Unit 3: Day 1: Getting to Know Polynomials

MCT 4C

Minds On: 5 Action: 50 Consolidate:20 Total=75 min	**Math Learning Goals:** • Make connections between polynomials given in factored form and the x-intercepts of the graph of the polynomial. • Identify the zeros of a function or the roots of a corresponding equation and the connection between the two.	**Materials** • BLM 3.1.1-3.1.3 • Graphing calculators

				Assessment Opportunities
	Minds On…	**Individual → Activity** Students work through Anticipation Guide on BLM 3.1.1 using prior knowledge and understanding of zeros of equations in factored form. **Curriculum Expectations/ Observation/Mental Note**: Listen to students as they explain their choices to a partner to determine their readiness for this unit. Poll the class by using a show of hands for the number who agree and disagree for each statement. Use the results to guide discussion during consolidation and debrief.		Literacy strategy: Anticipation guide (Think Literacy: Mathematics, Grade 7-9; pp.10-14) A review of factoring techniques may be helpful.
	Action!	**Individual → Guided Exploration** Distribute BLM 3.1.2 and introduce activity. Students will be using the graphing calculator to confirm their solutions. A class discussion can occur after each part of the activity. The goal of Part A is to confirm that by setting the dependent variable equal to zero we are finding the x-intercept of the function. The goal of Part B and C is to stress the importance of factoring a polynomial expression when determining the x-intercepts. **Mathematical Process: Connecting** – Students make **connections** between graphical and algebraic representations of functions.		Remind students to adjust window settings on graphing calculator as noted on the BLM. Remind students that roots, solutions, zeros and x-intercepts are related.
	Consolidate Debrief	**Individual → Activity** Students revisit their Anticipation Guide on BLM 3.1.1 completing the right hand column reflecting on the work completed. **Whole Class → Discussion** A poll of the class can be taken to see how the activity changed responses. Discuss answers to anticipation guide resolve any issues/misconcptins that may still exist		
	Reflection Application	**Home Activity or Further Classroom Consolidation** Complete BLM 3.1.3 for consolidation of understanding.		Collect BLM 3.1.3 to provide feedback to students. Last question on BLM is designed to investigate the multiplicity of roots.

3.1.1: Up to Now With Polynomials

Anticipation Guide

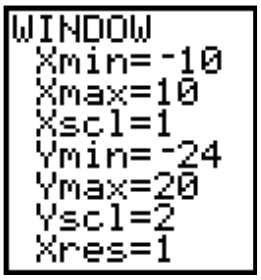
Instructions:

- Check “Agree” or “Disagree” beside each statement ***before*** you start the task.
- Compare your choice and explanation with a partner.
- Revisit your choices after completing the task on BLM 3.1.2. Compare the choices you made before the task and after the task.

Before		Statement	After	
Agree	**Disagree**		**Agree**	**Disagree**
		1. The zeros are the y-intercepts on a given graph.		
		2. The solutions of an equation and the zeros of a function are the same thing.		
		3. $x^2 + 5x + 6$ is $(x + 3)(x + 2)$ in factored form.		
		4. All parabolas have at least one root/solution.		
		5. The degree of the polynomial $y = 3x^2 - 6x^3 - 2$ is 5.		
		6. The function $y = (x - 4)(x + 5)$ has two real solutions/roots.		
		7. The function $y = (x - 4)(x - 4)$ has one real solution/root.		
		8. The graph of $y = -7x^3 - 1$ is linear.		
		9. The solution(s) of an equation(s) is always of the form (x, 0).		
		10. All cubic functions have at least one root/solution.		

3.1.2: Getting to Know Polynomials

Part A: Before you begin, change your window settings to:



1. For each function in the chart below, do the following:
   - Set the function equal to zero and solve.
   - Sketch a graph of the function.
   - Determine the x-intercept.

Function	Solution when y = 0	Sketch	x-intercept
$y = 5x + 15$			
$5x + 7y - 17 = 0$			
$y = -6(x + 6)$			

2. Compare your answer for the solutions to the x-intercepts. What do you notice?

3. If you were given the function *5y = 10*, how many x-intercepts would it have? Justify your answer.

3.1.2: Getting to Know Polynomials (continued)

Part B: Use the same window settings as in Part A to complete the chart below.

Function	Solution when y = 0	Sketch	x-intercept
$y = -2(x-4)(x+1)$			
$y = -4.9(x-2)^2$			
$y = x^2 + x - 20$			
$y = x^2 + 4x - 16$			
$y = x^2 + 6x + 10$			

4. Which form of a quadratic function is easier to use for solving algebraically?

□ Factored form □ Standard form (choose one). Give reasons.

3.1.2: Getting to Know Polynomials (continued)

Part C: Before you begin, change your window settings to:

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WINDOW
 Xmin=-10
 Xmax=10
 Xscl=1
 Ymin=-150
 Ymax=50
 Yscl=20
 Xres=1
```

Function	Solution when y = 0	Sketch	x-intercept
$y = (x-6)(x+2)(x+5)$			
$y = -2(x-3)(x+1)(x-5)$			
$y = (x-2)^2(x+2)$			
$y = (x+4)^3$			
$y = x^3 - x^2 - 6x$			

3.1.3: The Root of All Knowledge

1. On a test, students were asked to determine the roots of $y = x^2 + 4x - 60$.

Michael's solution	Susie's solution	Jaspal's solution
$y = x^2 + 4x - 60$ $y = (x - 6)(x + 10)$ $0 = (x - 6)(x + 10)$ $x = 6 \text{ and } x = -10$	$y = x^2 + 4x - 60$ $y = (x + 6)(x - 10)$ $0 = (x + 6)(x - 10)$ $x = 6 \text{ and } x = -10$	$y = x^2 + 4x - 60$ $y = (x - 6)(x + 10)$ $0 = (x - 6)(x + 10)$ $x = -6 \text{ and } x = +10$

a) Whose solution is correct?

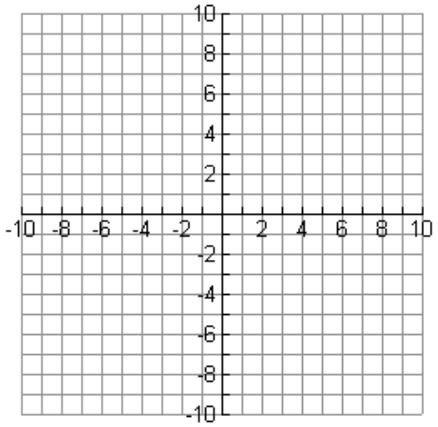
b) Explain what was done in the correct solution.

c) Explain what was done incorrectly in the other two solutions.

2. a) Create a linear, quadratic, cubic and quartic function that has the x-intercept of $x = 3$.

b) Sketch each function on the grid provided.

c) Compare and contrast the functions. (i.e. What is the same and what is different about the functions?)



Unit 3: Day 8: Why do we have to learn this?

MCT 4C

Minds On: 10 Action: 45 Consolidate:20 Total=75 min	**Math Learning Goals:** • Investigate applications of mathematical modelling in occupations. • Investigate college programs that explore applications of mathematical modelling.	**Materials** • BLM 3.8.1-3.8.3 • Computers with internet access

			Assessment Opportunities
	Minds On…	**Groups of 4 → Brainstorm** Provide students with the following prompt for place mat activity (BLM 3.8.1). *"Think of as many professions, careers, trades, jobs, etc. that use math on a regular basis."* Students fill in their portion of place mat quietly for a few minutes. Students share responses with rest of group. Common responses are recorded in the centre of the place mat. **Whole Class → Discussion** Have groups share responses recorded in centre of each place mat. Students should make note of these occupations and use them as a basis for their research during the investigation that follows.	Literacy strategy: Place Mat (Think Literacy: Mathematics, Grade 7-12; pp.66-70) Place mat can be copied on ledger or legal size paper to provide more space for students. Explore the website www.hrdc-drhc.gc.ca/essentialskills noted on BLM 3.8.2 ahead of time. Ensure that students select an occupation where numeracy is listed as one of the most important essential skills. Only address the mathematical foundations specific to the job. Not all math foundations will apply to every job. **Optional**: One of the jazz days can be used for student presentations of research conducted during this lesson.
	Action!	**Individual or Pairs → Exploration** Students are to follow the guided investigation on BLM 3.8.2. Anything in quotations in the BLM is a link. **Mathematical Process: Connecting** – Students make **connections** between mathematical modelling and different occupations that may use modelling.	
	Consolidate Debrief	**Whole Class → Discussion** Ask students to refer to the chart completed in #7 of BLM 3.8.2 identifying the math foundations used in each occupation. Ask students to share their findings. Questions to guide discussion: • What surprised you by the amount of mathematics needed? • How important do you think mathematics is in everyday life? • What types of requirements do you think are needed to get into college programs leading to these various occupations? If students are still curious about program offerings, they may visit their counsellor or do some research themselves by visiting www.ontariocolleges.ca.	
	Reflection *Exploration*	**Home Activity or Further Classroom Consolidation** Journal: Are there any occupations that you were interested in pursuing when you leave high school? If so, what surprised you about the math required in that occupation? If your desired occupation was not mentioned, how do you think math is used by someone in that occupation? Students follow instructions on BLM 3.8.3 to write a report which shows connections between careers and the mathematics in this unit. Curriculum Expectations/Report/Rubric: Assess the written reports as part of the summative assessment for this unit.	Explore the Career Cruising website www.careercruising.com noted on BLM 3.8.3 ahead of time. Ask a member of the guidance department for the username and password needed.

3.8.1: Where's the Math?

Through group sharing, record the occupations that were most common to all group members.

3.8.2: Occupations and Math

Introduction: Mathematics is used in many occupations.

The website www.hrdc-drhc.gc.ca/essentialskills explores various occupations and mathematical skills needed.

As you work through this worksheet, you will explore and gather information on an occupation. Your goal will be to describe the numeracy skills needed for that occupation.

Searching the Occupation on www.hrdc-drhc.gc.ca/essentialskills:

1. From the homepage, select English.
2. Select "Understanding Essential Skills" from the left had menu. List the nine essential skills:

1.
2.
3.
4.
5.
6.
7.
8.
9.

3. On the left menu, select "Essential Skills Profile".

a) What does a profile include?

b) How can a profile help you?

4. Scroll to the bottom of the page and select "List of all profiles". Scroll through the page and scan the list of occupations. Choose an occupation. Try some of the occupations the class brainstormed earlier. Select "View the entire profile" for the occupation.

5. List the most important essential skills for that occupation. Make sure that numeracy is one of them. If not, try a different occupation.

   Most important essential skills:

3.8.2: Occupations and Math (continued)

6. Scroll to the Document Section and select "Numeracy". Identify a minimum of 5 ways mathematics is used in that occupation.

7. Under the Math Skills Summary, you will find Mathematical Foundations used for that occupation. Complete the table below.

Mathematical Foundations	List of Specific Math Skills	Connection to the Occupation
Number Concepts		
Patterns and Relations		
Shape and Spatial Sense		
Statistics and Probability		

3.8.3: College Math

We will now look at programs in various colleges that require the course you are taking.

Go to the following websites:

- Career Cruising – www.careercruising.com
  Username :
  Password:
- Ontario Colleges - www.ontariocolleges.ca

Write a one to two page report that includes the following:

- □ The name of the Ontario College chosen. You must verify your choice with the teacher since everyone MUST choose a different college.
- □ The name of the program that **requires** MCT 4C0.
- □ The reason mathematical modelling with polynomials is needed for this course.
- □ At least two careers that this college program will lead to. Describe both careers and how mathematical modelling is used in both careers.