



***Literacy &  
Numeracy for  
the Teaching  
of Problem  
Solving  
Workshop 6***

Bernie O'Donoghue

# Learning Intentions

Appreciate:

- ❑ literacy and numeracy understanding in mathematics as the key to successful problem solving
- ❑ the use of print and broadcast media as motivations for problem solving
- ❑ the focus on understanding the problem
- ❑ the use of student mathematical contributions

# Mapping Numeracy to Mathematics

**Think and communicate  
quantitatively**

**Make sense of data**

**Have spatial awareness**

**Understand patterns and  
sequences**

**Solve problems**

# Mapping Numeracy to Mathematics

**Stand 3 Number**

**Think and communicate  
quantitatively**

**Strand 1 Statistics and Probability**

**Make sense of data**

**Strand 2 Geometry and Trigonometry**

**Have spatial awareness**

**Strand 4&5 Algebra & Functions**

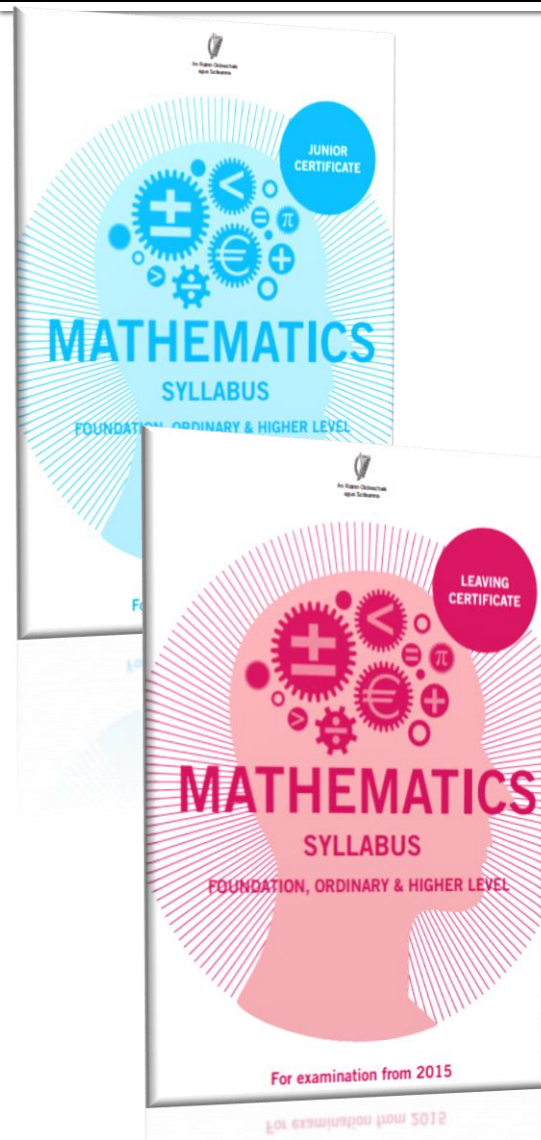
**Understand patterns and  
sequences**

**Synthesis and Problem Solving**

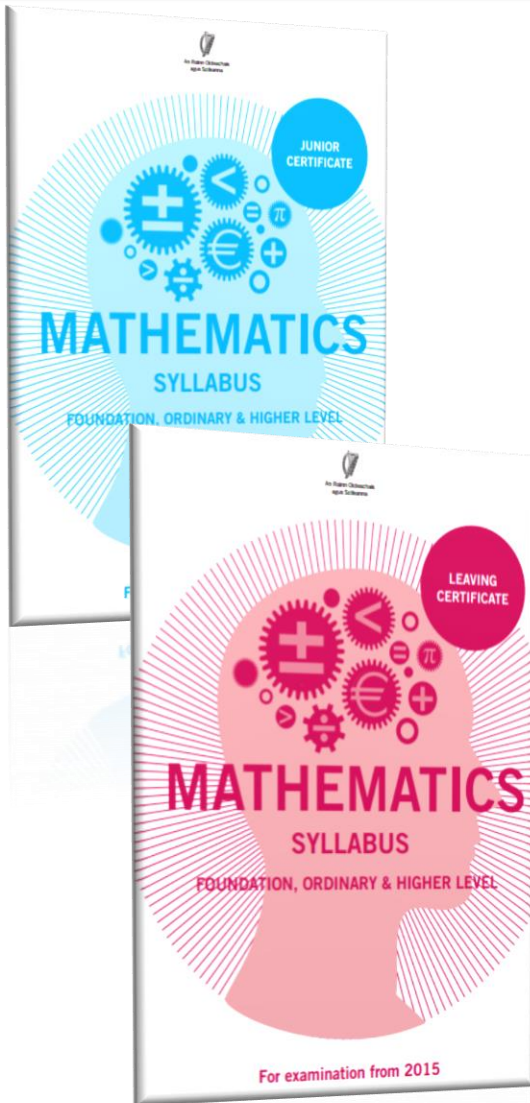
**Solve problems**

# Rationale for Problem Solving

- JC Syllabus 92 references
- LC Syllabus 103 references
- Problem solving means engaging in a task for which the solution is not immediately obvious (p.10)



# Rationale for Problem Solving



- In the mathematics classroom problem solving should not be met in isolation, but should permeate all aspects of the teaching and learning experience.
- Problems may concern purely mathematical matters or some applied context. (p.10)

# Synthesis and Problem Solving

communicate mathematics verbally and in written form

explain findings

justify conclusions

**Literacy**

explore patterns and formulate conjectures

apply their knowledge and skills to solve problems in  
familiar and unfamiliar contexts

**Numeracy**

analyse information presented verbally and translate it into  
mathematical form

devise, select and use appropriate mathematical models,  
formulae or techniques to process information and to draw  
relevant conclusions.

**Literacy and  
Numeracy**



## Mathematical Quality of Instruction

- Linking between Representations
- Patterns and Generalisations
- Mathematical Language
- Mathematical Sense Making
- Explanations
- Multiple Procedures or Solution Methods
- Remediation of Student Errors and Difficulties
- Teacher uses student mathematical contributions





## Mathematical Quality of Instruction

- Remediation of Student Errors and Difficulties
- Teacher uses student mathematical contributions

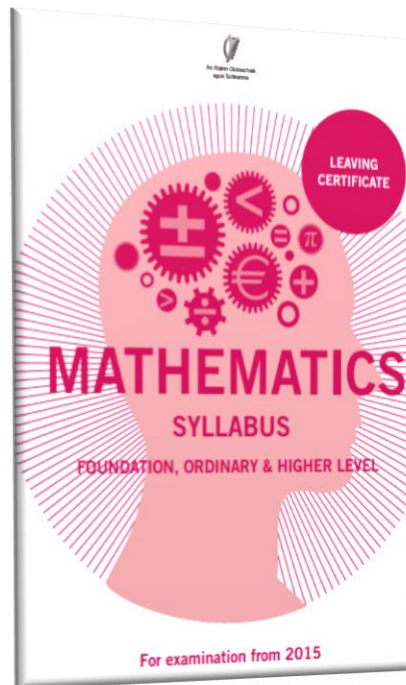
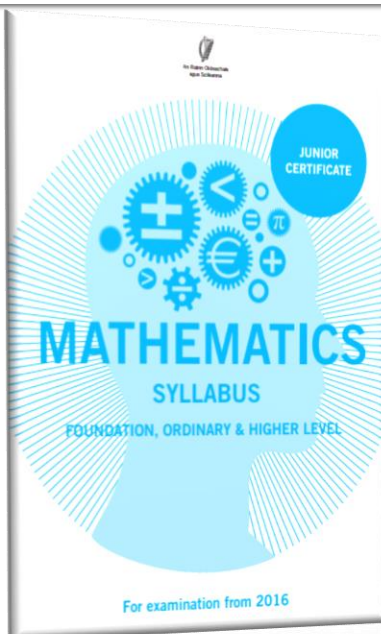
# WS1: Numeracy Model

*Goos, Geiger, and Dole*

Table 1: Description of elements of the numeracy model

Element of model	Description of element
Mathematical knowledge	Mathematical concepts and skills; problem solving strategies; estimation capacities.
Contexts	Capacity to use mathematical knowledge in a range of contexts, both within schools and beyond school settings.
Dispositions	Confidence and willingness to use mathematical approaches to engage with life-related tasks; preparedness to make flexible and adaptive use of mathematical knowledge.
Tools	Use of material (models, measuring instruments), representational (symbol systems, graphs, maps, diagrams, drawings, tables, ready reckoners) and digital (computers, software, calculators, internet) tools to mediate and shape thinking.
Critical orientation	Use of mathematical information to: make decisions and judgements; add support to arguments; challenge an argument or position.

# WS<sub>1</sub>: JC&LC Objectives



The objectives of Junior Certificate Mathematics are that learners develop mathematical proficiency, characterised as

- *conceptual understanding*—comprehension of mathematical concepts, operations, and relations
- *procedural fluency*—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- *strategic competence*—ability to formulate, represent, and solve mathematical problems in both familiar and unfamiliar contexts
- *adaptive reasoning*—capacity for logical thought, reflection, explanation, justification and communication
- *productive disposition*—habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence, perseverance and one's own efficacy.

# Strategy: 'How To Solve It'



**Understand the Problem**

**Devising a plan**

**Carrying Out the Plan**

**Looking Back**

Polya, G.1957

# Problem Solving Strategies



A cartoon illustration of a clown with orange hair, a blue hat, and a striped shirt, holding a green balloon. The clown is smiling and looking towards the right. The background is a simple green gradient.



### Use an Equation





# Pólya (Best Motivation) & Meyer (Headache)



# Three Acts of a Mathematical Story

## Meyer: Real life Context

act one



1. How many sugar packets do you think are inside a 20-oz bottle of soda?
2. Guess as close as you can.
3. Give an answer you know is too high.
4. Give an answer you know is too low.

Estimation

# Three Acts of a Mathematical Story: Real Life Context

act one



1. How many sugar packets do you think are inside a 20-oz bottle of soda?
2. Guess as close as you can.
3. Give an answer you know is too high.
4. Give an answer you know is too low.

What information will you need to know to solve the problem?



# Information Required

Coca-Cola

20 fl oz bottle

GO



nutrition

ingredients

varieties

## Nutrition Facts

Serving Size 1 bottle

Servings Per Container 1

### Amount Per Serving

Calories 240

% Daily Value\*

Total Fat 0g 0%

Sodium 75mg 3%

Total Carbohydrate 65g 22%


Sugars 65g

Protein 0g

Not a significant source of fat, calories, saturated fat, trans fat, cholesterol, fiber, vitamin A, vitamin C, calcium and iron.

\*Percent Daily Values (DV) are based on a 2,000 calorie diet.

# Information Required



*We'll Always Be Your Sugar!*

ABOUT US | PARTY CENTRAL | BAKING MADE EASY | FUN CORNER | RECIPES

**SEARCH**  
*our site*

GO


☐ Search Recipes  
☒ Search Entire Site

**MY**  
*recipes*

Create a virtual cookbook by collecting all your favorite recipes from this site. Returning users please login below. New users please [click here to register](#).

USERNAME:   
PASSWORD:

LOGIN



**PERSONALIZE**  
*your baking*

Add a special touch to your homemade baked goods with these handy accessories you can personalize and print right from your home computer. What better way to say - "Baked with love!"


Gift Tags for your Baked Items:  
[Baking Gift Tags](#)  
[Holiday Gift Tags 1](#)

SHARE | EMAIL

**Sugar Packets**

Each packet contains one portion of 100% pure Superfine Granulated Sugar. At home, at work, the go, Domino® Sugar Packets are always so convenient.

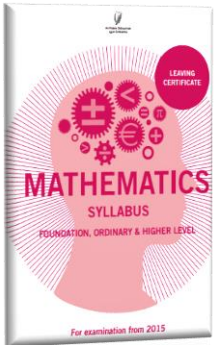
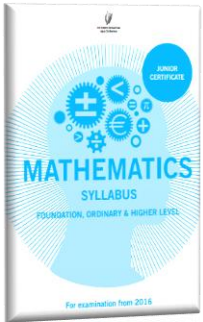
Available Sizes:  
50 count box  
100 count box



Domino® Sugar - Nutrition Facts -- Sugar Packets

Nutrition Facts	
Serving size 1 Teaspoon (4g)	
Amount Per Serving	
<b>Calories</b>	15
% Daily Value*	
<b>Total Fat</b>	0g 0%
<b>Sodium</b>	0mg 0%
<b>Total Carbohydrate</b>	4g 1%
Sugars 4g	
<b>Protein</b>	0g
*Percent Daily Values are based on a 2,000 calorie diet.	

# Syllabus



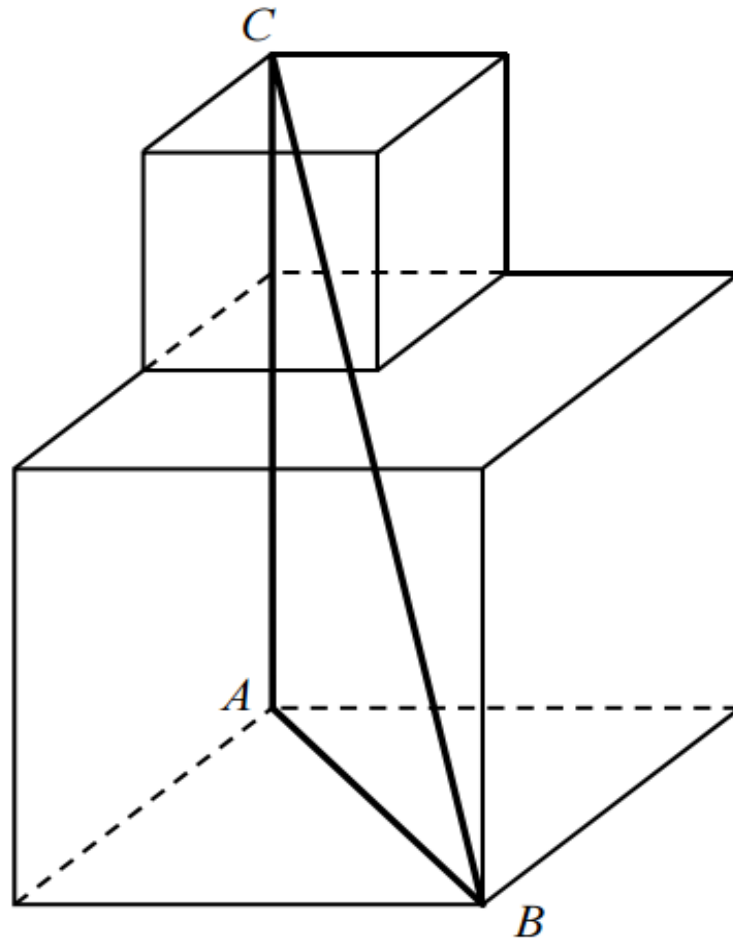
In a mathematics problem-solving environment it is recognised that there are three things learners need to do:

- make sense of the problem
- make sense of the mathematics they can learn and use when doing the problem
- arrive at a correct solution to the problem. (p.10)

## Mathematical Context:

Find the length of the part of the line  $BC$  that is inside the larger cube

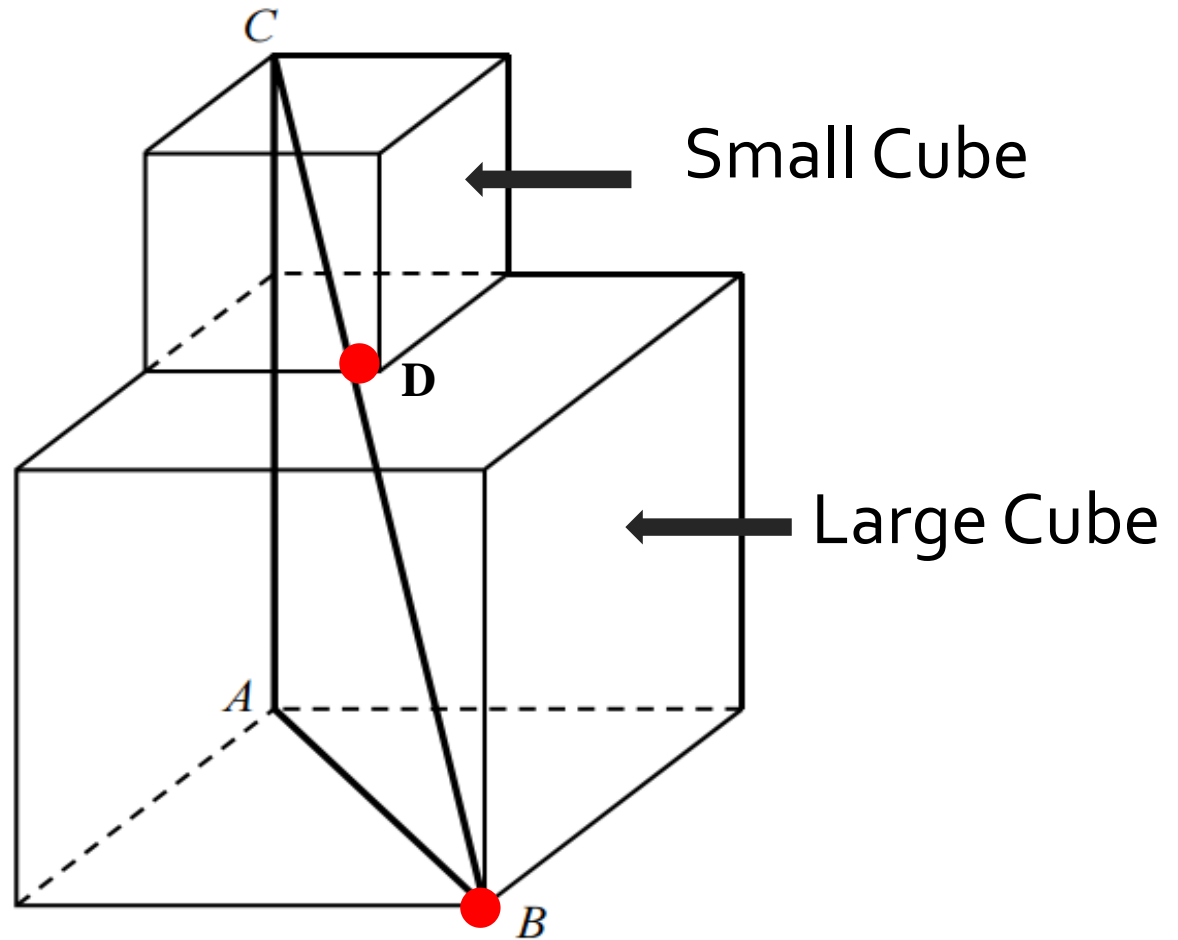
What  
information  
are we given in  
the question?



# Find the length of the part of the line $BC$ that is inside the larger cube

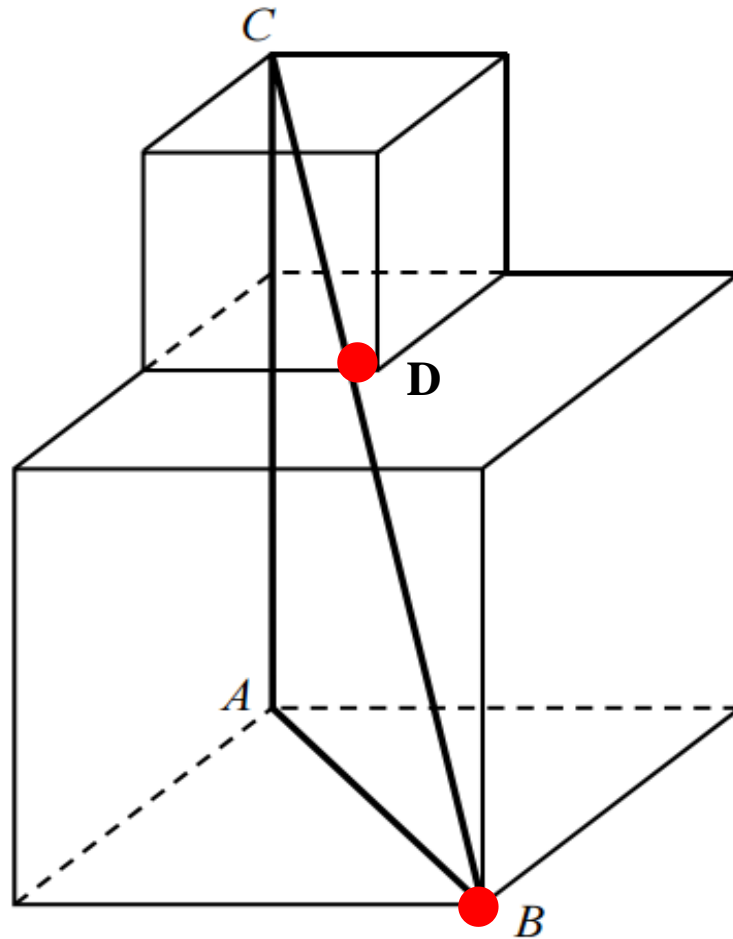
What information are we given in the question?

Find  $|BD|$



# Find the length of the part of the line BC that is inside the larger cube

What  
information do  
we require?



# Broadcast Media: Number Pattern leading to Exponential Function







**Míle buíochas**