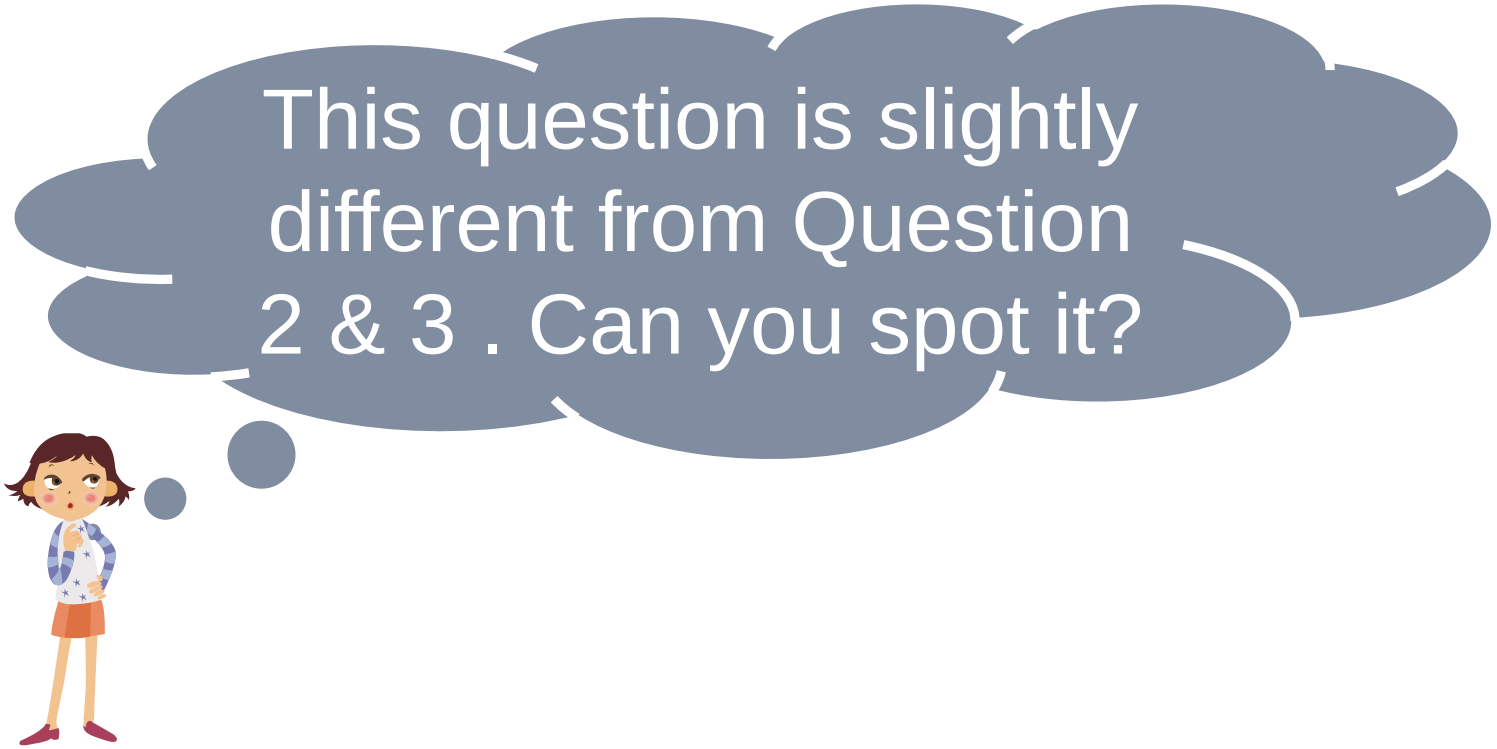


2 units = 86 + 14 = 100

1 unit = 100 ÷ 2 = 50

Mary = 50 + 86 = 136

Q4. There were twice as many men as women at a funfair. After 20 women left the party, there were thrice as many men as women. How many men were at the party?



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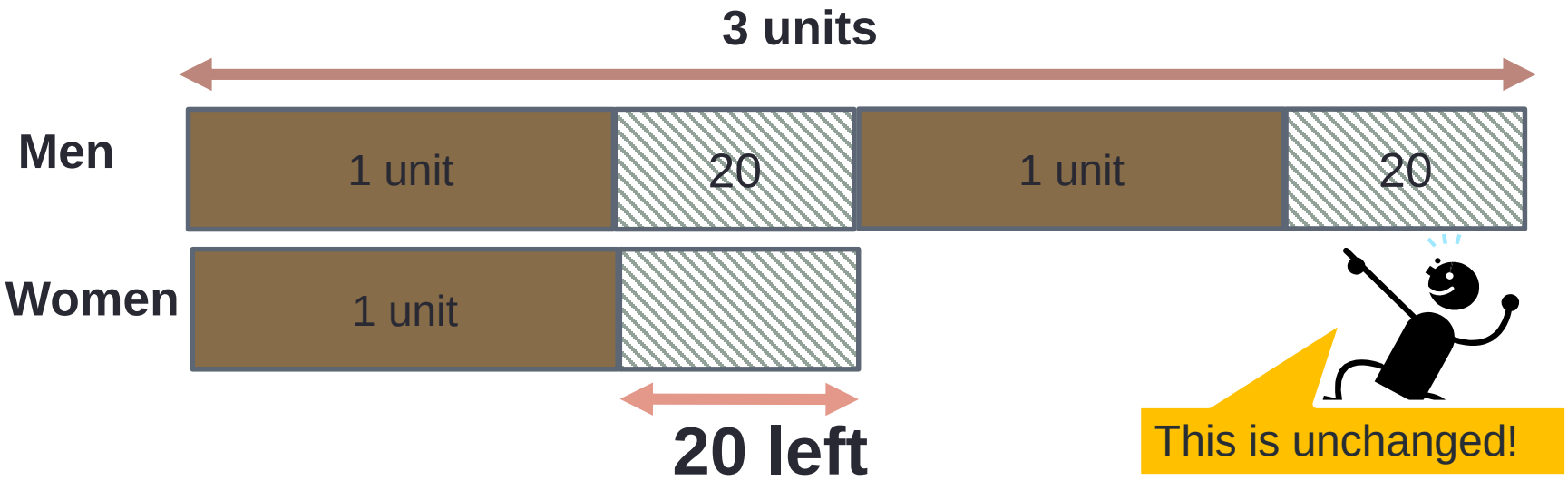


1 unit = 20 + 20 = 40

Men = 40 × 3 = 120

Unchanged Total

- Involve changes that take place internally or changes that involve a mutual exchange

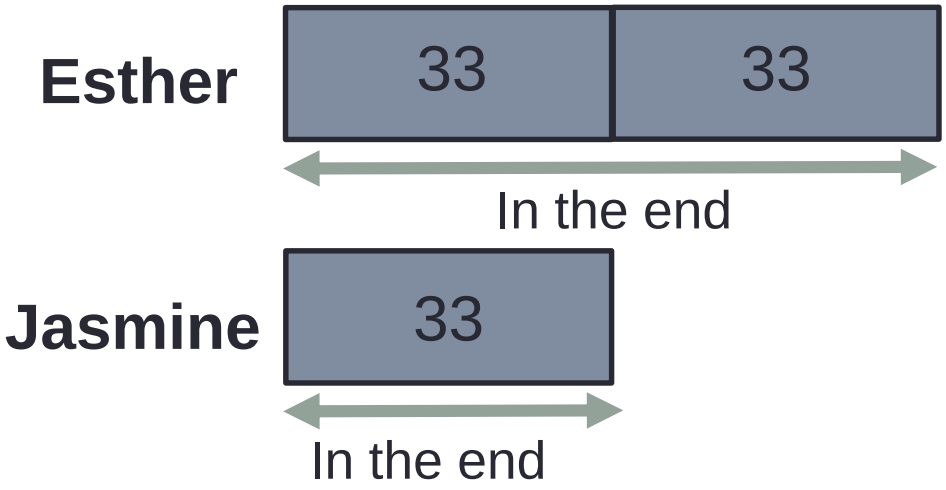
- However the total is unchanged

Q5. Esther and Jasmine had 99 ribbons. After Esther gave Jasmine 18 ribbons, Esther had twice as many ribbons as Jasmine. How many ribbons did Esther have at first?

* What is the difference between this question and previous questions?
* What is unchanged? How do you know?
* Do we know how many ribbons each has at first?
* Should we work from the start or work backwards? Why?

Since we do not know how many each has at first but we know Esther had twice as many as Jasmine in the end, we need to work backwards.

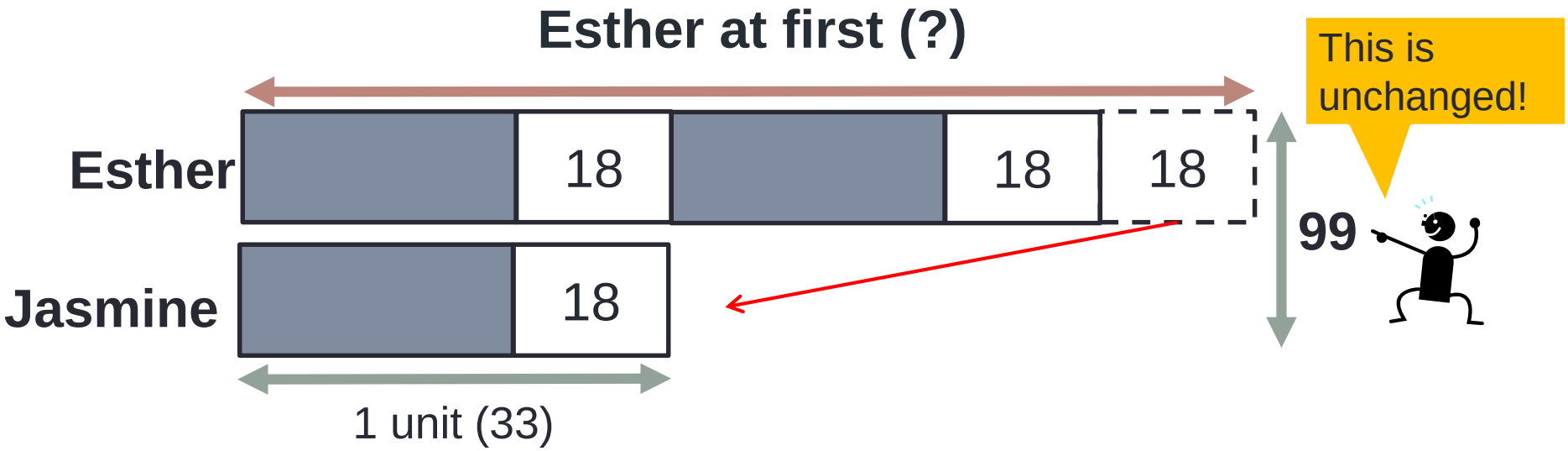
Q5. Esther and Jasmine had 99 ribbons. After Esther gave Jasmine 18 ribbons, Esther had twice as many ribbons as Jasmine. How many ribbons did Esther have at first?



3 units = 99

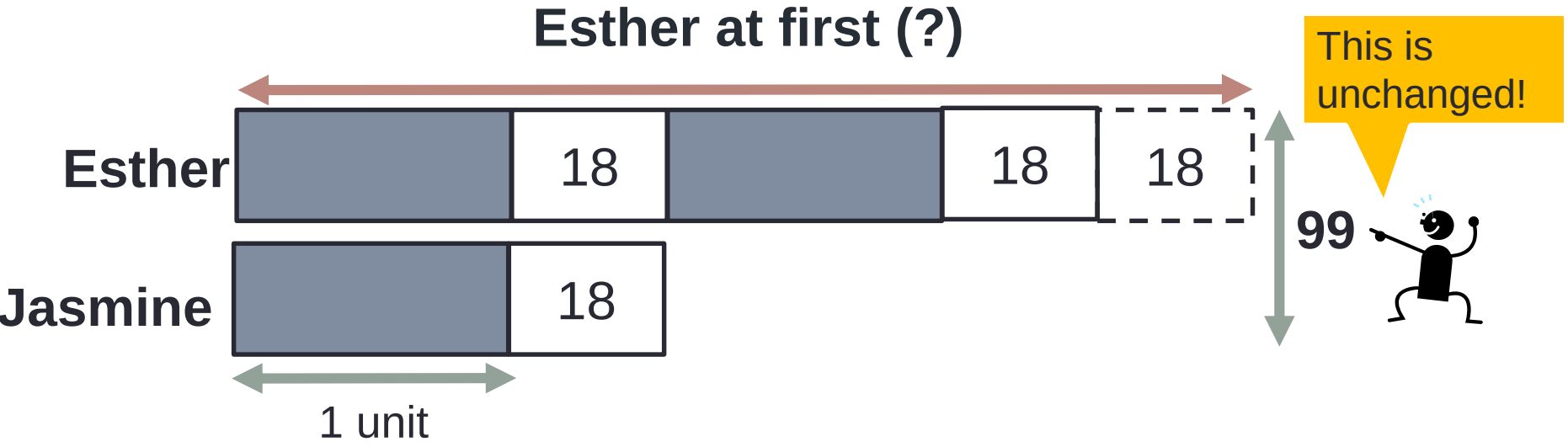
1 unit = 99 ÷ 3 = 33

Q5. Esther and Jasmine had 99 ribbons. After Esther gave Jasmine 18 ribbons, Esther had twice as many ribbons as Jasmine. How many ribbons did Esther have at first?



Esther = 33 + 33 + 18 = 84

Q5. Esther and Jasmine had 99 ribbons. After Esther gave Jasmine 18 ribbons, Esther had twice as many ribbons as Jasmine. How many ribbons did Esther have at first?



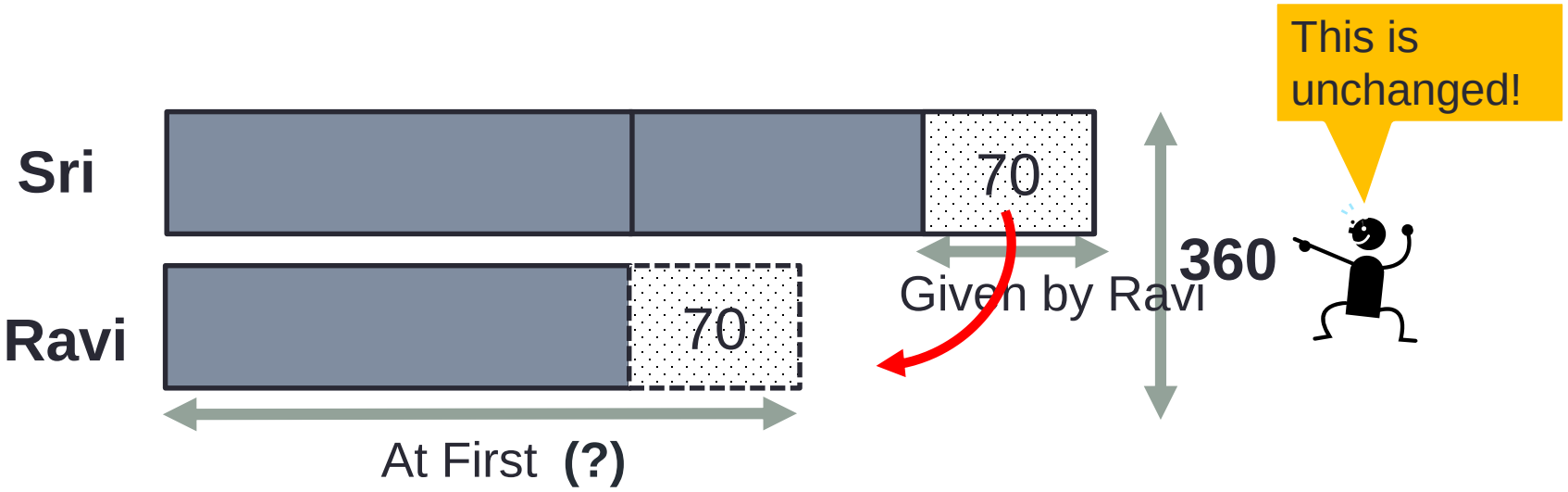
Alternatively,

$$3 \text{ units} = 99 - (18 \times 3) = 45$$

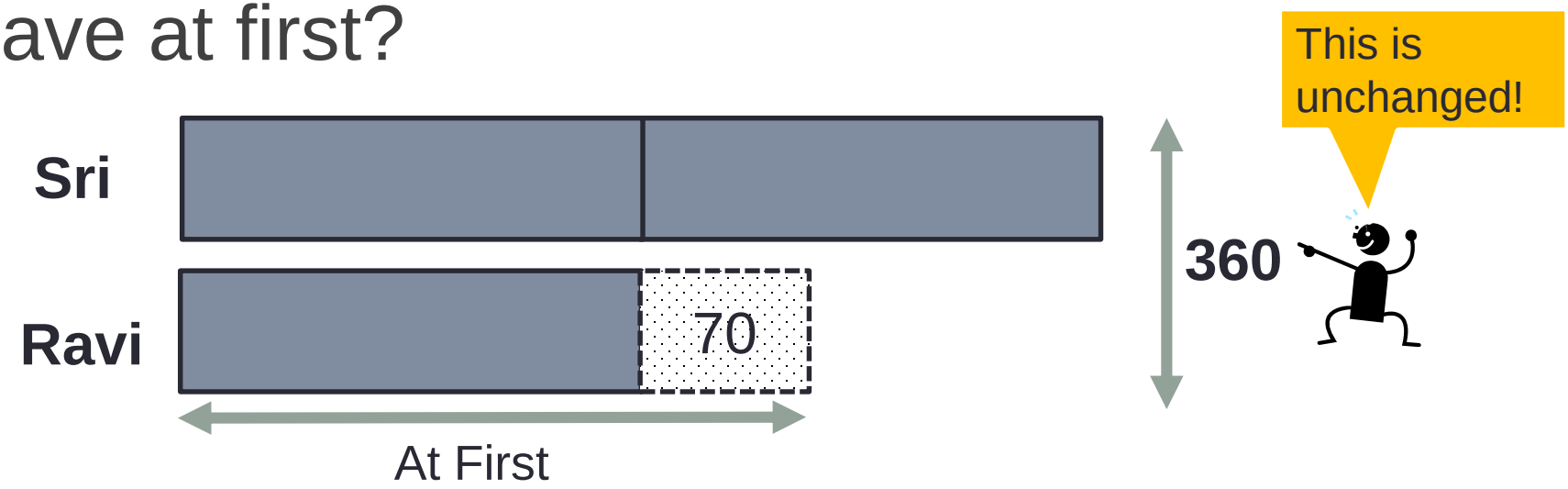
$$1 \text{ unit} = 45 \div 3 = 15$$

$$\text{Esther} = 15 + 15 + 18 + 18 + 18 = 84$$

Q6. Sri and Ravi had 360 stamps. After Ravi gave Sri 70 stamps, Sri had twice as many stamps as Ravi. How many stamps did Ravi have at first?



Q6. Sri and Ravi had 360 stamps. After Ravi gave Sri 70 stamps, Sri had twice as many stamps as Ravi. How many stamps did Ravi have at first?



3 units = 360

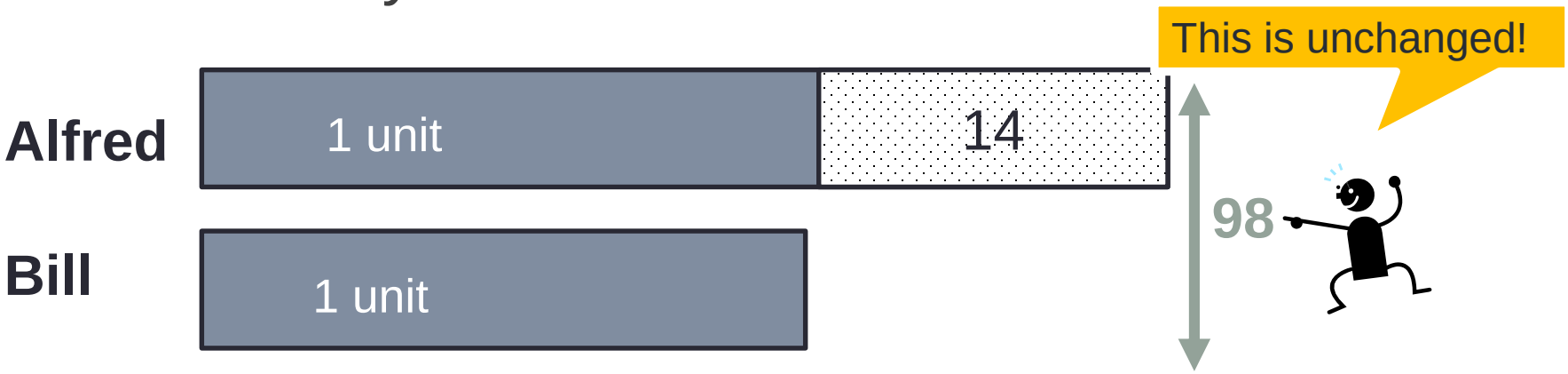
1 unit = 360 ÷ 3 = 120

Ravi = 120 + 70 = 190

Q7. Alfred and Bill had 98 stickers. Alfred gave 19 stickers to Bill. In return, Bill gave 23 of his stickers to Alfred. In the end, Alfred had 14 more stickers than Bill. How many stickers did Alfred have at first?

* Do we know how many stickers each has at first?
* In the end, who has more stickers? How many more?
* Do we work forward or word backwards? Why?
* What is unchanged throughout the exchanges? Why?

Q7. Alfred and Bill had 98 stickers. Alfred gave 19 stickers to Bill. In return, Bill gave 23 of his stickers to Alfred. In the end, Alfred had 14 more stickers than Bill. How many stickers did Alfred have at first?



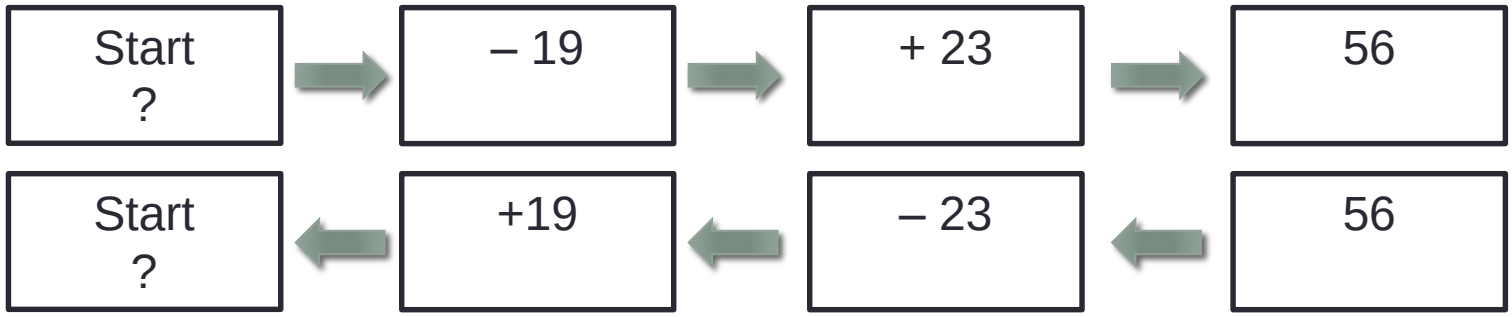
2 units = 98 – 14 = 84

1 unit = 84 ÷ 2 = 42 (Bill in the end)

Alfred at the end = 42 + 14 = 56

Q7. Alfred and Bill had 98 stickers. Alfred gave 19 stickers to Bill. In return, Bill gave 23 of his stickers to Alfred. In the end, Alfred had 14 more stickers than Bill. How many stickers did Alfred have at first?

Alfred at the end = 42 + 14 = 56



Alfred at first = 56 – 23 + 19 = 52

Number × Value

- This concept is used when the number of items in units (usually expressed in fractions, ratio or whole as well as the value of each item (individual amount)

Q8. Gary bought 3 times as many shirts as shorts. Each shirt cost $10 and each pair of shorts cost $5. He spent a total of $350. How many shirts did he buy?

Do you think model will help to solve the problem? Explain

Q8. Gary bought 3 times as many shirts as shorts. Each shirt cost $10 and each pair of shorts cost $5. He spent a total of $350, how many shirts did he buy?

Using Guess & Check Method,

Shirts	$ Shirts	Shorts	$ Shorts	Total $	Check
3	3 × 10 = 30	1	1 × 5 = 5	30 + 5 = 35	×
9	9 × 10 = 90	3	3 × 5 = 15	90 + 15 = 105	×
15	15 × 10 =150	5	5 × 5 = 25	150 + 25 = 175	×
30	30 × 10 = 300	10	10 × 5 = 50	300+ 50 = 350	✓

Is this the most efficient method?

Q8. Gary bought 3 times as many shirts as shorts. Each shirt cost $10 and each pair of shorts cost $5. He spent a total of $350, how many shirts did he buy?

Using Number × Value,

1 group ⟶ 3 shirts and 1 pair of shorts

	Shirts	Shorts
Shirts / Pair of shorts	3	1
Cost of each	10	5
Total Value	30	5

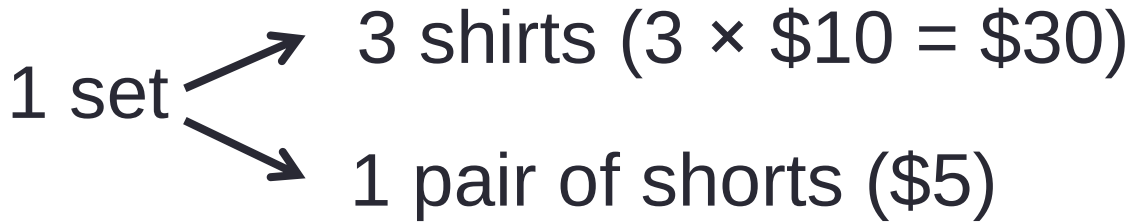
35 units = 350

1 unit = 350 ÷ 35 = 10

Shirts = 10 × 3= 30

Q8. Gary bought 3 times as many shirts as shorts. Each shirt cost $10 and each pair of shorts cost $5. He spent a total of $350, how many shirts did he buy?

Different form of presentation



Value of 1 set = 30 + 5 = 35

Number of sets = 350 ÷ 35 = 10

Shirts = 10 × 3 = 30

Q9. There were 4 more cars than two-wheel motorcycles in a carpark. There were 160 wheels counted altogether. How many cars were there?

Note the difference in this question... what should we do first?

Since there were more cars than motorcycles, what should I do? If there was an equal number of cars and motorcycles, how many wheels would there be?

Q9. There were 4 more cars than two-wheel motorcycles in a carpark. There were 160 wheels counted altogether. How many cars were there?

4 cars = 4 × 4 = 16

If there was equal number of cars and motorcycles,

Total No. of Wheels = 160 – 16 = 144

Q9. There were 4 more cars than two-wheel motorcycles in a carpark. There were 160 wheels counted altogether. How many cars were there?

1 group = 1 car and 1 motorcycle

	Cars	Motorcycle
No. of Cars / Motorcycles	1	1
Wheels of Each Car / Motorcycle	4	2
Total No. of Wheels	4	2

6 units = 144

1 unit = 144 ÷ 6 = 24

cars = 24 + 4= 28

Some Ways to Help Your Child

- Get them to spot / explain their mistakes instead of teaching them straight away
- Guide them to follow the problem solving process
- Give them more practices of similar problems that they make mistake in
- Encourage them to use varied strategies to solve problems, to seek alternative solutions to problems and to create, formulate or extend problems

I hear, I forget.
I see, I remember.
I do, I understand.

Study the problem

Plan

Act

Reasonableness

Explain