Dallas, We have a Problem

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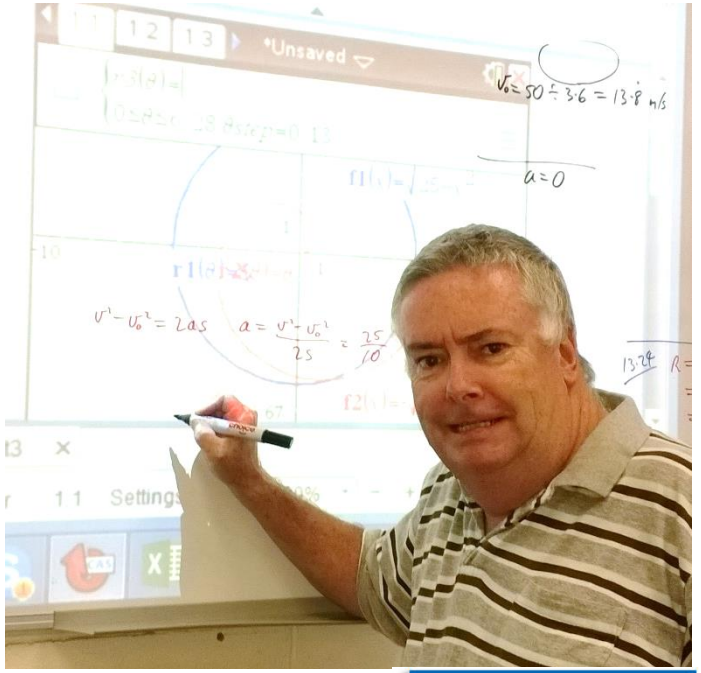

This year marks the 50th anniversary of the Apollo 13 lunar mission. Who can remember this remarkable event from their own timeline? Who knows of it from the 1995 Tom Hanks film? Who has visited the NASA Space Center in Houston? We will start this session by using Ron Howard's inspiring docudrama as a springboard to consider problem-solving. We will formalize what the problem-solving process involves, with consideration of Polya's 4 Steps, and for the application phase, we will examine some engaging problems and lesson plans that are freely available for download from TI websites.

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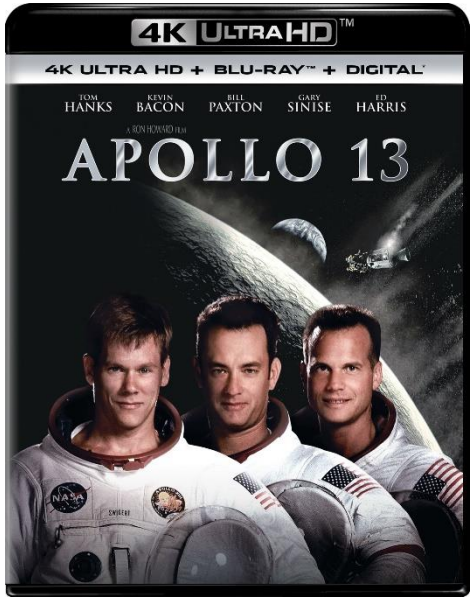
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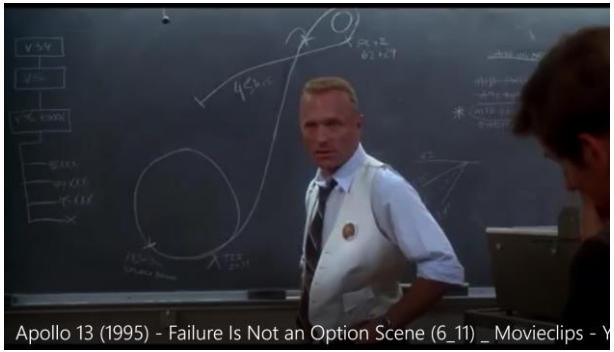
Inspirational Problem-Solving scenes from the movie



What is (mathematical) Problem-Solving?

Does Problem-Solving need to be explicity taught?

Yes, it does. Here's my 9th Grade story

- Polya 4 steps
- Resources from Tom Reardon
- Problem-Solving Process
- Problem-Solving Strategies
- Rich Problems to engage with and practise

Some definitions of Problem-Solving

George Polya – 4 Step Process

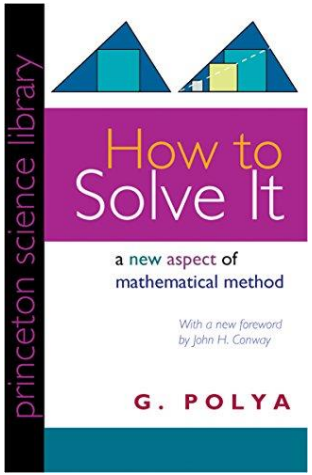
The 4 stages of problem solving (Polya)

- **Find Out** what the problem is asking for
  - ~ identify relevant data
  - ~ look for the question or verb in the problem
- **Select** a strategy
- **Apply** the strategy
- **Look Back** ~ Does your solution make sense?
  - ~ Reread the original question
  - ~ Should your solution include units?

List of problem-solving strategies

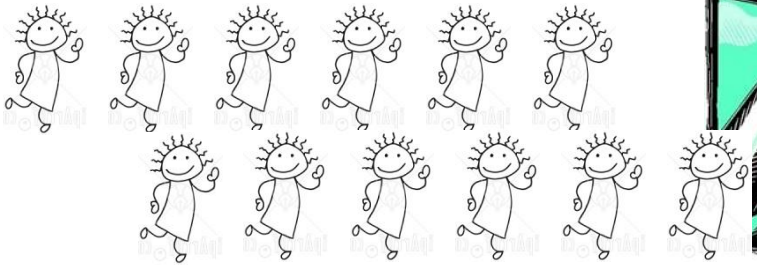
A demonstration problem

Some problems for you to practise



Strategies List – The handshake problem

If there are 12 people at a party and each person shakes hands with each other person, then how many handshakes are there in total?



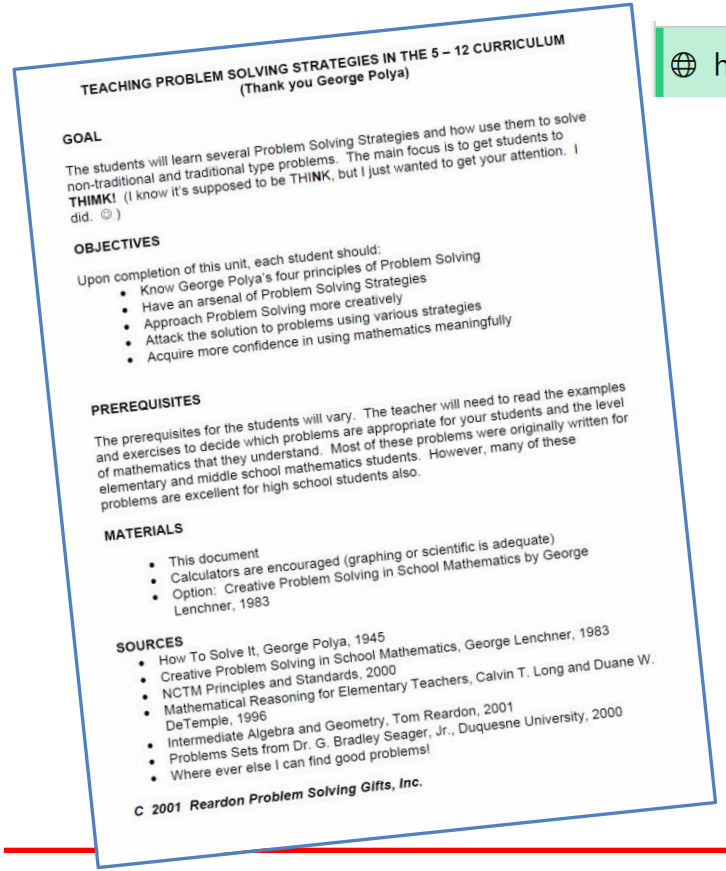
Problem-Solving Strategies

- .Find a Pattern
- . Make a Table, Graph, or Chart
- .Make an Organized List
- .Draw a Picture or Diagram
- .Guess, Check, and Revise
- .Logical Reasoning
- .WORK BACKWARD
- .Write an Equation
- .Solve a Simpler Problem
- .Use Multiple Strategies
- .Simulate a Problem
- .Choose a Formula

The handshake problem

- There are 12 teams in the football competition
- 6 games are played every Saturday
- There are 22 rounds to the season
- Each team plays each other team twice in the season
  - once at home and once away
  - after 11 rounds all teams will have met once
- 11 x 6 = 66
- This is analogous to the handshake problem so 66 is the answer.

Resources from Tom Reardon



TEACHING PROBLEM SOLVING STRATEGIES IN THE 5 – 12 CURRICULUM
(Thank you George Polya)

GOAL

The students will learn several Problem Solving Strategies and how use them to solve non-traditional and traditional type problems. The main focus is to get students to **THIMK!** (I know it's supposed to be THINK, but I just wanted to get your attention. I did. ☺)

OBJECTIVES

Upon completion of this unit, each student should:

- Know George Polya's four principles of Problem Solving
- Have an arsenal of Problem Solving Strategies
- Approach Problem Solving more creatively
- Attack the solution to problems using various strategies
- Acquire more confidence in using mathematics meaningfully

PREREQUISITES

The prerequisites for the students will vary. The teacher will need to read the examples and exercises to decide which problems are appropriate for your students and the level of mathematics that they understand. Most of these problems were originally written for elementary and middle school mathematics students. However, many of these problems are excellent for high school students also.

MATERIALS

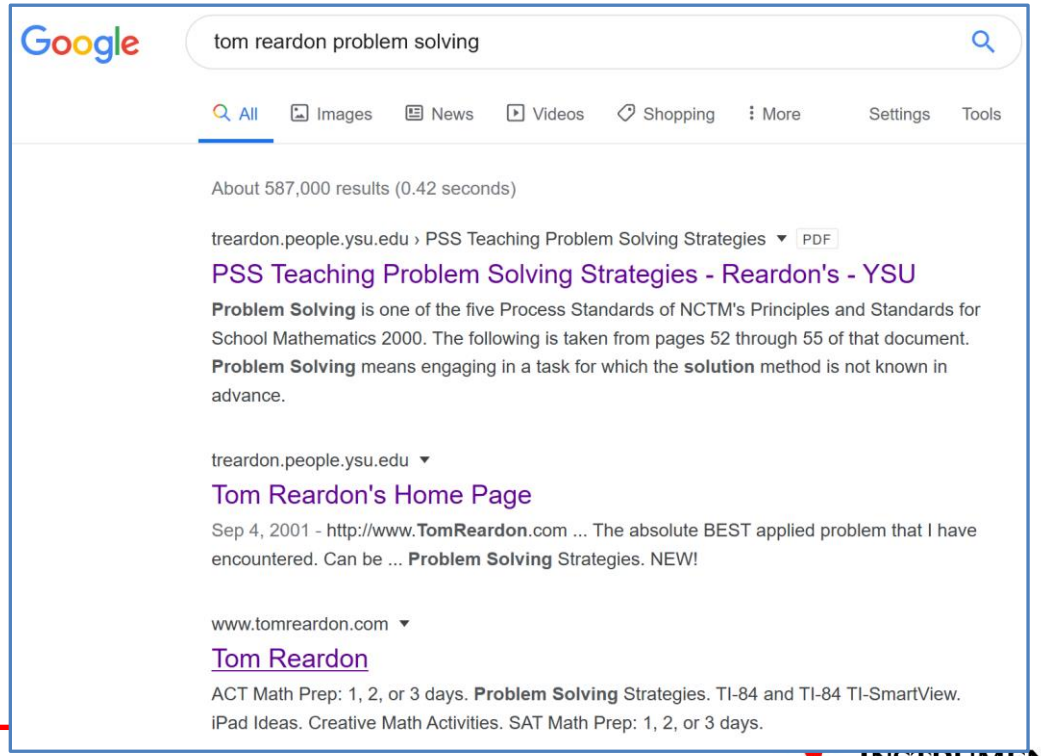
- This document
- Calculators are encouraged (graphing or scientific is adequate)
- Option: Creative Problem Solving in School Mathematics by George Lenchner, 1983

SOURCES

- How To Solve It, George Polya, 1945
- Creative Problem Solving in School Mathematics, George Lenchner, 1983
- NCTM Principles and Standards, 2000
- Mathematical Reasoning for Elementary Teachers, Calvin T. Long and Duane W. DeTemple, 1996
- Intermediate Algebra and Geometry, Tom Reardon, 2001
- Problems Sets from Dr. G. Bradley Seager, Jr., Duquesne University, 2000
- Where ever else I can find good problems!

C 2001 Reardon Problem Solving Gifts, Inc.

http://**treardon.people.ysu.edu/PSS Teaching Problem Solving Strategies.pdf**

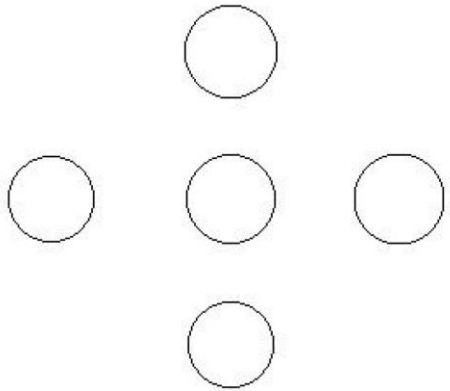


INSTRUMENTS

Resources from Tom Reardon

PSS 1 ***GUESS AND CHECK***

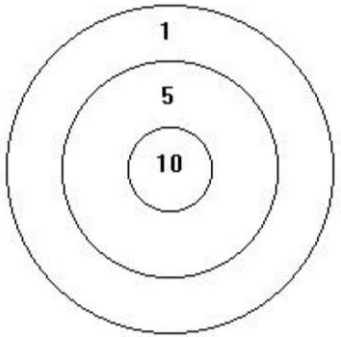
EX. 1 Copy the figure below and place the digits 1, 2, 3, 4, and 5 in these circles so that the sums across (horizontally) and down (vertically) are the same. Is there more than one solution?



DAY 2 ***PSS 2*** ***MAKE AN ORGANIZED LIST***

EX. 2

Three darts hit this dart board and each scores a 1, 5, or 10. The total score is the sum of the scores for the three darts. There could be three 1's, two 1's and 5, one 5 and two 10's, And so on. How many different possible total scores could a person get with three darts?



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  - STEM
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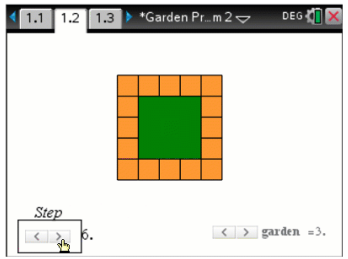
- Year 10A

Year 9: Paving Problem

by Texas Instruments

Objectives

- **ACMNA213**: Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate.



Vocabulary

- Factorise
- Expand
- Simplify

About the Lesson

A square garden bed is surrounded by pavers, how many pavers are required for a 1m x 1m garden? What about a 2m x 2m or n x n garden. Students use animations that support the development of the rules followed by algebraic techniques such as factorise, expand and simply to illustrate that these abstract algebraic representations are equivalent. Students take this knowledge and experience and apply it to a different style of garden bed.

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Student Activity
Teacher Notes and Answers

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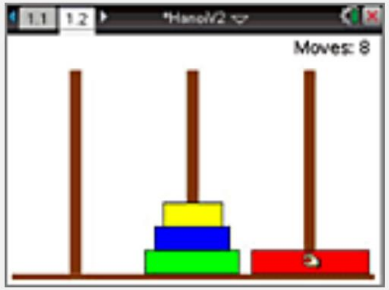

Standard ACMNA296

Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations

Activity: Towering Mathematics

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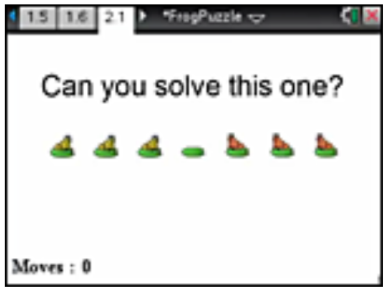

Standard ACMNA296

Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations

Activity: Leap Frog

This classic puzzle requires all the frogs on the left side of the pond to reach the right side and vice versa. How many moves does it take to solve the puzzle? What if there were more frogs? Click on the frogs in this TI-Nspire document to make them move, the moves are counted automatically. Set the number of frogs on each side and start solving!

Paving Problem

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Student Activity

7 8 **9** **10** 11 12

TI-Nspire™ | Activity | Student | 30 min

Introduction

Three different landscape garden companies: Mow Town, M.T.Potts and Compost Happens specialise in paving. They are all currently working on a job that requires them to lay pavers around square garden beds of various sizes. Your task is to write a formula for each landscaper that determines the number of pavers required for each job.

Garden 1 – Mow Town Landscapers

Mow Town is an old fashioned landscape company that like to lay their pavers in a specific order.

Open the TI-Nspire file: "Garden Problem 1"

Navigate to page 1.2

There are two sliders on the page:

Garden = side length of garden bed.

Step = Demonstrates order in which pavers are laid.

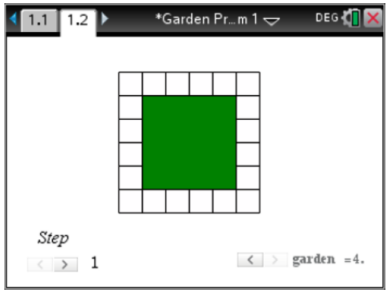
Colours:

Green = Garden bed

White = Where pavers will be laid

Yellow = Pavers currently being laid

Orange = Pavers laid previously



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Bringing it all back to Earth

- 50th Anniversary - Apollo 13
- Problem-Solving Process
- Problem-Solving Strategies
- Handshakes, Number puzzles, Darts
- Paving, Jumping Frogs, Towers …