Building mathematical understanding

Pearl read 10 pages of a book on Monday.

She read 1/3 of the remainder on Tuesday.

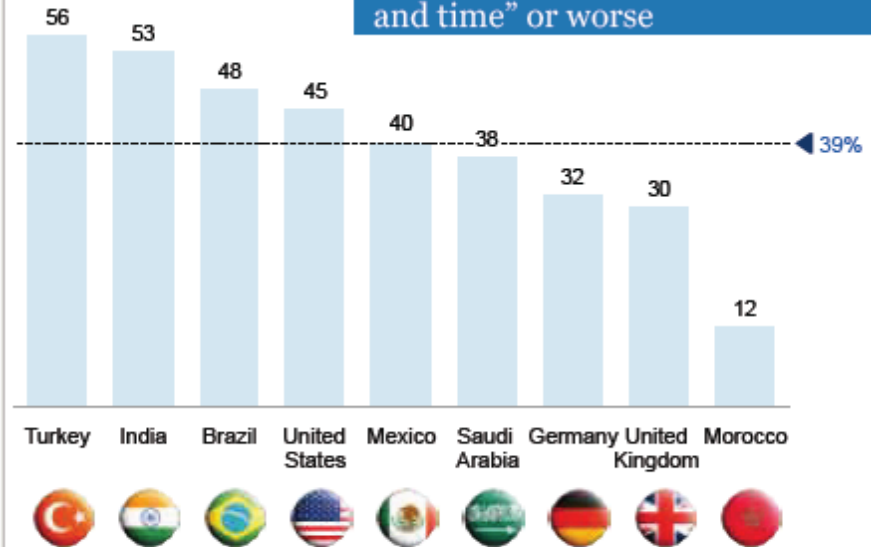If she still had 24 pages to read, how many pages were there in the book?

Despite high levels of youth unemployment we are continuing to see a shortage of job seekers with critical skills.

39% of employers say a skills shortage is a leading reason for entry-level vacancies

Lack of skills is a common reason for entry-level vacancies
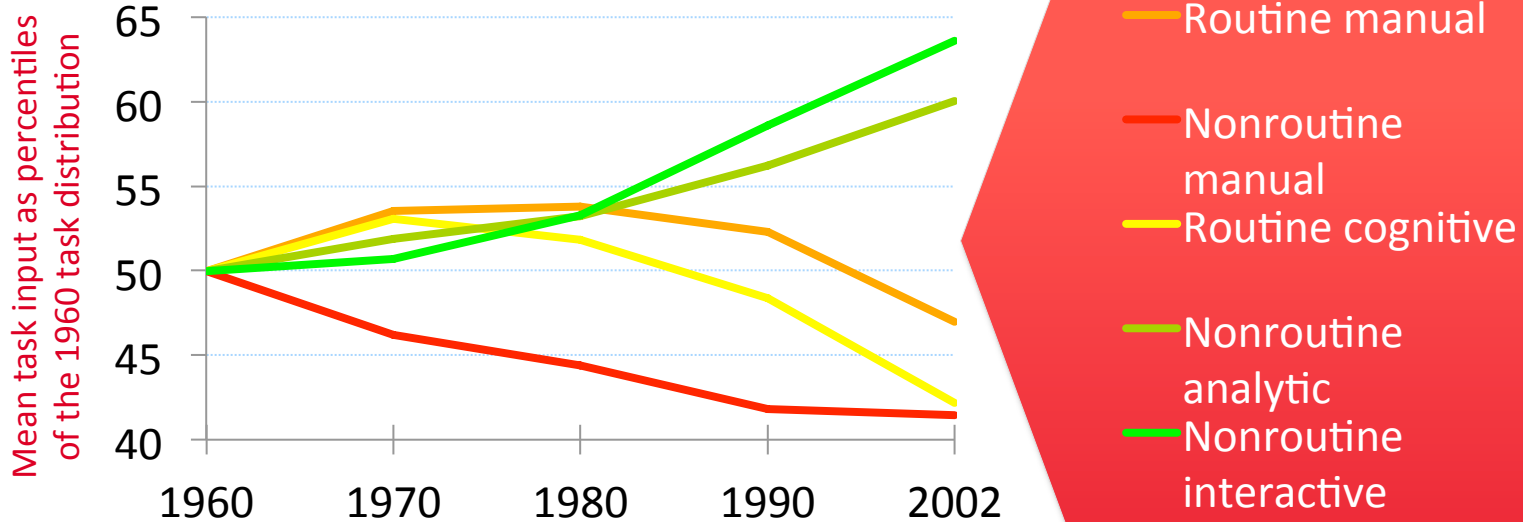
% of employer respondents

36% of employers also reported a lack of skills caused "significant problems in terms of cost, quality, and time" or worse

Turkey	India	Brazil	United States	Mexico	Saudi Arabia	Germany	United Kingdom	Morocco
56	53	48	45	40	38	32	30	12

◀ 39%

SOURCE: McKinsey survey, Aug-Sept 2012

How the demand for skills changed from the 90s and early 2000s

Economy-wide measures of routine and non-routine task input

Legend:
- Routine manual
- Nonroutine manual
- Routine cognitive
- Nonroutine analytic
- Nonroutine interactive

Y-axis: Mean task input as percentiles of the 1960 task distribution (40–65)
X-axis: 1960, 1970, 1980, 1990, 2002

The New Division of Labor: How Computers Are Creating the Next Job Market
Frank Levy & Richard J. Murnane

SCHOLASTIC
open a world of possible

The dilemma:

The skills that are easiest to teach and test are also the ones that are easiest to digitize, automate and outsource.
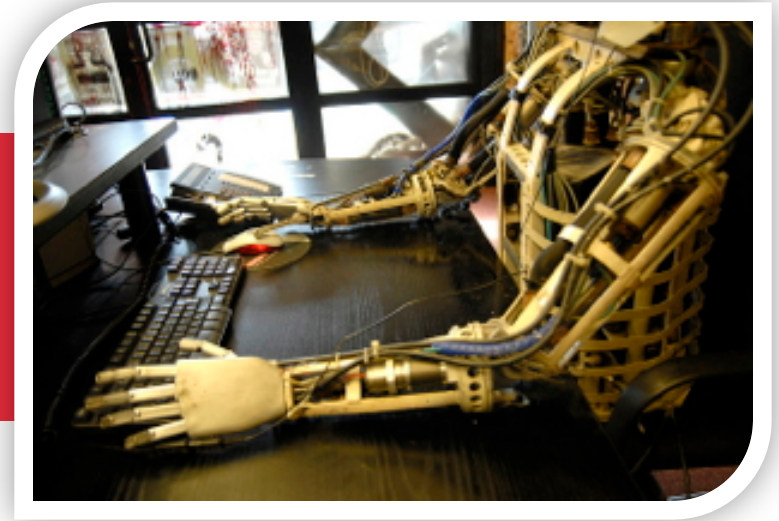
The future:

Belongs to those who excel in solving problems for which there are no rules-based solutions, and interacting with people to acquire and understand information, and persuade others of its implications for action.

Education systems are looking for different pedagogies with proven results to improve students' achievement to meet employers' changing needs.

Average mathematics scores (TIMSS 2007)
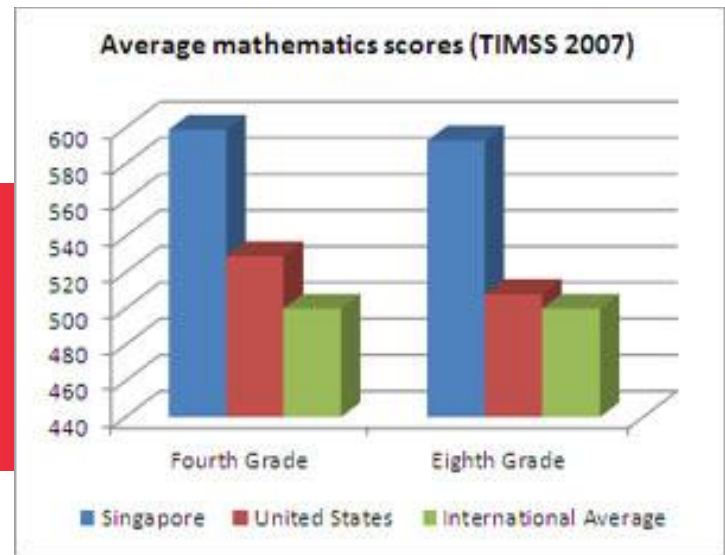
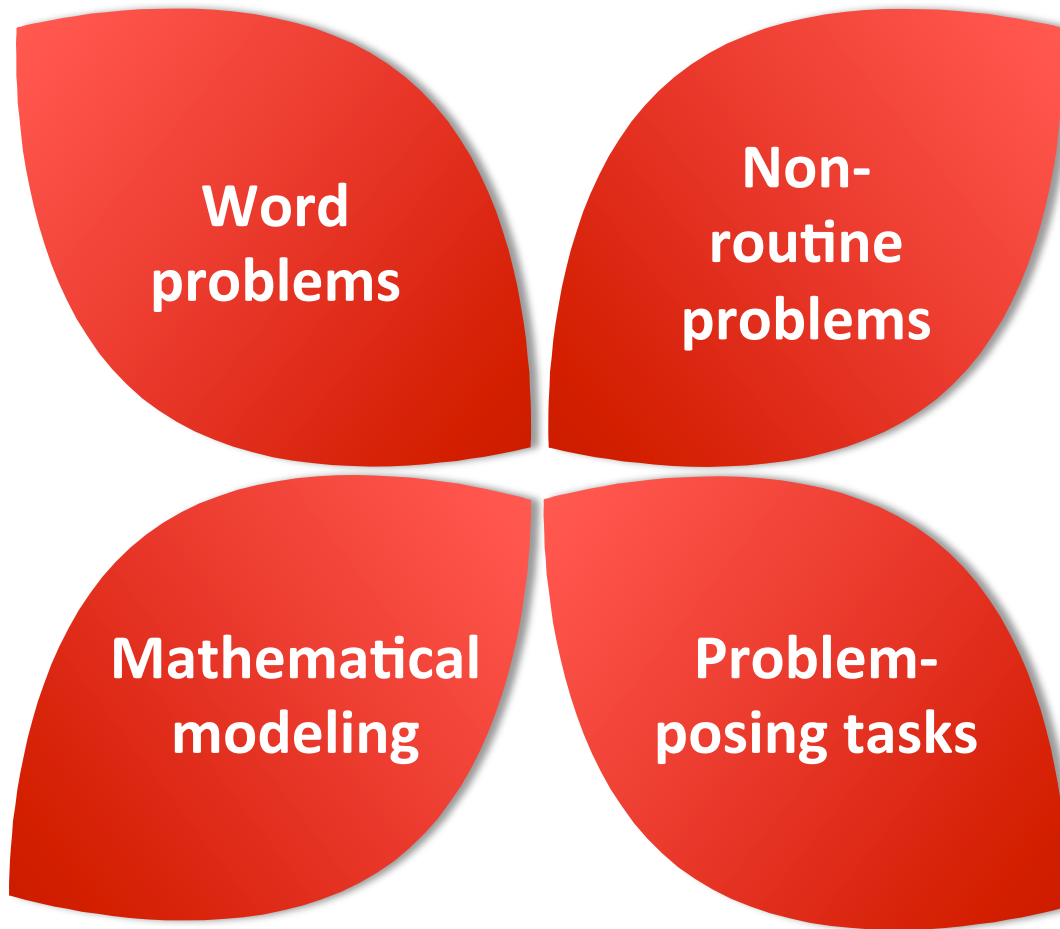**Singapore's approach to teaching and learning mathematics is now used in more than 50 countries**

- Australia
- Bahrain
- Bangladesh
- Botswana
- Brazil
- Brunei
- Cambodia
- Chile
- China
- Colombia
- Denmark
- Egypt
- Fiji Islands
- Finland
- France
- Germany
- Ghana
- Hong Kong
- India
- Indonesia
- Israel
- Japan
- Jordan
- Kenya
- Korea
- Laos
- Lesotho
- Libya
- Malaysia
- Mauritius
- Mexico
- Myanmar
- Netherlands
- Nigeria
- Oman
- Pakistan
- Panama
- PNG
- Peru
- Philippines
- Qatar
- Rwanda
- Saudi Arabia
- Seychelles
- Singapore
- Solomon Islands
- South Africa
- Sri Lanka
- Sudan
- Taiwan
- Thailand
- Trinidad & Tobago
- Turkey
- UAE
- United Kingdom
- USA
- Vietnam
- Zimbabwe

What features of the Singapore approach to mathematics is making it an overwhelming favourite worldwide?

Teaches via problem-solving

- provides students with a context for learning mathematical knowledge

- is a vehicle for developing logical thinking

- enhances transfer of skills to unfamiliar situations

- allows students to construct their own ideas about mathematics and to take responsibility for their own learning

PR1ME Mathematics

4 key types of problem:

Word problems

Non-routine problems

Mathematical modeling

Problem-posing tasks

Word problems

✓ allow students to view the concepts / skills they have learnt in a context thus making mathematics relevant to daily life

✓ assess students' ability to apply knowledge learnt

Let's Do

1. Danny has 34 key chains.
   He buys 5 more.
   How many key chains does he have now?

Let's Learn

Sonia ate $\frac{3}{8}$ of a melon.

William ate $\frac{1}{2}$ of the same melon.

Who ate a bigger portion of the melon?

Non-routine problems

✓ develop higher order thinking skills and use of problem solving strategies

Mind stretcher

Let's Learn

Jo baked a round cake.
She invited 7 friends to share the cake with her.
How many ways can she cut the cake equally so that everyone gets 1 piece?

Mind stretcher

Let's Learn

$$\frac{2}{\blacksquare} + \frac{2}{\blacksquare} = 1$$

What are the two possible pairs of denominators that are missing above?

Problem-posing tasks

Create Your Own!

Change the numbers in the word problem.
Then, solve the word problem.
Show your work clearly.

Reno jumps 141 centimeters from the start line.
Eloy jumps 10 centimeters further than Reno.
a) How far did Eloy jump?
b) What is the total distance jumped by
    the two boys?

Create Your Own!

Write a word problem using these words and measurements.

jug	1 L 350 ml	more
3 L 745 ml	bottle	capacity

✓ Students communicate their understanding of word problems and improve their conceptual understanding

✓ Students engage in a range of higher order thinking skills

Mathematical Modeling

Mathematical Modeling

Designing Birthday Cards

Task
Creative Cards Company has invited your team to design a new series of birthday cards. Come up with five birthday card designs.

Condition
The company makes birthday cards with a maximum area of 300 square centimeters.

- ✓ Students form various perspectives of real-world problem situations
- ✓ Students model solutions using a variety of data representations
- ✓ Allows for collaborative learning

Problem-solving method

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Emphasis on bar-model as a problem-solving strategy

✓ Allows students to solve complex word problems using visual representation

PR1ME Mathematics

Emphasis on bar-model as a problem-solving strategy

Pearl read 10 pages of a book on Monday. She read 1/3 of the remainder on Tuesday. If she still had 24 pages to read, how many pages were there in the book?

< Monday > <   Tuesday   >

<   10   >   < ------------------ 24 ------------------ >

< ------------------------------------ ? ------------------------------------ >
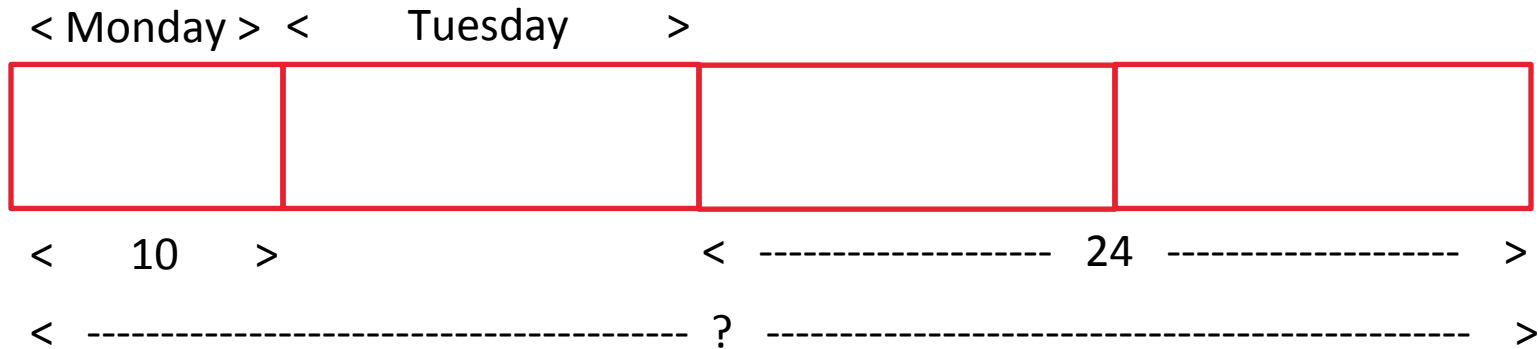
What do I need to find?
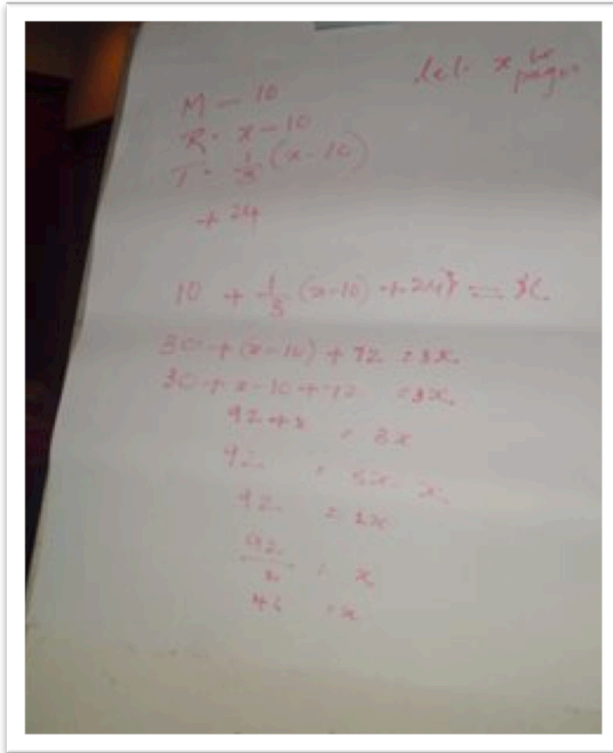
2 units → 24
1 unit → 12
3 units → 36

36 + 10 = 46

There were 46 pages in the book.

Problem-solving method

The same problem solved using algebra

Use the bar-model as a problem-solving strategy for the below

There are 840 ml of water left in a bottle after Paul and his 3 friends shared some water equally. If the bottle contained 1 litre 800 milliliters of water at first, how many litres of water did each of them drink?
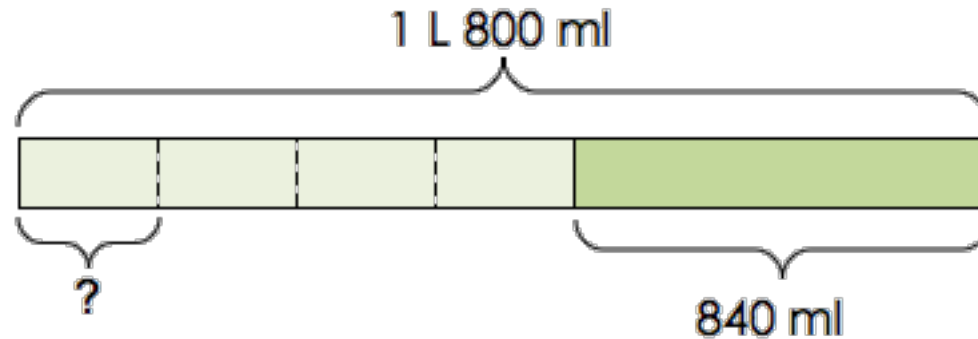
What do I need to find?

1 L 800 ml = 1800 ml
1800 ml − 840 ml = 960 ml

960 ml ÷ 4 = 240 ml
240 ml = 0.24 L

Each of them drank
0.24 litres of water.

Use the bar-model as a problem-solving strategy for the below

There were 440 boys and girls in a school hall. After 5/7 of the boys and 1/3 of the girls left the hall, an equal number of boys and girls remained. How many boys were there in the hall at first?

$1 - 5/7 = 2/7$
2/7 of the boys remained

< -------------------------------------- ? -------------------------------------- >

BOYS

GIRLS

440

$1 - 1/3 = 2/3$
2/3 of the girls remained

10 units = 440
1 unit = 44
7 units = 308
There were 308 boys in the hall at first

PR1ME Mathematics

Concrete-Pictorial-Abstract approach

Concepts are taught using physical representations, followed by pictorial representations and finally symbolic representations

Concrete:

Math Lab

Pictorial:

Picture It

Abstract:
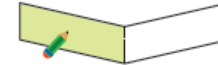
1 2 4 3 +

Lesson 2   Equivalent Fractions

You will learn to...
• find equivalent fractions
• express a fraction in its simplest form
• compare using equivalent fractions
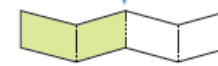
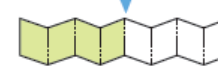**Understanding equivalent fractions**

Let's Learn

$\frac{1}{2}$ of the paper is shaded.

1 out of 2 equal parts

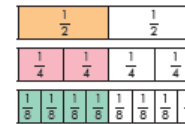$\frac{2}{4}$ of the paper is shaded.

2 out of 4 equal parts

$\frac{4}{8}$ of the paper is shaded.

4 out of 8 equal parts

The fractions $\frac{1}{2}$, $\frac{2}{4}$ and $\frac{4}{8}$ have different numerators and denominators, but they are equal.

$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$

$\frac{1}{2}$, $\frac{2}{4}$ and $\frac{4}{8}$ are equivalent fractions.

$\frac{2}{4}$ and $\frac{4}{8}$ are different ways of writing $\frac{1}{2}$.

Two more equivalent fractions of $\frac{1}{2}$ are $\frac{3}{6}$, $\frac{5}{10}$

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Concrete-Pictorial-Abstract approach in practice

Mrs. Mitchell has 3 cakes.

She divides them equally among her 4 children.
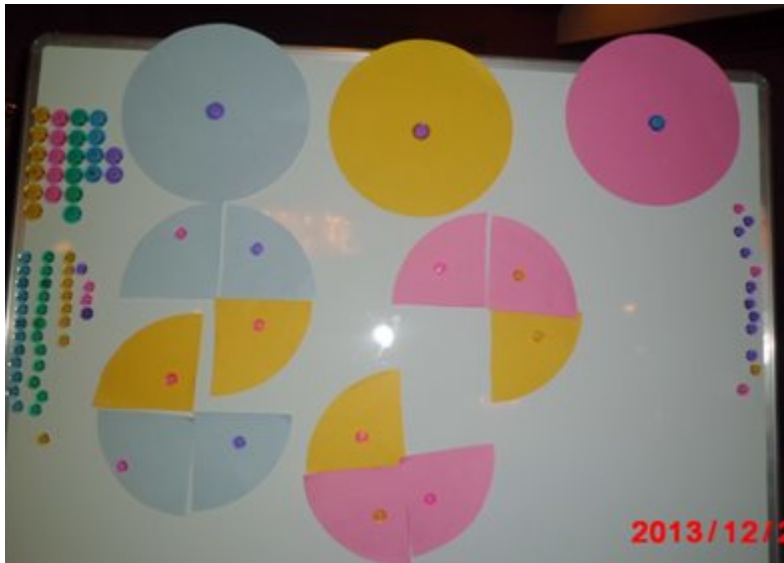
How much cake does each child get?

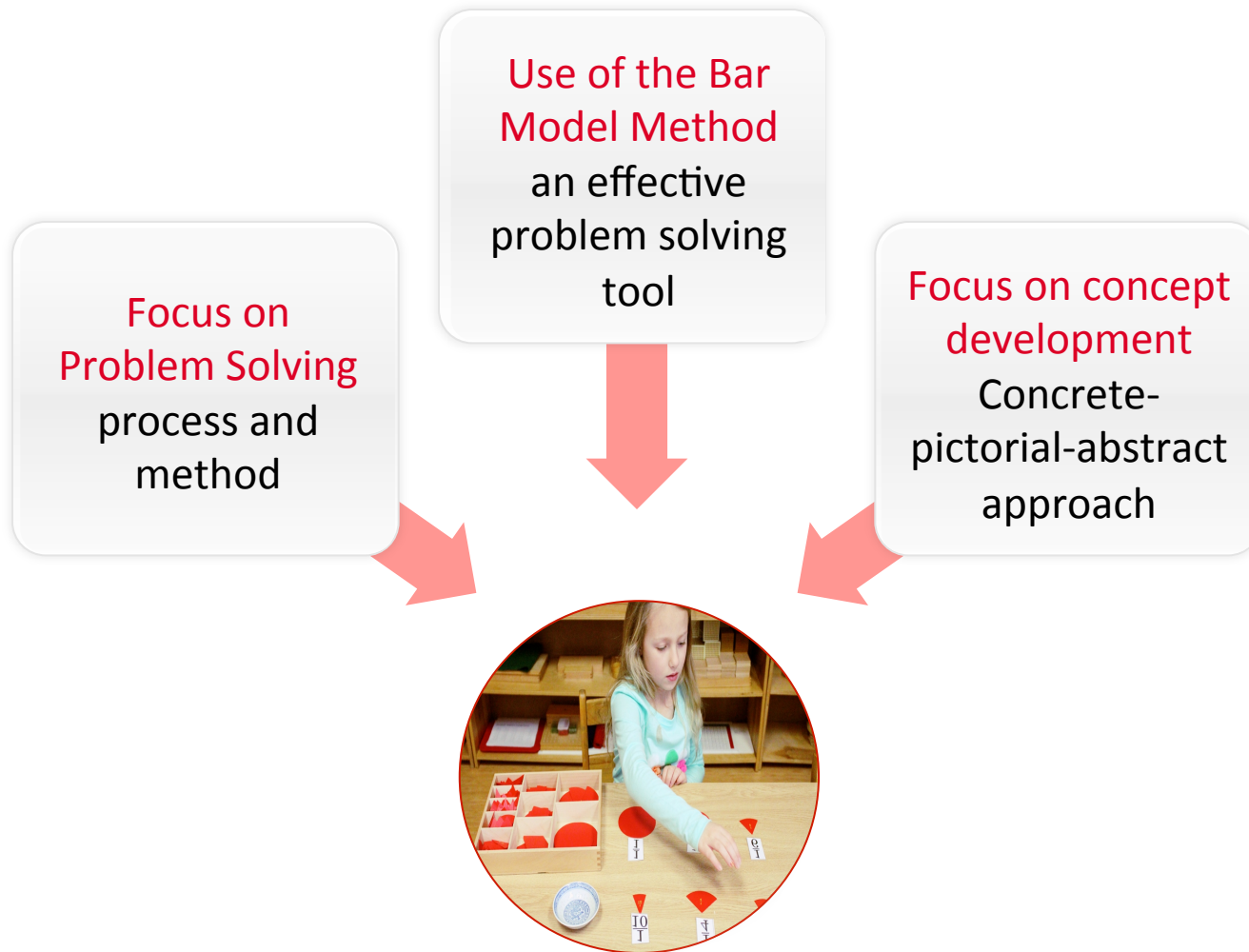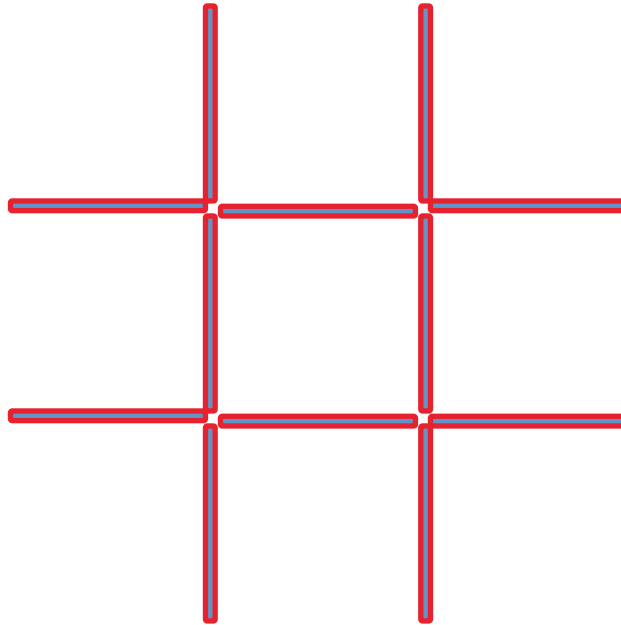**Concrete visual representations of the solution**

Key takeaways of this approach to mathematical learning and thinking:

Focus on Problem Solving
process and method

Use of the Bar Model Method
an effective problem solving tool

Focus on concept development
Concrete-pictorial-abstract approach

Move 3 sticks to make 3 squares.

How many sticks
do I have to move?

scholastic.com/worldofpossible   rtheakston@scholastic.com   #sharepossible