Exemplars of "Thinking" in TVDSB Secondary Math Evaluation

Ideas Thames Valley Educators are Exploring for Assessing and Evaluating Thinking:

- Starting with informal conferences in my classroom
- Changing questions on tests and looking for opportunities for students to hand in journal entries (answer more challenging questions and put the focus on the thinking rather than the "numbers")
- Using Open Question Prompts
- Integrating conferencing for evaluation
- Focusing on "Processing" and "Analyzing" rather than solely "Difficult/Extension"
- Increased focus on assessing the planning pieces/explanation of strategy/effectiveness
- *Thinking.* The use of critical and creative thinking skills and/ or processes,[3] as follows:
  - planning skills (e.g., understanding the problem, making a plan for solving the problem)
  - processing skills (e.g., carrying out a plan, looking back at the solution)
  - critical/ creative thinking processes (e.g., inquiry, problem solving)

(Ontario Math Curriculum)

Examples of Thinking Questions Focused on Planning and Processing:

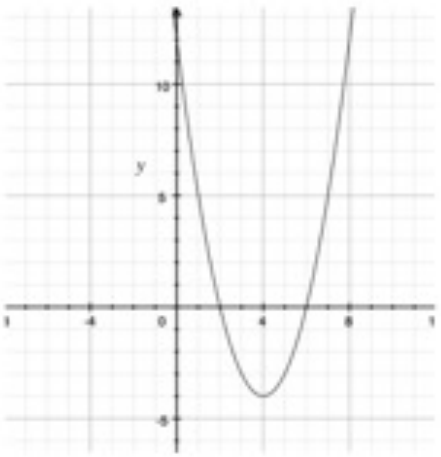
- Given the equation **3x + 2y = 6**, how would you graph this equation? Create a plan and clearly explain all the steps in your plan. Give details in your answer. [T4] (Pretend you are explaining it to someone who does not know how to graph this equation at all!)

A. Create a quadratic function such that its zeros are very close together (but not the same). Write your final answer in standard form.

B. Explain why you have to use the quadratic formula to solve $3x^2 + 6x - 8 = 0$.

C. Which of the following parabolas are the most alike? Which are the least alike? Explain your reasoning using key features of the graphs.

i. $y = -(x + 2)(x + 6)$ ii. $y = x^2 + 8x + 12$ iii.



- Mr. S's favourite student Ura Nitwit has worked through the two problems below. Mr. S thinks that Ura may have made a couple of mistakes. Check Ura's work and highlight any errors he may have made. Explain why you think Ura may be wrong.

a) 3x+5=2x-6
5x=-11
x= -1.2

b) $2(2x+1)=3(5-2x)$
$4x+2=15-6x$
$-2x=13$
$x=\frac{13}{-2}$
$x=-6\frac{1}{-2}$

EXTENDING YOUR THINKING: Expanding and Factoring

5. A question on a test was to factor $3x^2-27$. Molly wrote the answer $3(x^2-9)$
This question was worth 4 marks. Molly did not earn full marks for the question. What did she forget to do, with respect to factoring? What would she need to do to receive full marks?

6. Timmy expanded the expression $-2(3x-7)$ and got the answer $-6x-14$.
Explain what he did wrong and how to fix his mistake.

7. Can the trinomial $x^2+6x+12$ be factored? Why or why not?

- Create four equations with an answer of x=2. Each equation has to have at least two steps!

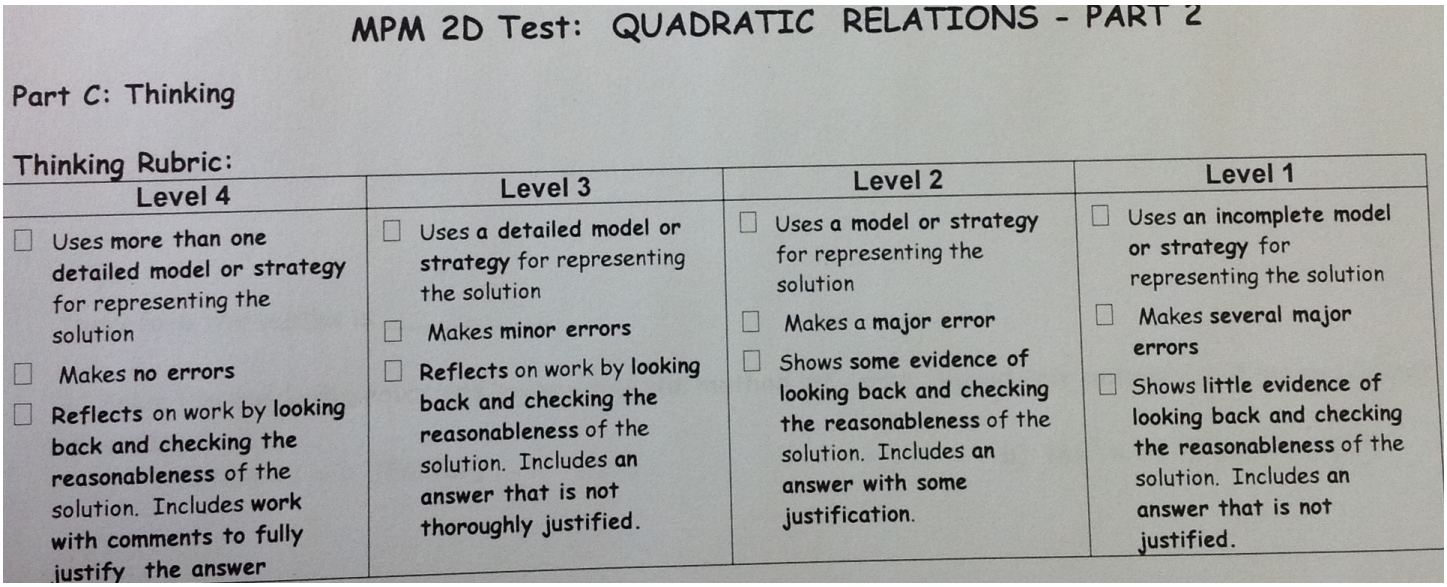
- Two different fireworks are launched upward. The height, *h,* of each firework is in metres and time, *t*, is in seconds. The path of the first is given by the equation: ***h = -4.9t^2+8.4t+1.5***

  The path of the second is shown in the following graph: (Given Graph).

  What is the same about the path of each rocket? What is different?

Exemplars of "Thinking" in TVDSB Secondary Math Evaluation

Assessing Thinking & Communication on a Test/Task through Rubric:



MPM 2D Test: QUADRATIC RELATIONS - PART 2

Part C: Thinking

Thinking Rubric:

Level 4	Level 3	Level 2	Level 1
☐ Uses more than one detailed model or strategy for representing the solution ☐ Makes no errors ☐ Reflects on work by looking back and checking the reasonableness of the solution. Includes work with comments to fully justify the answer	☐ Uses a detailed model or strategy for representing the solution ☐ Makes minor errors ☐ Reflects on work by looking back and checking the reasonableness of the solution. Includes an answer that is not thoroughly justified.	☐ Uses a model or strategy for representing the solution ☐ Makes a major error ☐ Shows some evidence of looking back and checking the reasonableness of the solution. Includes an answer with some justification.	☐ Uses an incomplete model or strategy for representing the solution ☐ Makes several major errors ☐ Shows little evidence of looking back and checking the reasonableness of the solution. Includes an answer that is not justified.

Communication Rubric: Level: ____

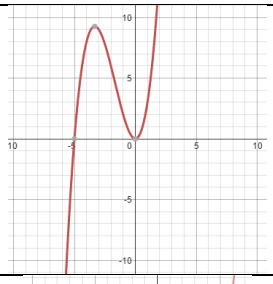
Level 4	Level 3	Level 2	Level 1
☐ *My work is **very well organized** and includes **clear explanations** making it logical and **extremely easy to follow.***	☐ *My work demonstrates **good organization** and **sufficient explanation.***	☐ *My work is **somewhat organized** but **lacks** the **details** needed to make it clear.*	☐ *My work has **limited organization** making it **difficult to follow**.*
☐ *I **consistently use relevant terminology** and **notation** (e.g., trig and inverse trig notation, approximate equal signs, and units) **correctly** .*	☐ *I **usually use relevant terminology** and **notation** (e.g., trig and inverse trig notation, approximate equal signs, and units) **correctly.***	☐ *I **sometimes use relevant terminology** and **notation** (e.g., trig and inverse trig notation, approximate equal signs, and units) **correctly.***	☐ *I **rarely use relevant terminology** and **notation** (e.g., trig and inverse trig notation, approximate equal signs, and units) **correctly.***
☐ ***All** of my **graphs/diagrams** are **clearly labeled** with key features.*	☐ ***Most** of my **graphs/graphs** are **labeled appropriately**.*	☐ ***Some** of my **graphs/diagrams** are **labeled appropriately**.*	☐ *My **graphs/diagrams** are **incomplete** or **partially labeled**.*

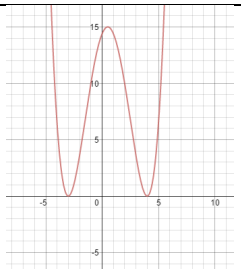
Thinking Rubric: Level: ____

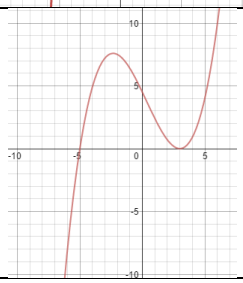
Level 4	Level 3	Level 2	Level 1
☐ *I **created a thorough plan** that **solves all aspects of the problem**.*	☐ *I **created an appropriate plan** that **solves most aspects of the problem.***	☐ *I **created a plan** that **solves some aspects of the problem**.*	☐ *I **created a very limited plan** that **solves only a few aspects of the problem**.*
☐ *I **used effective problem-solving strategies** for representing and solving **all** aspects of the problem and have **no errors.***	☐ *I **used problem-solving strategies** for representing and solving **most** aspects of the problem and have **only minor mechanical errors.***	☐ *I **used problem-solving strategies** for representing and solving **some** aspects of the problem but I have a **major conceptual error** in my solution.*	☐ *There is **little evidence of problem-solving strategies** in my solution.*
☐ *I **looked back** at my solution and **fully explained** why my answer makes sense.*	☐ *I **looked back** at my solution but my answer is **not thoroughly supported or explained**.*	☐ *I **attempted to look back** at my solution but my answer is **only partially supported or explained**.*	☐ *There is **little evidence that I looked back** at my work. If I found an answer, it was **rarely supported or explained**.*

MHF4U Performance assessment Unit 2 Name:_____

Given the following "Which One Does not belong?" where there are 4 different reasons, and explaining with full justification why each graph does not belong. Provide a graph that would finish off the following WODB and fully justify which properties each graph has or is missing in order to have each graph have 3 ways in which "they belong" and 1 way in which it "does not belong". Fully support your answer on the next page.







?

Location:	**Reason:**
Top Left:	
Top Right:	
Bottom Left:	
Bottom Right:	

Below Level 1	Level 1	Level 2	Level 3	Level 4
-Makes many large errors -Uses an incomplete model or strategy for representing the solution -shows no evidence of looking back and checking the reasonableness of the solution	-uses an incomplete model or strategy for representing the solution -makes several major errors -show little evidence of looking back and checking the reasonableness of the solution. Includes an answer that is not justified.	-uses a model or strategy for representing the solution -makes a major error -show some evidence of looking back and checking the reasonableness of their solution. Includes an answer with some justification	-uses a detailed model or strategy for representing the solution -makes minor errors -reflects on work by looking back and checking the reasonableness of their solution. Includes an answer that is not thoroughly justified.	-uses a detailed model or strategy for representing the solution -makes no errors -reflects on work by looking back and checking the reasonableness of the solution. Includes a solution with comments to fully justify the answer.