Introduction to a Quadratic Function Unit



Big idea

The first half of this course - the first four units - are review of quadratics you've learned in grade 10. If you took grade 10 applied, you will learn a lot of new things in addition to what was done last year. If you took academic course you will find that there is not a lot of new material to learn. Whatever was done before, you must learn to be very proficient with working with quadratic equations as well as learn some new concepts that relate to guadratics you have never seen before. In this unit you will concentrate on the following topics that are outlined in the table below. (The review topics in the table are from BOTH academic and applied course.)

		Succes	s Criter	ia					
		Assessm	ent as Lea	rning for L	earning and	of Learning			
I know all the prior concepts related to this unit. (If not STOP & complete more review)	Place a ✓ if you are confident in that section. Place a ≈ if you are just ok in that section. Leave it blank if you are lost in that section. If there are gaps in any row, please see the teacher for extra help in that topic.	I can understand the lesson (If not, ask clarifying questions. Be specific – "what part is unclear?")	I can do a question with an example to follow. (If not, see the teacher for extra help)	I can do questions independently (If not, redo a solved example without looking at solutions)	I can explain/communicate this concept in my own words – JOURNAL (If not, practice explaining steps done in a solved example)	I can apply this concept in other/new contexts/situations (This can be only attained with practice)	I am very confident and am able to complete questions quickly (If not, time yourself to see progress)	I completed the practice in EACH section	I completed the practice test and the review section for this unit.
KU		KU	KU	APP	COMM	TIPS		HW	TEST
	Learning Goal		eg,	1			٢		
graphing	Characteristics of Functions Section 1.1 #2,4,7,10,12,13								Test ions
s of and (Lines and Quadratics & Function Notation Section 1.2 #1,2,5,6,8 & EXTRA Handout								Self-
equation: ations, ex ics	Working with Function Notation Section 1.3 #3,4,5,6,13,15								haptei eview
lines, finding , , solving equa s and quadrat	Transformations of Quadratics – INVESTIGATION with Graphing Calculators Section 1.5 #1,2 i,ii,3,5,6,9,10 & EXTRA Handout								P70 - C 1apter R€
Jraphing pressions with line	Sketching Quadratics using Transformations Section 1.6 #5,7def,10,11 & EXTRA Handout								69 Cł
tions of and ç mplifying exp blem solving	Domain and Range Section 1.7 #2,3,6,7,8,9								P68-
Finding equat quadratics, sii factoring, prot	EXTRA – domain& range activity								



Tentative TEST date____

Reflect – TEST mark for this unit_____, Overall mark now____ Looking back on this unit, what should you plan to improve upon before the exam?

Corrections for wrong textbook answers:

Date: _____ Characteristics of Functions

- 1. Mathematics is a study of relationships. These relationships when written with variables are called **relations**. Sometimes a problem may relate variables that have interdependence. We usually call _____ variable as independent and the _____ variable the dependent. The independent variable can also be called the ______ and dependent variable the ______. This terminology is often used when the relations are **functions**.
- 2. What is a function? (Explain using the input/output terminology, as well as explain how to determine if it is a function from an equation and from a graph.)
 - 3. Define the terms domain and range.





k. <u>equations</u>	l.	m.
y = 3 - 6x	$y = 2x^2 - 8$	$x^2 + y^2 = 4$

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n. descriptions

A vending machine produces pop, gum, chocolate bars, etc. depending on the button pressed. 0.

The postal office looks at the postal code on the package to decide which address it goes to.

p.

The forensic office analyzing DNA, is trying to determine the identity of a person it belongs to.

3	For which	ch pair	of related quar	itities would	d time b	e the indep	endent va	ariable?
93	a.	grade,	time spent on	project	C.	flight time,	rainfall	

b. length of race, finish time d. distance to work, commute time

- 1. What is function notation?
- 3. You have seen function notation for specific functions, but you just didn't know it. Indicate what is the name of the function, the input and the output of each of the following
 - a. $\cos(\theta)$.
 - b. $\sin^{-1}(0.5)$
 - c. $\sqrt[3]{(9)}$
 - d. $(2x)^2$
 - 5. What do differences of the dependent variable tell you about the relation given?
 - 6. Determine what type of functions are these? Specify what variable is the function of what other variable and record the output in function notation.

b.

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1

7

13

19

22

Р

-8

2

12

22

27 32

<u>a.</u>	
X	У
0	-9
2	-10
4	-7
6	0
8	11
10	26

eg

с.	
Time	Radiation
(years)	level
1	17
2	9
3	5
4	3
5	2
6	1.5

		25
11.	A	1
Length	Area of	
	figure	
1	2	
2	5	
3	10	
4	17	
5	26	
6	37	

d.

e.	
# of	Cost
items	
10	7
12	9
14	11
16	13
18	15
20	17

2. What could function notation be confused with?

Name:

4. Explain why it is incorrect to write the following, give corrected versions.

a.
$$\cos = \frac{1}{2}$$

b. $\tan x = 0.5234$ $x = 0.5234 \tan^{-1}$ _____

7. What is a degree of a function? How does it help you determine what type of function is given?

8. Decide what type of function is given by expanding and simplifying then determining the degree of the function.

a. (a) f(x) = (2-x)(x+3)b. (a) g(x) = 5+4(x-2)-8xc. d. $h(x) = 2x-(x-2)^2$ i. i(x) = 3+x-5(x-7(x+1))

- The helium balloon is launched from a height of 2 meters and it rises at a rate of 0.5 m/s.
 a. Write an equation in function notation for the height, h, of the balloon at time, t, seconds.
 - b. What is the domain and range of this function, assuming that the balloon pops at a height of 1 km.

- 10. Video games cost on average \$8.00 to rent. The player costs \$300. The total cost of playing video games can ge represented by a function C(v).
 - a. Write an equation in function notation for the cost of v, video games.
 - b. State the degree of this function and whether it is linear or quadratic.
 - c. Use your equation to calculate the cost of renting 20 video games.
 - d. What is the domain and range of this function, assuming that you have \$780 to spend?

Date: _

Name:

- 11. A skydiver's height is modelled by $h(t) = 2000 4.9t^2$ for $\{t \in R, 0 \le t \le 14\}$, where t is the time elapsed, in seconds, and h is the height in meters. After 14 seconds the skydiver opens up the parachute and his descent is modelled by h(t) = 1039.6 3.5(t 14).
 - a. Use the degrees to determine what type of relations the equations are.
 - b. At what height was the parachute released?
 - c. At what time did the skydiver land on the ground?



d. Sketch the first relation on the domain of $\{t \in R, 0 \le t \le 14\}$ using a table of values with time increments of 2sec. Sketch the second relation by using the two points where t = 14 and t =answer from c.

- e. Show that the differences in the table for the first relation match with your answer about what type of relation it is in question a.
- f. Use vertical line test to determine if the relation is a function.

Date:



Function Notation

1. Determine f(7) of each of the following $f = \{(-9, 7), (-7, 6), (0, -7), (7, -9), (9, 7)\}$

x	0	1	3	5	7
f(x)	-7	-5	-3	-1	0

2. Determine f(-6) of each of the following $f = \{(-10, -6), (-9, -7), (-8, -8), (-7, -9), (-6, -10)\}$

x	-6	-4	-2	0	2
f(x)	-6	-6	-6	-6	-6



Is the this graph a function? Explain.

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3. For the following function determine f(-2), f(0), f(3), f(4x) $f(x) = x^2 + 7x + 12$

a. For the following function determine f(0), f(-1), f(2), f(5x) $f(x) = 7x^2 - 25x + 12$

Name:

- 5. Three consecutive even integers numbers are picked from the domain $-10 \le x \le 10$. The equation that models the sum of their squares is $S(x) = x^2 + (x+2)^2 + (x+4)^2$
 - a. What does each part of the equation represent?
 - b. Evaluate S(-10), what does it represent?
 - c. Evaluate the function for all valid values of the domain. Organize results in a table.
 - d. Find which three numbers would give th minimum sum?
- 6. A pebble falls straight to the ground from a cliff that is 1102.5 m tall. The function representing the distance the pebble has fallen in meters is $d(t) = 4.9t^2$, where t is the time the pebble has been falling in seconds.
 - a. Evaluate d(3). What does it represent?
 - b. Explain what does the following tell you? d(5) = 122.5
 - c. When did the pebble land on the ground?
 - d. What is the domain and range of this situation?



Date: ______ Transformations of Quadratics - INVESTIGATION

In this investigation you will graph different parabolas and determine the link between the equation in <u>"vertex form" $y=a(x-h)^2+k$ </u> and the transformations from the <u>basic parabola $y = x^2$ </u>

TECHNOLOGY OPTION To help you graph and plot the parabolas, enter the equation in the $Y =$								
Use x, τ, Θ, n to type a variable								
Remember to use GREY (-) when negative appears FIRST and BLUE – otherwise								
Press graph to see the graph								
Press 2 nd graph to see a table of values for the parabola								
Parabola Investigation #1								
Basic Equation y = x ²								
Vertex Form $y = a(x - h)^2 + k$								

Change	values for a						_					
keep h=	0 and k=0 for now											
values	Equations	Colour										
a=2												
a=0.2												
a=-1												
a=-2												
a=-0.2			\vdash				_				\mid	
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Summarize what effect does *a* have on the graph of $y = x^2$

1. State the transformations performed on $y = x^2$ in each of the following quadratics a. $y = 1/3x^2$ b. $y = -5x^2$ c. $y = -0.001x^2$



2. State the transformations performed on $y = x^2$ in each of the following quadratics a. $y = 2x^2 - 9$ b. $y = -0.5x^2 - 16$ c. $y = -3x^2 + 9$

Parabola Investigation #3



3. State the transformations performed on $y = x^2$ in each of the following quadratics a. $y = (x+2)^2$ b. $y = (x-4)^2 - 7$ c. $y = -(x+4)^2 + 3$ d. $y = 2(x-1)^2$

Bring colouring pencils to next class 10

Sketching Quadratics using Transformations

1. Summarize what the letters of $y = a(x-h)^2 + k$ stand for. Make a note on the order that transformations should be applied in.

2. Write an equation of a parabola that satisfies each set of conditions

a.Opens down, congruent with $y = \frac{1}{4}x^2$, vertex (5,-4) b. Vertex (-3,-8), x-intercepts of 1 and -7.

[6] c. Vertex (2,7), y-intercept – 3.

d. Vertex (0, -4), passes through (-3, 2)

Date: ____

Date: ______Name: ______ 3. Describe the transformations (in the correct order) applied to the graph of $y = x^2$ to obtain the graphs of the following quadratic relations. Sketch the graph by hand. Start with the graph of $y = x^2$ and show all transformations with different colours.

a. $y = -3(x+2)^2 + 8$	b. $x = 0.5x^2 - 9$	c. $y = -1.5(x-5)^2$

10 Determine the combination of transformations that would result in the following graphs, then determine a possible 4. equation for the graph.

10







Domain and Range



Some of the questions in the textbook require you to graph with technology. There are lots of applets you can use online, or you can download a free program to use on your computer offline.

Online Graphing Calculator

http://my.hrw.com/math06 07/nsmedia/tools/Graph Calculator/graphCalc.html

Download GeoGebra (offline and online) http://www.geogebra.org/cms/en/download,

select <u>webstart</u>, for offline select <u>appletstart</u>, for online

- 1. Use graphing software to graph each function and then use the graph to state the domain and range.
 - a. $f(x) = 2(x+3)^2 8$

b. $g(x) = 4 - 2x - 0.25x^2$

2. Notice that range is visible from ONE of the versions of quadratic equation above. What must the equation look like for range to be visible and how can you determine the range from it?

- 3. What is the domain and range for lines? (make sure you explain all types of possible lines)
- 4. Find the domain and range for each of the following ralations.
- i a. $f(x) = -3x^2 + 5$ b. g(x) = 5
- **a** c. x = -6d. $h(x) = 4(x+3)^2$
 - e. f(x) = 7x 3f. $g(x) = -(x - 5)^2 + 8$
 - g. $f(x) = x^2 + 5x 3$

Date:

Name:

- 5. While on vacation, Talisha won a lot of tickets at two arcades on the boardwalk she was visiting. The first arcade charges \$1 to cash in and gives you 12 cents back on each ticket won, the second arcade gives you 10 cents back on each ticket and no fee to cash in.
 - a. Determine the equations for the money you can leave with as functions of winning tickets for both arcades.
 - b. Determine the domain and range for both arcades.
 - 6. A rocket is launched and its height in feet as a function of time in seconds is given by $1600t 16t^2$. Find the domain and range that will make sense in the context of this real life situation. (use a table of values)

- 7. Oberon Cell Phone Company advertises servise for 3 cents per minute plus a monthly cost of \$29.95.
 a. Determine the equation for the cost as a function of minutes.
 - b. Determine the domain and range for this real life situation.
- 8. Two people are playing golf. The height above the ground in meters is given by $h_1(t) = -5t^2 + 40t$ for a person hitting the golf ball from ground level and $h_2(t) = -5t^2 + 40$ for a person hitting the golf ball from a roof of a building.
 - a. For which player must you create a table of values to see domain and range? Create it. (if you took grade 10 academic course, you may: for the RANGE -complete the square to see vertex, and for the DOMAIN – common factor to see zeros instead of doing the table of values – if you remember how)

b. Find the domain and range for both players.