Date: ____________________

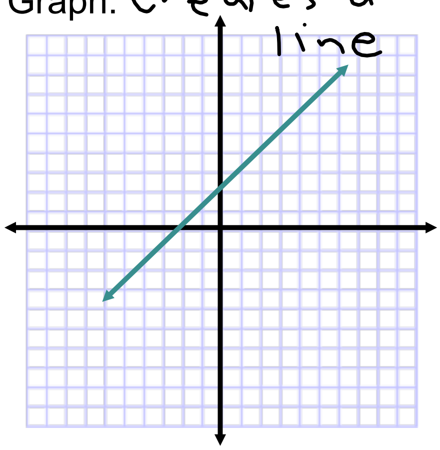
3.1 Exploring Quadratic Relations
Bellwork:

1) How can you tell if a relationship is linear using a table of values, graph, and equation?

Table: First Diff

x	y	
-2	7	
-1	3	-4
0	-1	-4
1	-5	-4
2	-9	-4

Graph: Creates a line



Equation:

$y = mx + b$

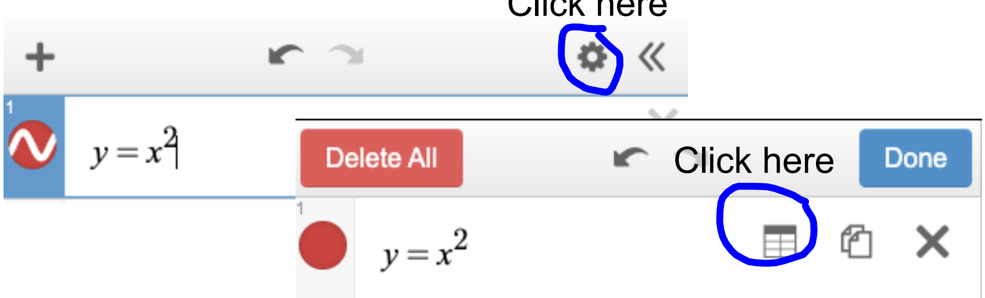
OR

$Ax + By + C = 0$

2) Turn to p. 134 in your text book and use Desmos (ignore all of the graphing calculator instructions, just open the Desmos app or go to desmos.com and type in the equation) to help you complete parts A and B.

To see the table that goes with your graph in Desmos, follow the instructions below.

Click here



3) Use your knowledge of first differences (the difference in the y-values in a table) to complete C and D.

3.1 Exploring Quadratic Relations

You spent lots of time learning about different representations of linear relationships in grade nine. This year, we are going to take that understanding one step further and learn about "quadratic relationships".

1) Finite Differences

first differences - the differences in the y - values of a relation

First differences allow us to conclude if a relationship is linear or not (equal = linear; not equal = not linear).

> Finite differences are simply the differences of the differences. For example, if I subtract my first differences from each other, I can find second differences, and so on.

ex/ Calculate the second differences for the table provided.

x	y
-2	16
-1	9
0	4
1	1
2	0

1st Diff

$9-16=-7$ > $-5-(-7)=2$

-5 > 2

-3 > 2

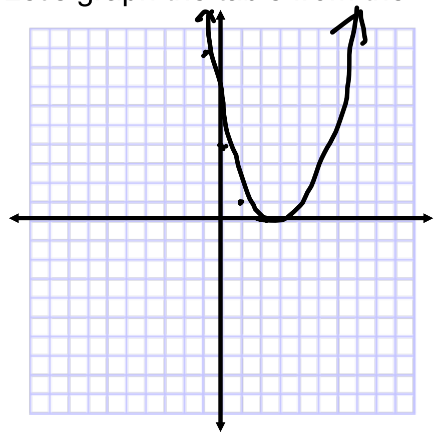
-1

When our second differences are EQUAL, the relationship is QUADRATIC. When our second difference are NOT EQUAL, the relationship is NEITHER linear nor quadratic.

2) <u>Curve of Best Fit</u>

We already know that a linear relation forms a line on a graph. Quadratic relations also have a characteristic graph. Let's graph the table from the previous example to see what it looks like.

x	y
-2	16
-1	9
0	4
1	1
2	0



This is called a PARABOLA. Every quadratic relation forms a parabola when it is graphed. Parabolas can only open UP (second differences are POSITIVE)or DOWN (second differences are NEGATIVE), never sideways.

3) <u>Finding the "Degree" of a Polynomial</u>

degree - the highest sum of the exponents IN ANY ONE TERM in a polynomial expression

<u>To determine the degree of an expression</u>:
- expand and simplify as much as you can;
- add up all of the variable's exponents in EACH TERM; the highest total wins, determining the degree of the expression.

ex/ Find the degree of each of the following:

3 terms

a) $6x^2 - 2x^1 - 5x^0$

2, 1, 0

2nd degree

b) $2x(x + 3)$

$= 2x^2 + 6x$

2nd degree

What does the degree tell us about a relationship?

- All linear relations ($y = mx^1 + b$) are first degree.
- All quadratic relations are second degree.

Now complete parts E to G and K to M in the activity we started for bellwork. You can put all of the graphs for Part E in to Desmos at once, and just look at them. Repeat for Parts F and G. Parts K to M ask you to think about what you saw. Your findings will help you with the text book questions!