ALBERTA DISTANCE LEARNING CENTRE
Mathematics 30-1
MAT3791
Workbook 1.2

Student's Questions and Comments

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Summary

	Marks Earned	Total Marks	Percent
Practice 1.2A	**I have ____ /8 and ____%**		
Practice 1.2B	**I have ____ /8 and ____%**		
Practice 1.2C	**I have ____ /8 and ____%**		
Practice 1.2D	**I have ____ /8 and ____%**		
Explore Your Understanding 1.2			

Teacher's Comments:

_____
Teacher's Signature

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http://www.adlc.ca

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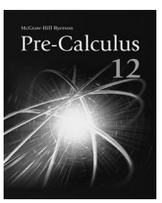

Pre-Calculus 12
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Mathematics 30-1

Workbook 1.2

Lesson 1.2
Polynomial Functions

Instructions for Submitting Workbooks

1. Submit Workbooks **regularly** for assessment.

2. Submit only **one Workbook at a time.** This allows your teacher to provide feedback that you can apply to subsequent course work and exams.

3. Check that your **Workbook is complete.** Your Workbook will be returned as **incomplete** if a reasonable attempt with relevant work has not been made. Therefore, **do not leave any questions blank.** Contact your teacher for help **prior** to submitting this Workbook.

4. Attach the correct address label or complete the Workbook coversheet.

5. Submission Methods:

Postal Mail – Mail the completed Workbook to an Alberta Distance Learning Centre office. Ensure that you attach sufficient postage by having the envelope weighed at the post office.

Electronically – Scan the completed Workbook. Save the file to your computer as **Math 30-1 Workbook# FirstInitial LastName.** Then, upload the file.

Fax – Fax the completed Workbook to Alberta Distance Learning Centre.

In Person – Drop the completed Workbook at the Alberta Distance Learning Centre office in Barrhead. The address is listed below.

Barrhead
4601 - 63 Avenue
Barrhead, Alberta T7N 1P4
Phone 780-674-5333
Toll-free 1-866-774-5333
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Mathematics 30-1

Workbook 1.2

Our Pledge to You:

Enrolling in this course is another step toward an Alberta High School Diploma. Everyone at Alberta Distance Learning Centre is committed to helping students achieve their educational goals. We welcome your contact in person or by phone, fax, e-mail, voice mail, or postal mail.

Advice:

Your achievement in this course is determined by your success in the assessments of each unit. Your responses to assignments indicate your understanding of outcomes established by Alberta Education.

- Before responding to the assigned questions, read all relevant directions for the Workbook and instruction in the course materials, including the appropriate Guide for Learning and any other resources provided.

- When you encounter difficulties, re-read the directions for the Workbook and review the relevant instruction in the Guide for Learning.

- If you require further clarification, contact your Alberta Distance Learning Centre teacher for assistance.

Notice:

You have one opportunity to submit each Workbook.

- Only under exceptional circumstances will your ADLC teacher re-assess your work. Therefore, apply significant effort to each Workbook.

- If your final exam mark is vastly different from your Quiz marks, your teacher may apply discretion in determining your course mark.

ADLC Plagiarism Policy (ADLC Administrative Policy 60–1)

Program integrity and academic honesty are very important at ADLC. When students are successful in ADLC courses, we want full confidence that they have clearly met the intended program outcomes.

Plagiarism is the practice of representing someone else's work or ideas as one's own. It is an academically dishonest practice and is detrimental to a student's knowledge & skill development.

ADLC takes a progressive approach to plagiarism to educate and correct the behaviour. If a student is currently enrolled in any ADLC course and found to have plagiarized work, the following steps are taken:

Warning: ADLC Teachers decide if a warning happens instead of calling the first instance. The warning is recorded in SIS Communications.

First Instance	Second Instance	Third Instance
Students are assigned a mark of zero and a chance to redo the question or the assignment. It is up to the ADLC teacher's discretion whether or not to assign a mark of zero on the plagiarized question or on the entire assignment. ADLC teachers record a SIS Communication and a 'Student Note'.	The student is assigned a mark of zero with no chance to redo the question or the assignment. It is up to the ADLC teacher's discretion whether or not to assign a mark of zero on the plagiarized question or on the entire assignment. The ADLC Principal, or designate, is notified and the instance is recorded in SIS Communications.	Student is removed from the course in which the third instance occurred. The ADLC Principal, or designate, is notified and the instance is recorded in SIS Communications.

Important

While removal from a course is limited to the course in which the Third Instance has occurred, the preceding steps can occur across different courses. A student who has been found plagiarizing in Course A and held to the First Instance consequences who then plagiarizes in Course B will move to the Second Instance consequences.

Further Instances

After the Third Instance, any further instances of plagiarism in any course will result in immediate removal from that course. Ongoing occurrences may result in removal from all courses and barring of registration with ADLC.

Clean Slate

Students earn a clean slate after one calendar year passes with no instances.

Sharing of ADLC Work (ADLC Administrative Policy 60–4)

Plagiarism is the practice of representing someone else's work or ideas as one's own. It is a dishonest practice and is damaging to a student's knowledge & skill development. Plagiarism is addressed in ADLC Administrative Policy 60-01.

The sharing of school work, especially after having been marked by ADLC, to students for the purposes of submitting plagiarized work (either paraphrasing or directly copying student work) is dishonest, and this sharing goes against the Alberta School Act's expectation of students to respect school rules and co-operate with how schools offer education to their students.

ADLC prefers to take a progressive approach to sharing of work with other students, in order to educate and correct the behaviour.

If a student is currently enrolled in any ADLC course and found to be sharing school work, whether from their current course or another, to others:

First Incidence	Second Incidence
The student is informed that their work has been submitted as plagiarized work by another student; a warning is provided that further submissions of such work, from any course, will be grounds for removal from the current course(s).	The student is removed from all active ADLC courses.

If the student is not currently enrolled in any ADLC course and found to be sharing school work with others, they are informed that their work has been submitted as plagiarized work by another student and, as such, further registrations in any ADLC course will not be permitted. The incident will be recorded on the student's file.

Such actions do not limit ADLC to pursue other remedies (actions), either criminal or civil, for the distribution of its copyrighted materials.

Practice Assessment

Practice provides practice and allows you to self-reflect on your conceptual understanding of the Lesson skills. You will mark your work for *Practice* in each *Workbook* according to the following rubric.

Category	Strategy and Procedures	Response to Questions
	I have…	*I have…*
4	• used efficient and effective strategies to solve the problem(s)	• provided detailed explanations and followed directions appropriately to complete all questions
3	• used effective strategies to solve the problem(s)	• provided clear explanations and followed directions adequately to complete most questions
2	• used effective strategies inconsistently to solve the problem(s)	• provided incomplete explanations and followed some directions to complete a few questions
1	• used ineffective strategies to solve the problem(s)	• provided incomplete explanations and have not followed directions to complete some questions

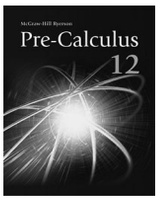
Complete *Practice* exercises using your best work, showing all relevant steps needed to arrive at your solution. Refer to the *Module* to review lesson instructions. Contact your teacher for assistance or clarification as needed, or to investigate the topic further.

Check and correct your work using the solutions provided in *Appendix* in the *Module*.

Practice is worth 8 marks; your mark can help you gauge your understanding of *Lesson* material.

After you have assessed your work, reflect on your understanding of the concepts addressed in the *Practice* exercises in the table provided.

Practice 1.2A



Now, try what you have learned so far. Turn to pages 114 to 116 in *Pre-Calculus 12* and do questions 1a to 1f, 4a to 4f, 6a to 6f, 10a, 10b,11a to 11c.

You may check your practice work by turning to the *Appendix* section of the *Module.*

Questions 1a to 1f, page 114

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

d.

My solution	My corrections if needed

e.

My solution	My corrections if needed

f.

My solution	My corrections if needed

Questions 4a to 4f, page 114

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

d.

My solution	My corrections if needed

e.

My solution	My corrections if needed

f.

My solution	My corrections if needed

Questions 6a to 6f, page 115

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

d.

My solution	My corrections if needed

e.

My solution	My corrections if needed

f.

My solution	My corrections if needed

Questions 10a and 10b, page 116

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

Questions 11a to 11c, page 116

a.

My solution	My corrections if needed

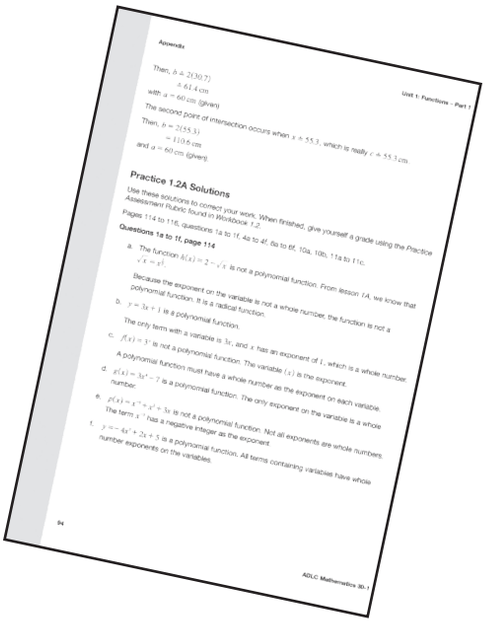
b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

Turn to *Practice 1.2A Solutions* in the *Appendix* in *Unit 1 – Part 1*. Use the solutions to check your work and make corrections. Next, use the Practice Assessment rubric found on page 1 to give yourself a grade. **Record your grade on the cover of this booklet.** When complete, continue in the *Module*.



Appendix

Then, $b \doteq 2(30.7)$

$b \doteq 61.4$ cm

with $a = 60$ cm (given)

Unit 1: Functions – Part 1

The second point of intersection occurs when $x \doteq 55.3$, which is really $x \doteq 55.3$ cm.

Then, $b \doteq 2(55.3)$

$\doteq 110.6$ cm

and $a = 60$ cm (given)

Practice 1.2A Solutions

Use these solutions to correct your work. When finished, give yourself a grade using the *Practice Assessment Rubric* found in *Workbook 1.2*.

Pages 114 to 116, questions 1a to 1f, 4a to 4f, 6a to 6f, 10a, 10b, 11a to 11c.

Questions 1a to 1f, page 114

a. The function $h(x) = 2 - \sqrt{x}$ is not a polynomial function. From lesson 1A, we know that $\sqrt{x} = x^{\frac{1}{2}}$

Because the exponent on the variable is not a whole number, the function is not a polynomial function. It is a radical function.

b. $y = 3x + 1$ is a polynomial function.

The only term with a variable is $3x$, and x has an exponent of 1, which is a whole number.

c. $f(x) = 3^x$ is not a polynomial function. The variable (x) is the exponent.

A polynomial function must have a whole number as the exponent on each variable.

d. $g(x) = 3x^4 - 7$ is a polynomial function. The only exponent on the variable is a whole number.

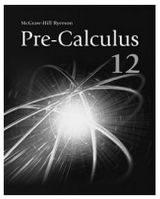
e. $p(x) = x^{-3} + x^2 + 3x$ is not a polynomial function. Not all exponents are whole numbers. The term x^{-3} has a negative integer as the exponent.

f. $y = -4x^3 + 2x + 5$ is a polynomial function. All terms containing variables have whole number exponents on the variables.

94

ADLC Mathematics 30-1

Practice 1.2B



Now, try what you have learned so far. Turn to pages 124 to 125 in *Pre-Calculus 12* and do questions 2a to 2d, 3b, 3f, 4a, 4b, 6a, 7a, 7b, 8a, 8b, 9, 10, and 13a to 13c.

You may check your practice work by turning to the *Appendix* section of the *Module.*

Questions 2a to 2d, page 124

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

d.

My solution	My corrections if needed

Questions 3b and 3f, page 124

b.

My solution	My corrections if needed

f.

My solution	My corrections if needed

Questions 4a and 4b, page 124

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

Question 6a, page 124

a.

My solution	My corrections if needed

Questions 7a and 7b, page 124

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

Questions 8a and 8b, page 124

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

Question 9, page 124

My solution	My corrections if needed

Question 10, page 125

My solution	My corrections if needed

Questions 13a to 13c, page 125

a.

My solution	My corrections if needed

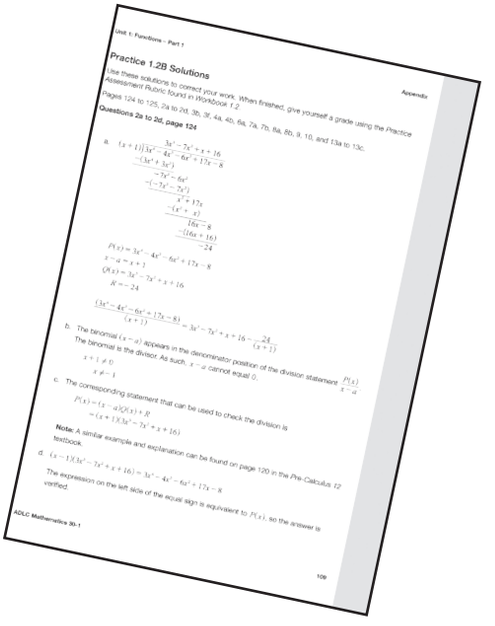
b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

Turn to *Practice 1.2B Solutions* in the *Appendix* in *Unit 1 – Part 1.* Use the solutions to check your work and make corrections. Next, use the Practice Assessment rubric found on page 1 to give yourself a grade. **Record your grade on the cover of this booklet.** When complete, continue in the *Module.*



Unit 1: Functions – Part 1

Practice 1.2B Solutions Appendix

Use these solutions to correct your work. When finished, give yourself a grade using the Practice Assessment rubric found in Workbook 1.2.

Pages 124 to 125, 2a to 2d, 3b, 3f, 4a, 4b, 6a, 7a, 7b, 8a, 8b, 9, 10, and 13a to 13c.

Questions 2a to 2d, page 124

a. $(x+1)\overline{)3x^3-4x^2-6x^2+17x-8}$

$3x^3-7x^2+x+16$

$-(3x^3+3x^2)$

$-7x^2-6x^2$

$-(-7x^2-7x^1)$

x^2+17x

$-(x^2+x^1)$

$16x-8$

$-(16x+16)$

-24

$P(x)=3x^3-4x^2-6x^2+17x-8$

$x-a=x+1$

$(R\,x)=3x^3-7x^2+x+16$

$R=-24$

$\frac{(3x^3-4x^2-6x^2+17x-8)}{(x+1)}=3x^3-7x^2+x+16-\frac{24}{(x+1)}$

b. The binomial $(x-a)$ appears in the denominator position of the division statement $\frac{P(x)}{x-a}$. The binomial is the divisor. As such, $x-a$ cannot equal 0.

$x+1\neq 0$

$x\neq -1$

c. The corresponding statement that can be used to check the division is

$P(x)=(x-a)Q(x)+R$

$=(x+1)(3x^3-7x^2+x+16)$

Note: A similar example and explanation can be found on page 120 in the *Pre-Calculus 12* textbook.

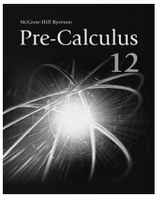
d. $(x-1)(3x^3-7x^2+x+16)=3x^4-4x^3-6x^2+17x-8$

The expression on the left side of the equal sign is equivalent to $P(x)$, so the answer is verified.

ADLC Mathematics 30-1

109

Practice 1.2C



Now, try what you have learned so far. Turn to pages 133 to 135 in *Pre-Calculus 12* and do questions 2a to 2f, 4a, 4c, 5a, 5d, 5e, 11, and 14.

You may check your practice work by turning to the *Appendix* section of the *Module.*

Questions 2a to 2f, page 133

a.

My solution	My corrections if needed

b.

My solution	My corrections if needed

c.

My solution	My corrections if needed

d.

My solution	My corrections if needed

e.

My solution	My corrections if needed

f.

My solution	My corrections if needed

Questions 4a and 4c, page 133

a.

My solution	My corrections if needed

c.

My solution	My corrections if needed

Questions 5a, 5d, and 5e, page 134

a.

My solution	My corrections if needed

d.

My solution	My corrections if needed

e.

My solution	My corrections if needed

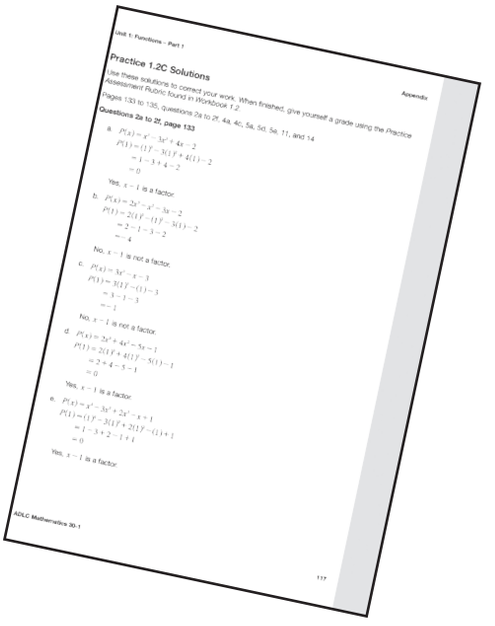
Question 11, page 134

My solution	My corrections if needed

Question 14, page 135

My solution	My corrections if needed

Turn to *Practice 1.2C Solutions* in the *Appendix* in *Unit 1 – Part 1*. Use the solutions to check your work and make corrections. Next, use the Practice Assessment rubric found on page 1 to give yourself a grade. **Record your grade on the cover of this booklet.** When complete, continue in the *Module*.



Unit 1: Functions – Part 1

Appendix

Practice 1.2C Solutions

Use these solutions to correct your work. When finished, give yourself a grade using the *Practice Assessment Rubric* found in *Workbook 1.2*.

Pages 133 to 135, questions 2a to 2f, 4a, 4c, 5a, 5d, 5e, 11, and 14

Questions 2a to 2f, page 133

a. $P(x) = x^3 - 3x^2 + 4x - 2$

$P(1) = (1)^3 - 3(1)^2 + 4(1) - 2$

$= 1 - 3 + 4 - 2$

$= 0$

Yes, $x - 1$ is a factor.

b. $P(x) = 2x^3 - x^2 - 3x - 2$

$P(1) = 2(1)^3 - (1)^2 - 3(1) - 2$

$= 2 - 1 - 3 - 2$

$= -4$

No, $x - 1$ is not a factor.

c. $P(x) = 3x^2 - x - 3$

$P(1) = 3(1)^2 - (1) - 3$

$= 3 - 1 - 3$

$= -1$

No, $x - 1$ is not a factor.

d. $P(x) = 2x^3 + 4x^2 - 5x - 1$

$P(1) = 2(1)^3 + 4(1)^2 - 5(1) - 1$

$= 2 + 4 - 5 - 1$

$= 0$

Yes, $x - 1$ is a factor.

e. $P(x) = x^3 - 3x^2 + 2x^1 - x + 1$

$P(1) = (1)^3 - 3(1)^2 + 2(1)^1 - (1) + 1$

$= 1 - 3 + 2 - 1 + 1$

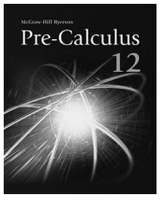
$= 0$

Yes, $x - 1$ is a factor.

ADLC Mathematics 30-1

117

Practice 1.2D



Now, try what you have learned so far. Turn to pages 147 to150 in *Pre-Calculus 12* and do questions 1a, 2a, 3a, 3c, 4c, 5, 7b, 9d, and 12.

You may check your practice work by turning to the *Appendix* section of the *Module.*

Question 1a, page 147

a.

My solution	My corrections if needed

Question 2a, page 147

a.

My solution	My corrections if needed

Questions 3a and 3c, page 148

a.

My solution	My corrections if needed

c.

My solution	My corrections if needed

Question 4c, page 148

c.

My solution	My corrections if needed

Question 5, page 148

My solution	My corrections if needed

Question 7b, page 149

b.

My solution	My corrections if needed

Question 9d, page 149

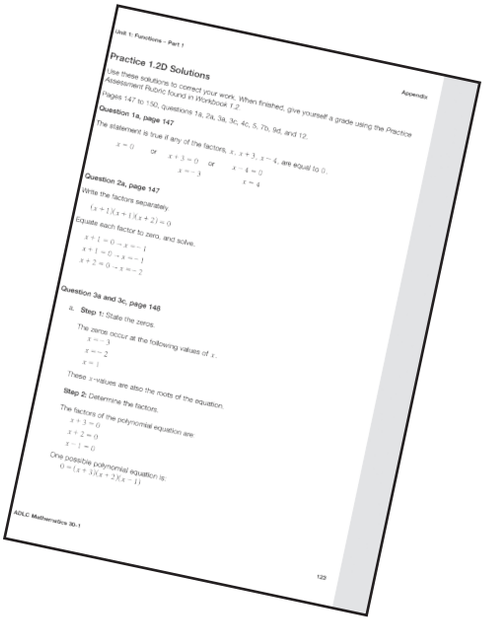
d.

My solution	My corrections if needed

Question 12, page 150

My solution	My corrections if needed

Turn to *Practice 1.2D Solutions* in the *Appendix* in *Unit 1 – Part 1*. Use the solutions to check your work and make corrections. Next, use the Practice Assessment rubric found on page 1 to give yourself a grade. **Record your grade on the cover of this booklet.** When complete, continue to *Explore Your Understanding Assignment 1.2.*



Unit 1: Functions – Part 1

Practice 1.2D Solutions Appendix

Use these solutions to correct your work. When finished, give yourself a grade using the *Practice Assessment Rubric* found in Workbook 1.2.

Pages 147 to 150, Questions 1a, 2a, 3a, 3c, 4c, 5, 7b, 9d, and 12.

Question 1a, page 147

The statement is true if any of the factors, x, $x+3$, $x-4$, are equal to 0.

$x = 0$ or $x + 3 = 0$ or $x - 4 = 0$

$x = -3$ $x = 4$

Question 2a, page 147

Write the factors separately.

$(x+1)(x+1)(x+2) = 0$

Equate each factor to zero, and solve.

$x + 1 = 0 \rightarrow x = -1$

$x + 1 = 0 \rightarrow x = -1$

$x + 2 = 0 \rightarrow x = -2$

Question 3a and 3c, page 148

a. **Step 1:** State the zeros.

The zeros occur at the following values of x.

$x = -3$

$x = -2$

$x = 1$

These x-values are also the roots of the equation.

Step 2: Determine the factors.

The factors of the polynomial equation are:

$x + 3 = 0$

$x + 2 = 0$

$x - 1 = 0$

One possible polynomial equation is:

$0 = (x + 3)(x + 2)(x - 1)$

ADLC Mathematics 30-1

123

Explore Your Understanding Assignment 1.2

This assignment includes 18 marks. You are expected to complete **15 marks** worth of work. If you complete more than this, all completed questions will be used to assign a grade. For example, if you complete all 18 marks worth of work, your assignment total will be 18 instead of 15. You can also complete a question and label it "DO NOT MARK" if you are not confident in your work. Your teacher will then give feedback on your response, which will help clarify any misconceptions, but will not count it towards your required mark total. Please contact your teacher if you have any questions.

1. A corresponding long division and synthetic division are shown.

$$
\begin{array}{r}
x^2+x-6 \\
x+1\overline{)\,x^3+2x^2-5x+7} \\
\underline{x^3+x^2} \\
x^2-5x \\
\underline{x^2+x} \\
-6x+7 \\
\underline{-6x-6} \\
13
\end{array}
$$

$$
\begin{array}{r|cccc}
1 & 1 & 2 & -5 & 7 \\
 & & 1 & 1 & -6 \\
\hline
 & 1 & 1 & -6 & 13
\end{array}
$$

(2) a. Complete the table so the long division and the synthetic division show the same stage of progress. Your solutions will be partially complete divisions.

Long Division	Synthetic Division
$\begin{array}{r} x^2+x-6 \\ x+1\overline{)\,x^3+2x^2-5x+7} \\ \underline{x^3+x^2} \\ x^2-5x \\ \underline{x^2+x} \\ -6x+7 \end{array}$	
Long Division	**Synthetic Division**
	$\begin{array}{r\|cccc} 1 & 1 & 2 & -5 & 7 \\ & & 1 & & \\ \hline & 1 & & & \end{array}$

(1) b. Express the division in the form $\frac{P(x)}{x-a} = Q(x) + \frac{R}{x-a}$.

(1) c. How does the remainder compare to $\frac{R}{x-a}$? What does the remainder of this division represent?

(3) 2. Determine the zeros of $P(x) = x^4 + 3x^3 - 15x^2 - 19x + 30$ by factoring.

3. This question is designed to generate understanding for why the remainder theorem and factor theorem work.

(1) a. Show that $\frac{P(x)}{x-a} = Q(x) + \frac{R}{x-a}$ can be rearranged to $P(x) = Q(x)(x-a) + R$.

(1) b. Evaluate $P(a)$, showing it simplifies to R.

(1) c. How does the answer in part b. relate to the remainder theorem?

(1) d. Use $P(x) = Q(x)(x-a) + R$ to explain the factor theorem. (Hint: What is the value of R if there is no remainder? Substitute this value for R into $Q(x)(x-a) + R$ to show $x-a$ is a factor of $P(x)$.)

4. Function f, has the following properties:
   - The graph of $y = f(x)$ extends down into quadrant III and down into quadrant IV.
   - The zeros of f are -2, 3, and 5.
   - The degree of $f \leq 5$.

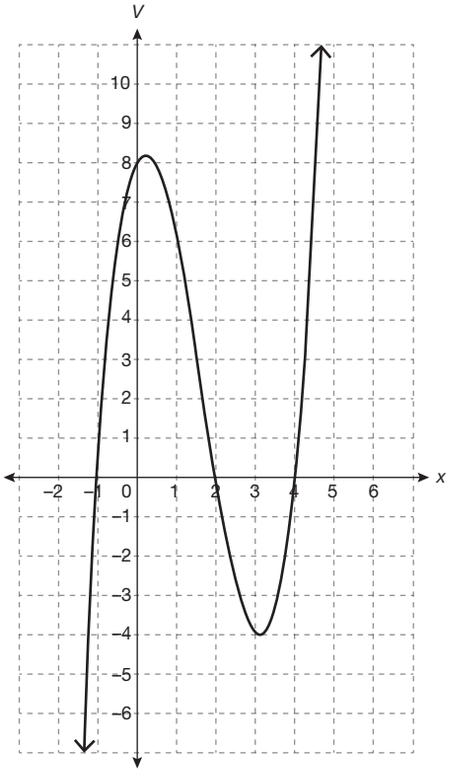
(1) a. What degree(s) is/are possible for f? Explain.

(1) b. What are the maximum and minimum multiplicities possible for a zero of f? Explain.

(1) c. Sketch two possible graphs of $y = f(x)$.

(1) d. State two possible equations for f.

5. A cube with side length x has been modified by adjusting its length, width, and height. A student determined a function of the form $V(x) = (x + a)(x + b)(x + c)$ can be used to represent the volume of the new box for different values of x, and then she graphed the function.

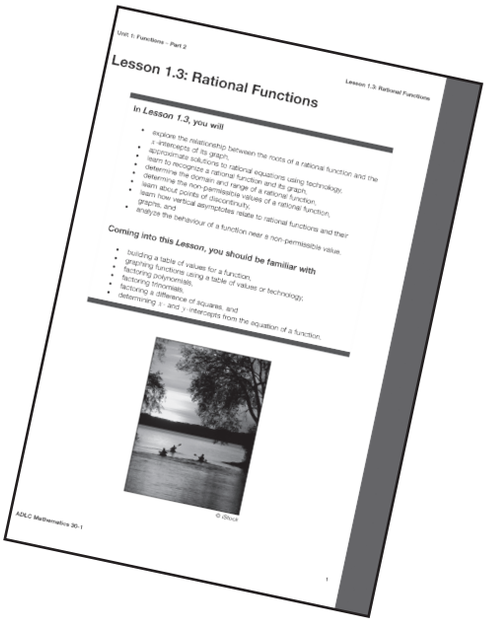


(1) a. Based on the graph, predict how the side lengths of the original cube changed. (Hint: What do the zeros of the function represent?)

(1) b. Determine a polynomial function of the form $V(x) = (x + a)(x + b)(x + c)$ that matches the function in the graph.

(1) c. Which part(s) of the graph are realistic? Explain. (Hint: All side lengths must be positive. Using two negative side lengths to give a positive volume is not realistic.)

When this workbook is complete, submit it using a method described at the beginning of this *Workbook*. Next, complete *Test Your Understanding Quiz 1.2* online in Moodle. When complete, return to the *Module* and begin *Lesson 1.3.*


Unit 1: Functions - Part 2

Lesson 1.3: Rational Functions

Lesson 1.3: Rational Functions

In Lesson 1.3, you will

- explore the relationship between the roots of a rational function and the x-intercepts of its graph,
- approximate solutions to rational equations using technology,
- learn to recognize a rational function and its graph,
- determine the domain and range of a rational function,
- determine the non-permissible values of a rational function,
- learn about points of discontinuity,
- learn how vertical asymptotes relate to rational functions and their graphs, and
- analyze the behaviour of a function near a non-permissible value.

Coming into this Lesson, you should be familiar with

- building a table of values for a function,
- graphing functions using a table of values or technology,
- factoring polynomials,
- factoring trinomials,
- factoring a difference of squares, and
- determining x- and y- intercepts from the equation of a function.

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1

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