Learning Fest
3 February 2018
Mathematics (P5 & P6)

The Model Method: A Tool for Representing & Solving Word Problems Involving Fractions, Ratio and Percentage

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Workshop Objectives

Solving word problems is a key component of the mathematics curriculum.

At this workshop, you will be introduced to different types of models. Through hands-on activities, you will understand how this method aids in:

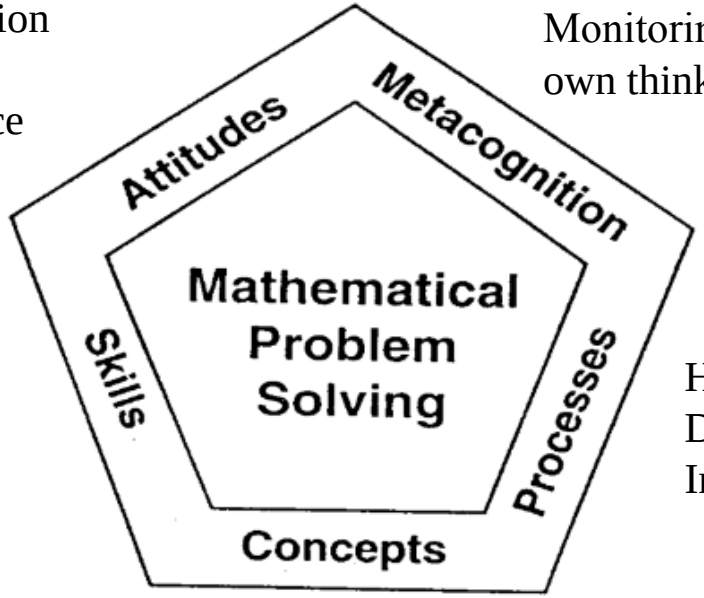
- the visualisation of word problems
- seeing the relationships between and among the variables in the word problem
- providing a deeper understanding of the operations that may be used to solve word problems

Workshop Overview

- Mathematics Curriculum Framework
- Polya's 4 Stages of Problem-Solving
- Different types of models
- Hands-on Experience

MOE Mathematics Curriculum Framework

1991 - 2000



Appreciation
Interest
Confidence

Monitoring one's own thinking

Estimation and Approximation
Mental calculation
Communication
Use of mathematical tools
Arithmetic manipulation
Algebraic manipulation
Handling data

Heuristics
Deductive reasoning
Inductive reasoning

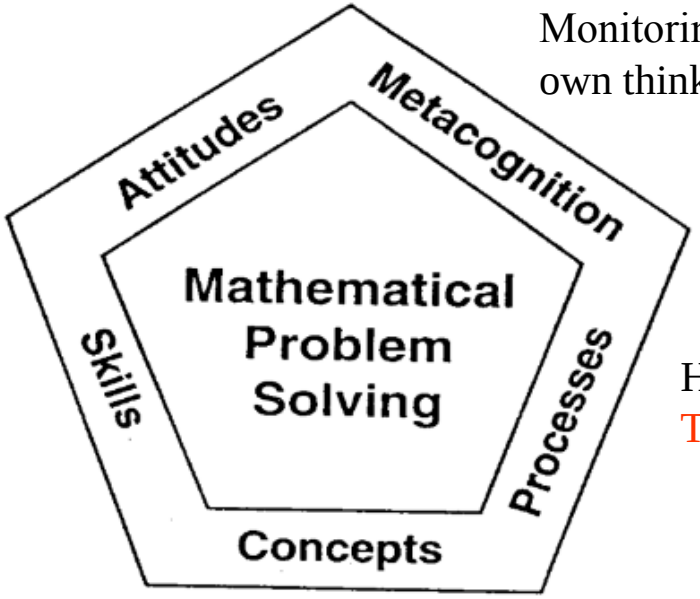
Numerical
Geometrical
Algebraic
Statistical

MOE Mathematics Curriculum Framework

2001 - 2006

Appreciation
Interest
Confidence
Perseverance

Monitoring one's own thinking



Estimation and Approximation
Mental calculation
Communication
Use of mathematical tools
Arithmetic manipulation
Algebraic manipulation
Handling data

Heuristics
Thinking skills

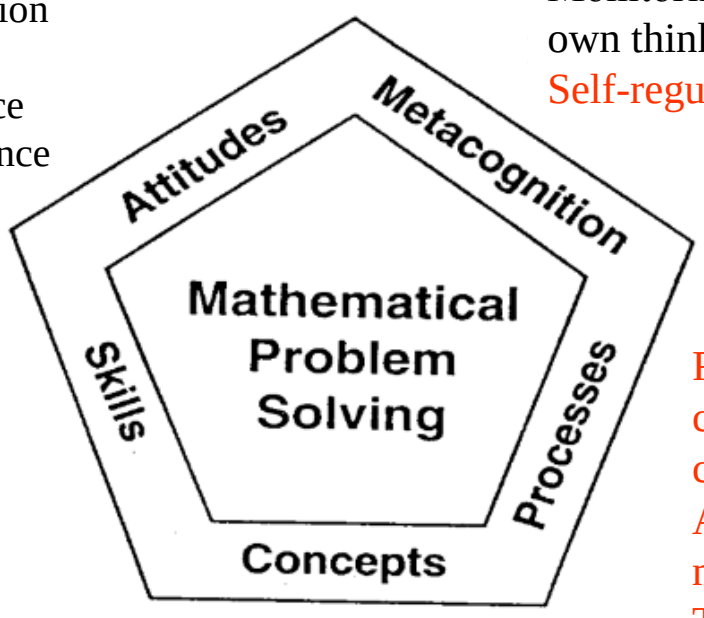
Numerical
Geometrical
Algebraic
Statistical

MOE Mathematics Curriculum Framework

2007 & Beyond

Beliefs
Appreciation
Interest
Confidence
Perseverance

Monitoring one's own thinking
Self-regulation of learning



Numerical calculation
Algebraic manipulation
Spatial visualisation
Data analysis
Measurement
Use of mathematical tools
Estimation

Reasoning, communication & connections
Applications and modeling
Thinking skills and heuristics

Numerical
Geometrical
Algebraic
Statistical
Probabilistic
Analytical

Polya's 4 Stages of Problem-Solving

1. Understanding the problem
2. Devising a plan to solve the problem
3. Carrying out the plan
4. Looking back

Learning from research about the model method

The table show the strategies used by pupils and their success rate.

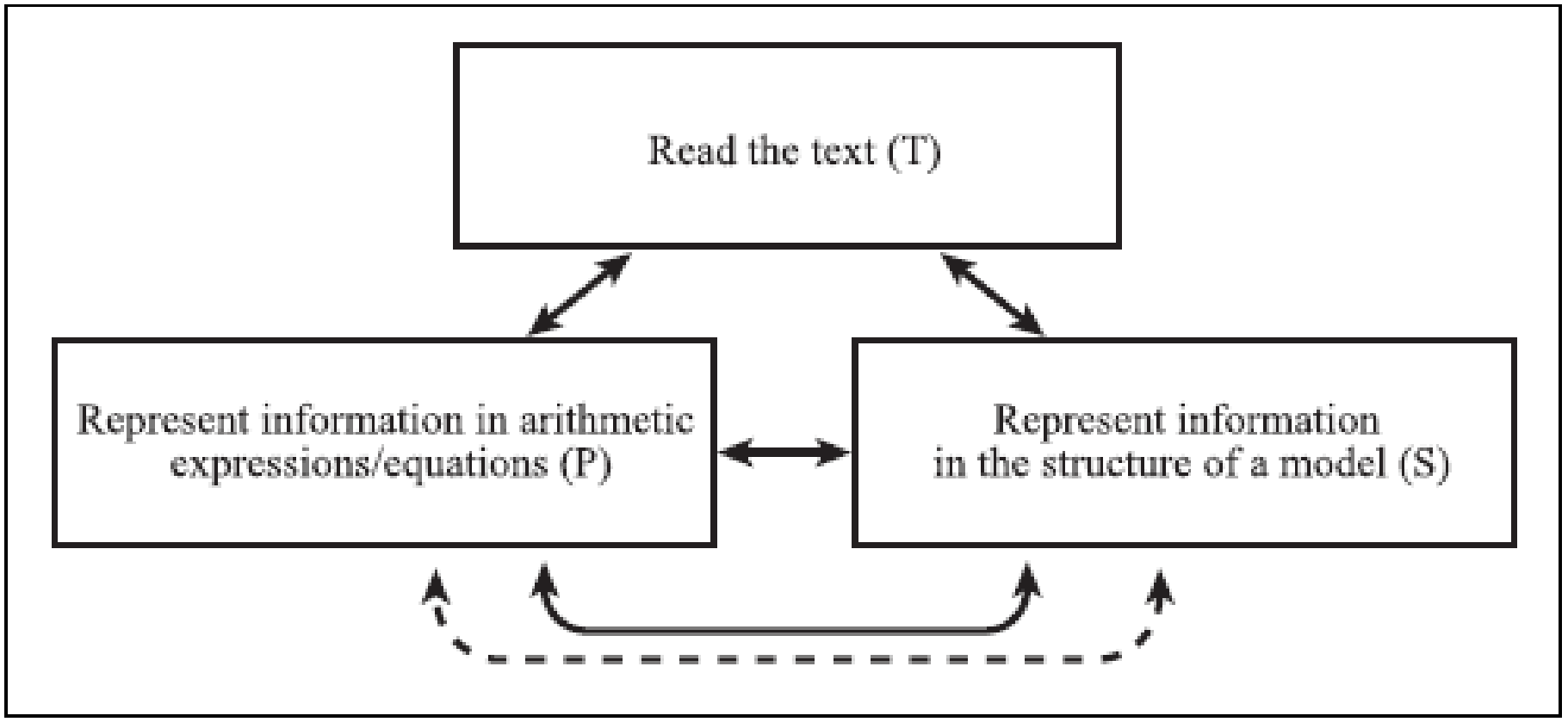
Pupils	Used the model method		Used number sentences	
	No. of pupils	No. successful	No. of pupils	No. successful
High-achievers n = 3	3	3	0	0
Mid-achievers n = 10	10	10	0	0
Low-achievers n = 19	10	8	3	1

Learning from research about the model method

Six potential areas of difficulty pupils have when solving word problems:

1. Difficulty in reading the text
2. Difficulty in comprehending the text
3. Lack suitable strategies to handle the problem
4. Not able to transform information in the text into mathematical forms
5. Lack computational skills
6. Unable to use computation results to solve the problems

Phases of Problem Solving by Children Using the Model Method



The Model Method helps pupils to

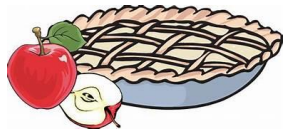
- visualise the situations described in word problems
- gain a deeper understanding of the operations they may use to solve problems
- see relationships between and among the variables in the problem

Let's have a look at this question… (PSLE 2016)

Suyin baked some pies. She gave $\frac{1}{5}$ of them to her relatives and 30 of them to friends. She was left with $\frac{2}{3}$ of the pies. She packed these into 18 boxes. Some boxes contained 6 pies while the rest contained 12.

a) How many pies were packed into the 18 boxes?

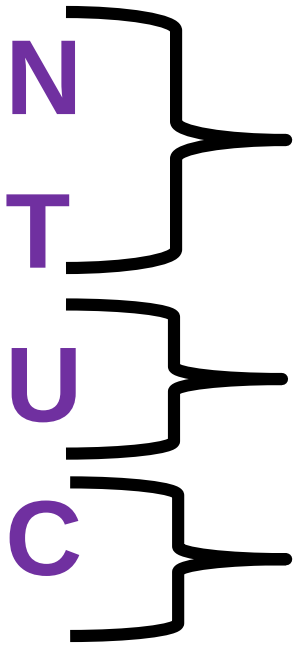
b) How many boxes contained 6 pies?



Features of Bar Models…

- The length of the rectangular bars should be drawn proportionately
  - Captures constraints given in the problem
  - Shows the relationship between and among quantities
- The available information is recorded onto the models and question marks are used to indicate the computation needed to find unknown information

NTUC



Number

Transfer

Units

Calculation

Remainder Model (PSLE Question)

At first, John had some money. He spent $\frac{1}{4}$ of it on a shirt and $\frac{2}{5}$ of the remainder on a pair of shoes. After that, his parents gave him $120. The ratio of the total amount of money he had at the end to the amount of money he had at first was 5 : 4. How much money did John have at first?

Different ways of saying the same thing…

He spent $\frac{1}{4}$ of it on a shirt and $\frac{2}{5}$ of the remainder on a pair of shoes.

II

He spent 25% of it on a T-shirt and 40% of the remainder on a pair of shoes.

Different ways of saying the same thing…

The ratio of the total amount of money he had at the end to the amount of money he had at first was **5 : 4**.

||

The amount of money he had at first was **80%** of the total amount of money he had at the end.

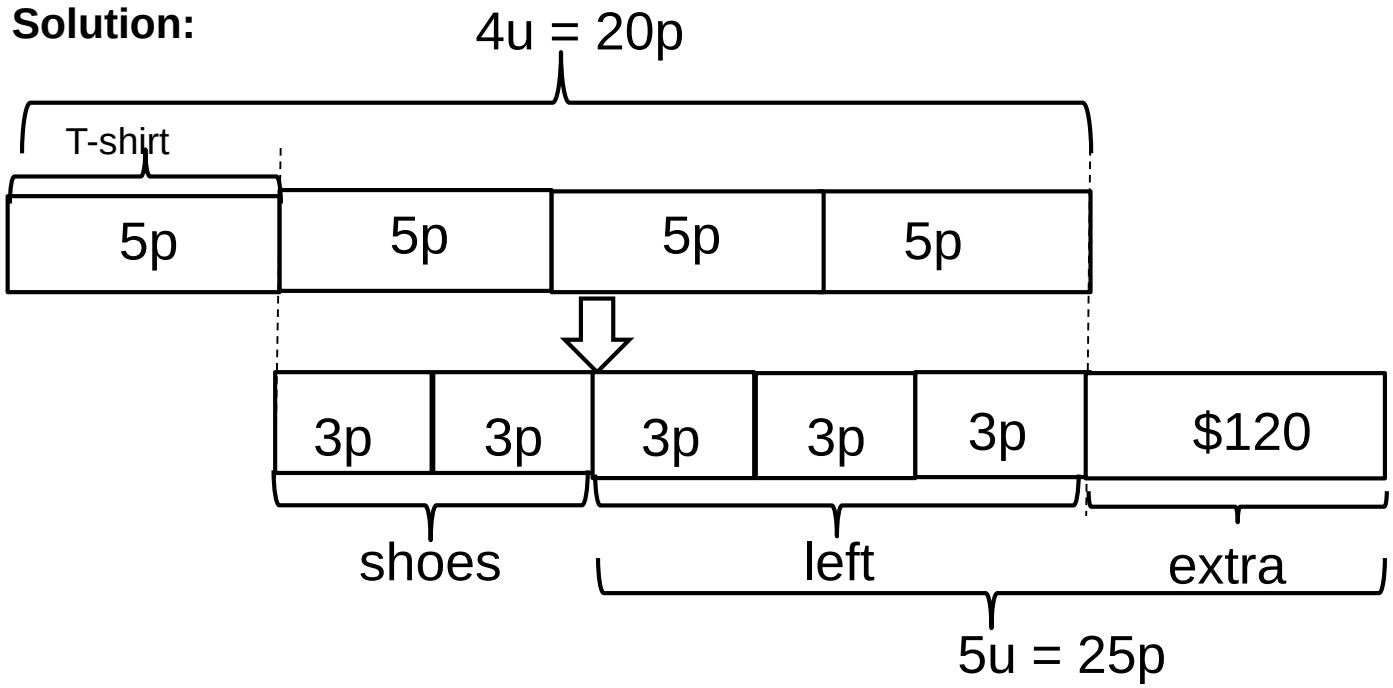
||

The amount of money he had at first was $\frac{4}{5}$ of the total amount of money he had at the end.

Let's solve:

At first, John had some money. He spent $\frac{1}{4}$ of it on a shirt and $\frac{2}{5}$ of the remainder on a pair of shoes. After that, his parents gave him $120. The ratio of the total amount of money he had at the end to the amount of money he had at first was 5 : 4. How much money did John have at first?

Solution:



LCM of 3 and 5:
3,6,9,12,15
5, 10, 15

1u = 5p
5u = 5 x 5p
= 25p

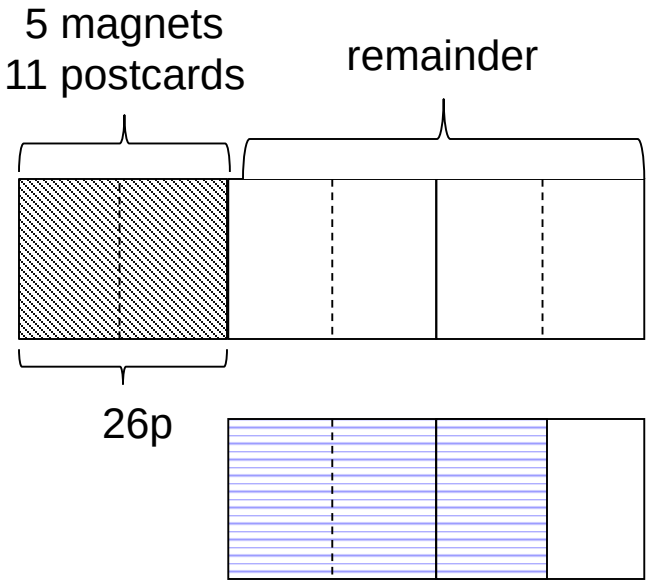
25p – 3 x 3p = 16p
16p = 120
1p = 120 ÷ 16
20p = 20 x 120 ÷ 16
= 150

John had $150 at first.

Remainder model (PSLE Question)

Kai Le spent $\frac{1}{3}$ of her money on 5 magnets and 11 postcards. The cost of each magnet is 3 times the cost of each postcard. She bought some more magnets with $\frac{3}{4}$ of her remaining money. How many magnets did Kai Le buy altogether?

Solution:



1 magnet 

1 postcard 

5 magnets : 3p x 5 = 15p
11 postcards : 1p x 11 = 11p

15p + 11p = 26p

2u = 26p
1u = 26p ÷ 2
= 13p

3 u = 13p x 3 = 39p

1 magnet is 3p
39p = 39p ÷ 3p = 13 magnets

Total number of magnets = 13 + 5 =18

Let’s try solving some questions now….

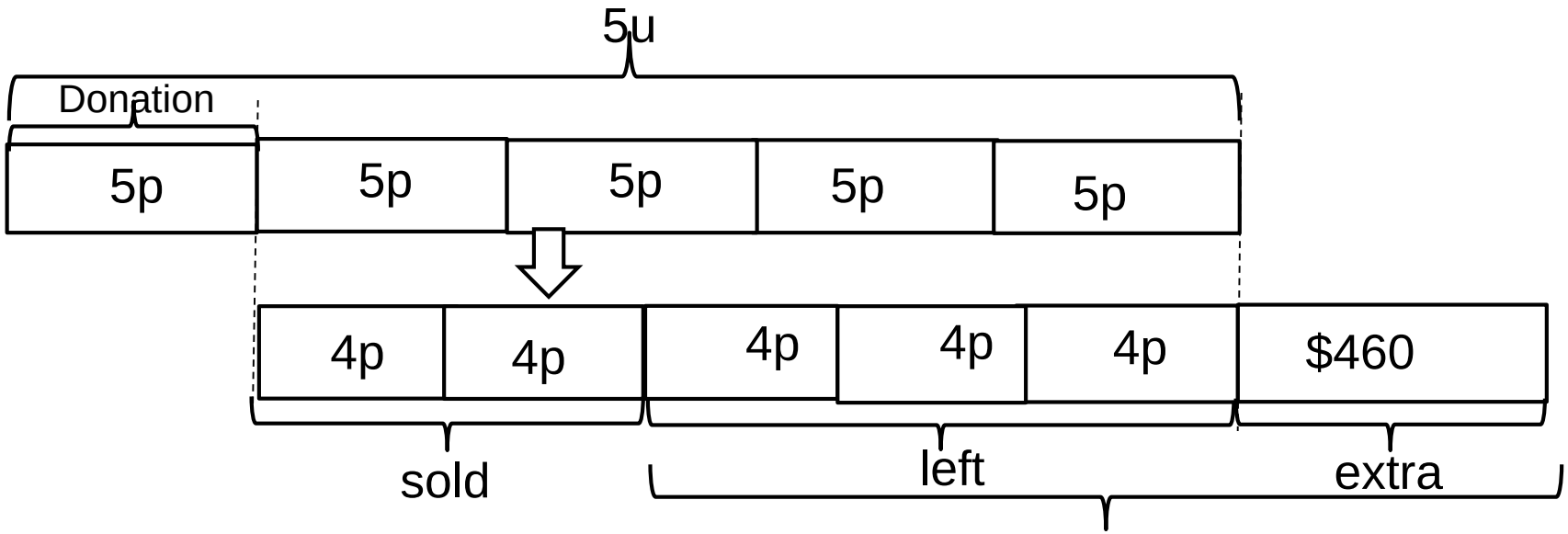
Remainder Model (PSLE Question)

At first, Jenny had some stamps. She donated 20% of it to a children's home and sold 40% of the remainder. After that, she bought 460 stamps.

The ratio of the total number of stamps she had at the end to the number of stamps she had at first was 7 : 5.

How many stamps did Jenny have at first?

Solution:



$$20\ \% = \frac{20}{100} = \frac{1}{5}$$

$$40\% = \frac{40}{100} = \frac{2}{5}$$

LCM of 4 and 5 :
4, 8,12,16, 20
5 ,10, 16, 20

1u = 5p
7u = 7 x 5p
= 35p
35p – 3 x 4p = 23p
23p = 460
1p = 460 ÷ 23
25p = 25 x 460 ÷ 23
= 500

Jenny had $500 at first.

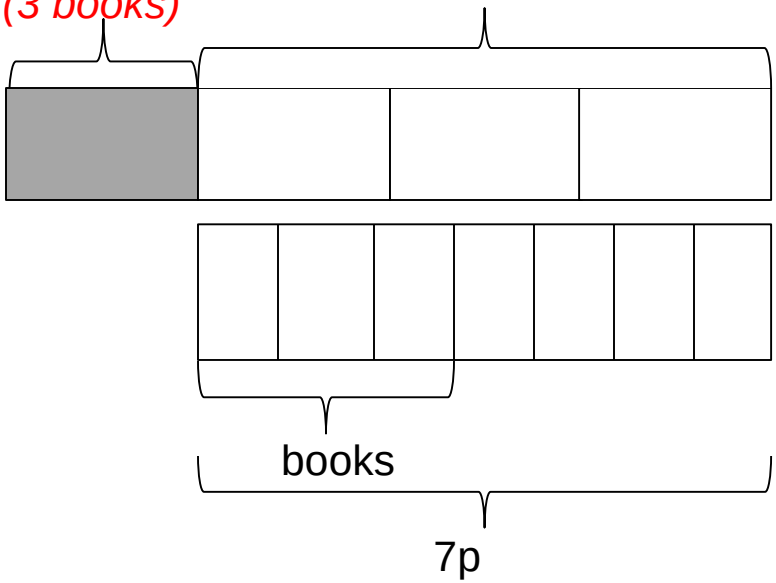
Remainder model (PSLE Question)

Jack spent $\frac{1}{4}$ of his money on 4 books and 6 magazines. The cost of each magazine is half the cost of each book. He bought some more books with $\frac{3}{7}$ of his remaining money. How many books did Jack buy altogether?

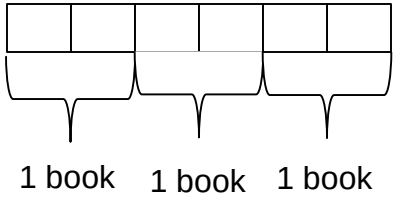
Solution:

4 books
6 magazines
(3 books)

3u = 21 books
remainder



1 magazine is 1p
1 Book is 2 p



6 magazine can be exchanged for 3 books

1 u = 7 books
3 u = 21 books

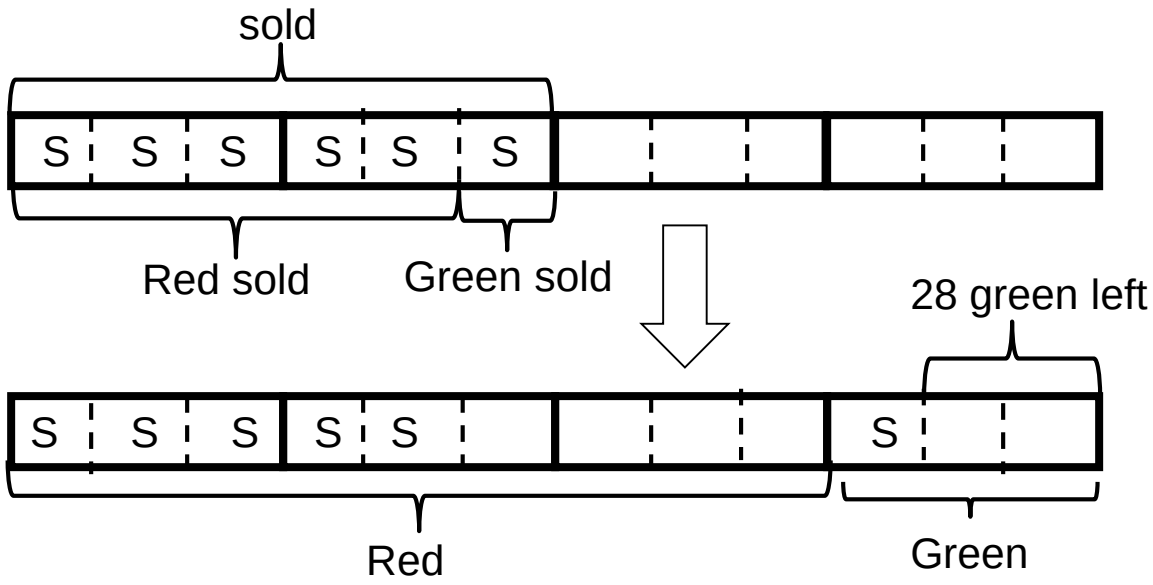
21 books is 7p
1p = 21 ÷ 7 = 3
3p = 3 x 3 = 9

Total books = 9 + 4 = 13 books

Part-whole Model (PSLE Question)

At Mr Chan's fruit stall, $\frac{3}{4}$ of the apples were red and the rest were green. He sold $\frac{1}{2}$ of the total amount of apples. $\frac{5}{6}$ of the apples sold were red. 28 green apples were left. How many red apples did Mr Chan sell?

Solution:



LCM of 1 and 6:
2,4,6
6

28 ÷ 2 = 14
14 x 5 = 70

Mr Chan sold 70 red apples.

Q & A


thank
you