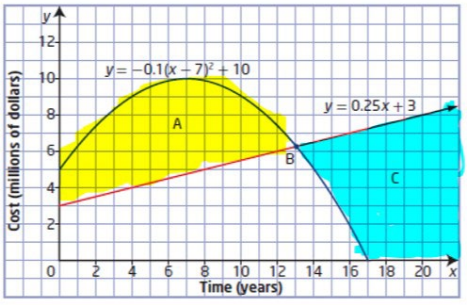
GRADE 11 MATH PRE-CALCULUS: Inequality Assignment

Summary of Learning Opportunity

In this lesson series, students first learned about how to solve linear and quadratic inequalities graphically and algebraically. They then explored inequalities in a real-life context, projecting production costs for a company. Through this learning opportunity students practiced numeracy skills of Interpret, Apply and Communicate, which supported their ability to demonstrate several Math Curricular Competencies (below).

Mathematics Pre-calculus 11	**Learning Standards**	• Model with mathematics in situational contexts • Develop, demonstrate and apply conceptual understanding of mathematical ideas through […] problem solving • Explain and justify mathematical ideas and decisions in many ways

Numeracy Connections	Instruction and Assessment	Competencies Developed, Practiced and/or Assessed
NUMERACY: Interprets—Extracts relevant information; Applies—Translates the scenario into a mathematical problem	1. Students first learned about how to solve linear and quadratic inequalities graphically and algebraically. 2. Students were given a real-life situation using inequalities. Excerpt: "The following graph models your projected cost of construction/production into the future. The line represents the cost of traditional production methods, while the parabola represents the cost of nanotechnology."  	Model with mathematics in situational contexts Develop, demonstrate, and apply conceptual understanding of mathematical ideas through…problem solving Explain and justify mathematical ideas and decisions in many ways
NUMERACY: Communicates—Defends decisions and assumptions	3. Students worked independently, in small groups, and/or with teacher assistance to answer the questions in the scenario. The teacher provided feedback about the reasonableness of students' responses and the clarity of their explanations.	

Demonstration of Student Learning, Teacher Assessment and Reflection

$1500 \leq (300 - 10x)(4 + 0.50x)$

$1500 \leq 1200 + 150x - 40x - 5x^2$

$1500 \leq 1200 + 110x - 5x^2$

$0 \leq 1200 - 1500 + 110x - 5x^2$

$0 \leq -300 + 110x - 5x^2$

$0 \leq -5x^2 + 110x - 300$

$0 \geq 5x^2 - 110x + 300$ → Flip the $\leq$ to $\geq$ when dividing or multiplying

$0 \geq \frac{5x^2 - 110x + 300}{5}$

$0 \geq x^2 - 22x + 60$

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\frac{-(-22) \pm \sqrt{(-22)^2 - 4(1)(60)}}{2(1)}$

$\frac{22 \pm \sqrt{244}}{2}$ → 18.8, 3.2

3.2 18.8

e) The regions A and C are important to me as a manufacturer and designer because they represent the cost of present and future nanotechnology production. It is important to recognize the long term benefits that the expenses for nanotechnology production will fall below the cost of traditional methods. The manufacturer also needs to think about the transition from region A to region C.

f) If the cost of of nanotechnology decreases from their peak more quickly than anticipated, the parabola will become thinner and cut the time shorter before nanotechnology production reaches the same cost. The cost will go down overtime saving more money. Point b will shift further to the left.

a) X = 3 b) X = 10 c) X= 20

a) $0 \geq 3^2 - 22(3) + 60$
   $0 \geq 9 - 66 + 60$
   $0 \geq 3$ FALSE
b) $0 \geq 10^2 - 22(10) + 60$
   $0 \geq 100 - 220 + 60$
   $0 \geq -60$ TRUE
c) $0 \geq 20^2 - 22(20) + 60$
   $0 \geq 400 - 440 + 60$
   $0 \geq 20$ FALSE

$3.2 \leq X \leq 18.8$
$3.2 \leq$ price ≤ 18.8
$(4 + 0.5(3)) \leq$ price $\leq (4 + 0.5(18)$
$\$5.5 \leq$ price $\leq \$13$

$3.2 \leq$ quantity ≤ 18.8
$(300 - 10(3)) \leq$ quantity $\leq (300 - 10(18))$
$270 \leq$ quantity ≤ 120

Teacher's Observations and Assessment

I observed the student's conversations with their peers while working in class. The student's written responses relate the graph (including the intersection between the line and parabola) to the real-world situation of cost analysis. They analyzed the graphs in order to justify their prediction of what will happen when nanotechnology costs decrease as engineering becomes more efficient. The Numeracy aspects of Interpret, Apply and Communicate supported this student to be able to be **proficient** in the math competencies of using a model in a real-world situation, applying their math knowledge to solve a problem and explaining their thinking.

Teacher's Reflection

By using the Numeracy framework, I was able to plan this assessment to look for competency-based learning, alongside content learning. Using the grade 11 Numeracy Learning Progression proficiency descriptors I was able to help students demonstrate skills like interpreting a problem, applying their math knowledge and skills, and communicating their thinking. I used the descriptors to create the guiding and discussion questions in many different ways. Students were able to explain the mathematical concept of inequality related to a real-world situation.