Topic 4 – Some Final Thoughts

For the final topic, we are going to talk more about how to adjust the viewing window in your calculator, and discuss some last minute ideas that are really nice to know for the exam. You have seen all the major ideas that will be tested on the Regents. At the end of this lesson, your instructor will give you an entire blank exam and you will decide which questions you must complete.

The Calculator WINDOW

When you press **ZOOM**, **6**, your calculator graph is set up so that the x- and y-axes go from -10 to 10.

```
WINDOW
 Xmin=-10
 Xmax=10
 Xscl=1
 Ymin=-10
 Ymax=10
 Yscl=1
↓Xres=1
```

Xmin and Xmax tell the calculator where to start and stop the *x*-axis, or how far left and right to show.

Ymin and Ymax tell the calculator where to start and stop the *y*-axis, or how far up and down to show.

The Xscl and Yscl tell the graph how far to space the marks on each axis. It is helpful to change the scales, but not necessary.
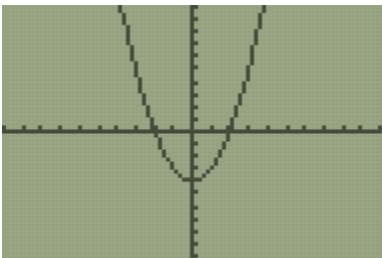
You will never adjust Xres or any other window settings.

For most functions, the ZOOM 6 viewing window gives a good picture of the graph.

```
Plot1  Plot2  Plot3
\Y1🔲(X+2)(X-2)
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

For the function rule

$$y = (x + 2)(x - 2)$$

When we use ZOOM 6, we can see the full graph. It is easy to tell that this is a quadratic function; its vertex is a minimum at the point (0, -4) and its zeros are *x* = -2 and *x* = 2.

Sometimes the standard viewing window doesn't provide a great picture.

Consider the situation from Topic 3: a school with 900 students is decreasing its enrollment by 2% each year. The function rule to model the population of the school over t years is $p(t) = 900(0.98)^t$.
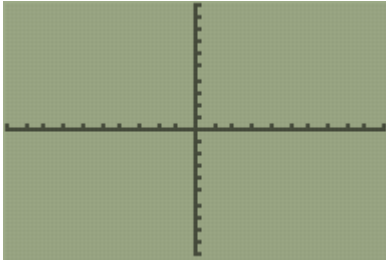
When we look at the standard ZOOM 6 window, the graph of $p(t)$ is not showing.

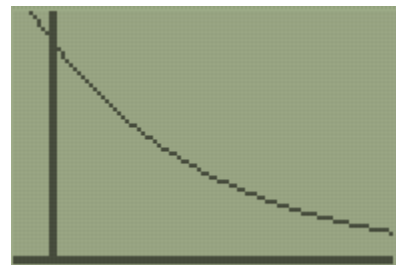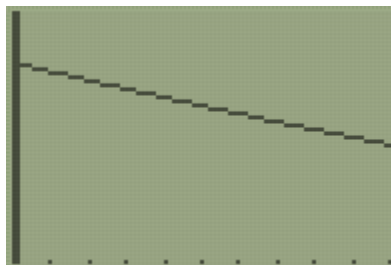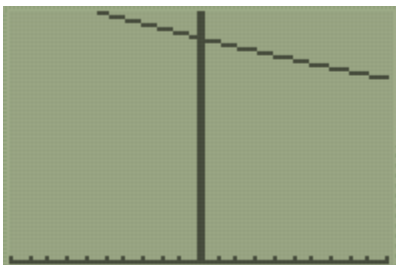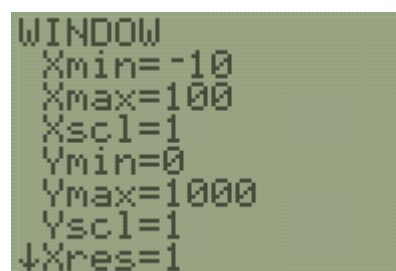We need to adjust our window settings.

The best way to get an idea of the numbers to set for the WINDOW is by looking at the table.

Notice that the y-values are in the 900s.

The x-values are generally in the single digits.

There is no one way to set up your window. Here are a few different settings and the graphs they produce.
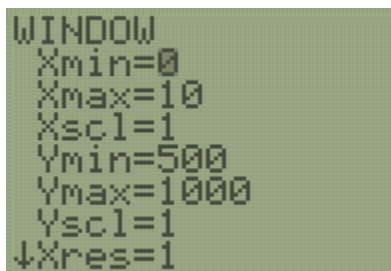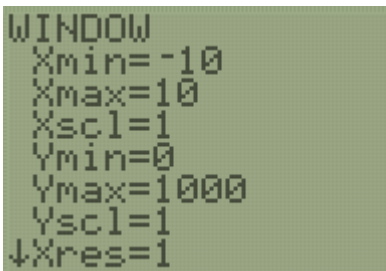
Each window setting gives a different looking picture of $p(t) = 900(0.98)^t$, but in each case we can see the graph.

Adjust the calculator window until you get a good picture of the graph and sketch what it looks like below each function rule. Write the window settings that you use.

$$f(x) = -16x^2 + 70x + 3 \qquad g(x) = 25x - 200 \qquad h(x) = 25(1.02)^x$$

Note: This is a process. For f, a Ymax in the 80s works well so that the vertex is visible. The Xmin and Xmax should be such that the zeros are visible. For g, the Ymin should be below -200 and the Xmax should be more than 8. For h, the Ymin and Ymax can be set from 0 to around 40, respectively. The Xmin and Xmax can be from -10 to 10.

Some tips for WINDOW setting:

- Mins should be lower than your lowest value.

- Maxs should be higher than your highest value.

- When in doubt, set your minimums to zero.

- If your graph doesn't look right, change one setting at a time and look back and forth from the WINDOW and the GRAPH until you get a good picture.

Another Function Family

There is another family (in addition to linear, exponential, and quadratic) that is worth knowing – the absolute value function.

The **absolute value** of a number a, written as $|a|$, is that number's distance from 0. Since distance is always positive, the absolute value of a number is always positive.
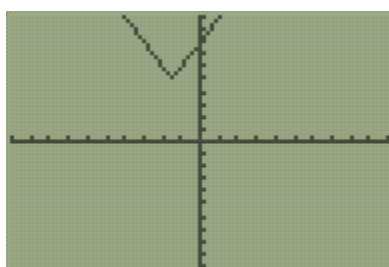
For example, the absolute value of negative four is four $|-4| = 4$ because negative four is four units away from zero on a number line.

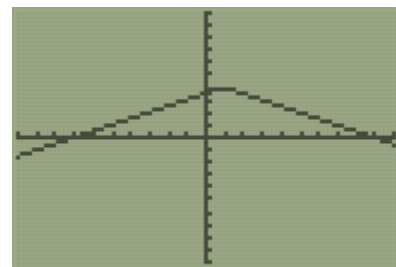Absolute value functions have similarities in the shape of their graphs.
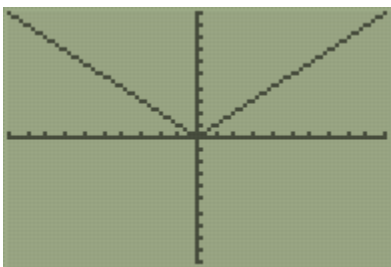
$y = |x|$	$y = |2x + 3| + 5$	$y = 0.5|x - 1| + 4$

Get the absolute value bars in the calculator by pressing **ALPHA**, **WINDOW**, **ENTER**.

What are some similarities between each function rule?

Answer: Each function rule has vertical absolute value bars around the variable.

What similarities do you notice in each graph?

Answers: Each graph is V-shaped and changes directions once. Each graph has a vertex that is either a maximum or a minimum.

Note: If your students are doing well with function families, feel free to explore the square root function family as well. Give students examples like $y = \sqrt{x}$, $y = 2\sqrt{x-4}$, and $y = -\sqrt{x+2} + 1$ and make observations as a class.

How Will I Remember Where Everything is in the Calculator??

By now you are noticing that the calculator can do many things. It is not obvious where everything is inside the calculator. You will probably forget where something is. Usually, you can find what you are looking for by doing one of the following things:

1. *ALPHA, and one of the top buttons*

These reveal hidden menus in the calculator. Play around with them to see what they can do. Here are a few highlights.

ALPHA, Y=, ENTER will create a fraction

ALPHA, WINDOW, ENTER will make absolute value bars

2. *It's probably the top row of buttons*

When you're working with graphs or tables, you always use the top row of buttons. You know that **Y=** is where you go to enter function rules, and **GRAPH** is what to press to look at a graph. Here are a few other features that you might find helpful.

```
TABLE SETUP
 TblStart=-2
 ΔTbl=0.5█
Indpnt: Auto  Ask
Depend: Auto  Ask
```

2nd WINDOW will allow you to change the starting *x*-value of the table.

ΔTbl adjusts how much the *x*-value changes by.

If you highlight "Indpnt: Ask" and press ENTER, when you visit your table (2nd GRAPH), it will be blank. You can type whatever x-values you want and the calculator will tell you the y-value. This sometimes confuses students, so only use this feature if it makes sense to you.

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

2nd TRACE is where all the tools for analyzing graphs are located.

Linear and Exponential Regression

Many students consider this an easy topic to earn points. The process of regression will generate a function rule that fits a set of data points.

Consider the question on the next page from the January 2019 exam:

34 The data given in the table below show some of the results of a study comparing the height of a certain breed of dog, based upon its mass.

Mass (kg)	4.5	5	4	3.5	5.5	5	5	4	4	6	3.5	5.5
Height (cm)	41	40	35	38	43	44	37	39	42	44	31	30

Write the linear regression equation for these data, where x is the mass and y is the height. Round all values to the *nearest tenth*.

Note: Students do not have to solve this yet. Just read, and then follow the solution steps below.

State the value of the correlation coefficient to the *nearest tenth*, and explain what it indicates.

Note: Students do not have to solve this yet. Just read, and then follow the solution steps below.
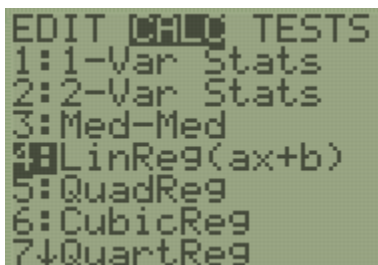
Solution:
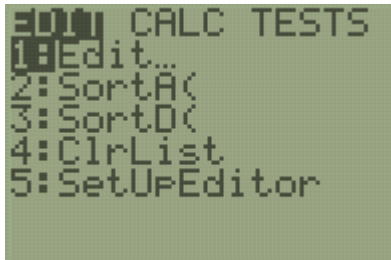
Press **STAT**, **ENTER**

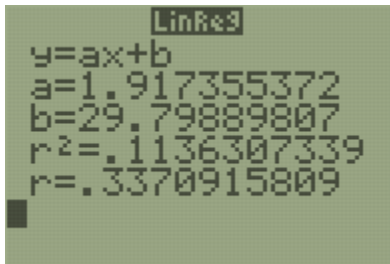Type the *x*-values in L1 and the *y*-values in Y2.

Press **STAT**, →

Since this problem asks for a <u>linear</u> regression, choose **4.**

(<u>Exponential</u> regression is choice **0.**)

Highlight "Calculate" and press **ENTER**

The first line, y = ax + b, is the function rule.

The next lines tell you the numbers to write in place of *a* and *b*. x and *y* will remain letters.

Ignore r^2

The *r* is called the **correlation coefficient**, and it is always between 0 and 1. The closer *r* is to 1, the better fit this data is to the type of function rule you chose.

Notice that this question asked us to round the values of the function rule to the nearest tenth.

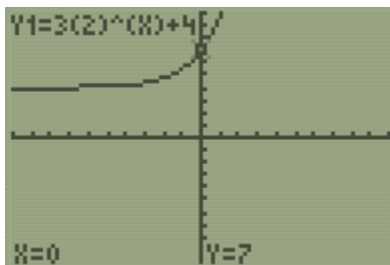The linear regression equation is $y = 1.9x + 29.8$.

The correlation coefficient, to the nearest tenth, is .3.

Since .3 is not close to 1, this function rule is not a very good fit for the data.

The y-intercept

This is a really easy one.

Consider $y = 3(2)^x + 4$

The *y*-intercept is the location where the graph intersects the *y*-axis.

Press **TRACE**, **0**, **ENTER**

X	Y1	
-1.5	5.0607	
-1	5.5	
-.5	6.1213	
0	▓▓▓▓	
.5	8.2426	
1	10	
1.5	12.485	

It is the **y-value when x = 0** in the TABLE.

The *y*-intercept of $y = 3(2)^x + 4$ is y = 7.

You're almost there. I hope that by now you feel some confidence toward passing this test. Next, your teacher is going to give you a copy of the June 2017 exam. (http://www.jmap.org/JMAPRegentsExamArchives/ALGEBRAIEXAMS/0617ExamAI.pdf)

It is now up to you to highlight ten problems that you can answer correctly by using the calculator strategies and ideas that we have discussed over these four lessons. Take your time to answer these questions first, and then focus on answering the other questions. Try the long response questions too.

Answers: From multiple choice, it is recommended that students choose questions 1, 3, 5, 6, 7, 9, 10, 12*, 14*, 16, 17, 18*, 19, 21, 22*

From long response, students may earn credit on 26, 27*, 28, 31, 32*, 33, 35

Note: The question numbers with an asterisk (*) are a little more challenging, but "gettable."

Encourage students to try long response, but focus more on the multiple choice.

The test answer key, scoring rubric, and student samples can all be found by following the above link.

If you have the time, try to spend at least two hours taking this practice exam. Pretend it's the real thing. Your teacher can help you read the questions, but they cannot to tell you whether your answers or work are right or wrong.

Taking a Regents

You may have been told that "it never hurts to ask." But <u>never</u> ask if something is right while you're taking a test. Students usually interpret a proctor saying "I can't tell you" to mean "what you're doing is wrong." Test proctors are simply not allowed to tell you whether what you are doing is right or wrong. For some reason, students tend to think this means that they are on the wrong track. Don't put your teacher or proctor in that position! Trust yourself.

If there is something you're having trouble with, but you are confident that you might be able to get it, put a star by that question and move on. The star will remind you to come back to that question later.

If you start to get sleepy, frustrated, or feel like your brain is fried, ask to get a drink of water or go to the bathroom and splash your face with water. While you're in the hallway, stretch your muscles and get your blood flowing. Focus on breathing slowly and deeply, then get back to work.

The night before the test, get to bed on time and eat a good breakfast. Bring a bottle of water with you to the test.

Try your hardest, and use as much time as you need. Don't feel like you are behind even if other kids are leaving the exam. Everyone processes at different speeds.

Don't rush. You have three hours. This is more than enough time to work slowly and carefully.

There are going to be questions that you cannot do. That is completely fine and expected. Remember, we are highlighting ten questions only, doing those, then finishing the rest. This is the key to your success.

On the long response, if you think you might have some idea, or you can do only part of the question, try it and write down your process.

Read every word of each question carefully. Sometimes only one word, such as "*not*", changes the meaning of a question completely.

Trust that the work you put into preparing for this test will pay off.

Good luck!