MAP 4CI   Name: ____________________________

REPRESENTING EXPONENTIAL EXPRESSIONS GRAPHICALLY

QUESTION 1

Raj started playing a word search game on the Internet. As he played, he found that his score, *S*, doubled after every day, *x*, he played according to the equation $S = 2^x$.

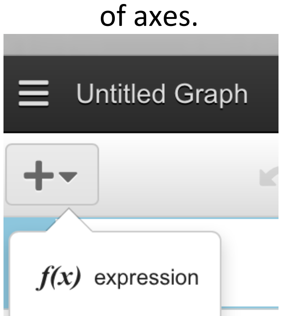
After three days, Raj told his friend Helen about the game. Helen enjoyed playing the game so much that her score, *S*, quadrupled after every day, x, according to the equation $S = 4^{(x-3)}$.

a) Explain why Raj's equation is expressed in terms of a base-2 power.

b) Explain why Helen's equation is expressed in terms of a base-4 power.

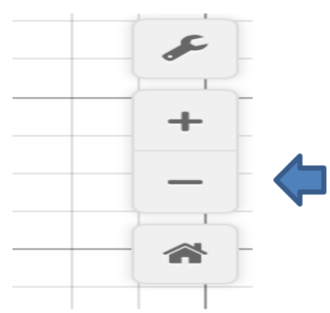
c) Why is there a -3 in the exponent of Helen's equation?

d) Using Desmos https://www.desmos.com/calculator, graph both equations on the same set of axes.



Click the "**+**" button and choose f**(x) expression**
Type in "y=2" then hit the button a^b and type the exponent x.
The graph of $y=2^x$ should appear.
Repeat this process to enter the equation $y = 4^{(x-3)}$.
Note: you must put the x-3 in brackets!

Click the "-" button to zoom out until you see the point of intersection. If you put your cursor over the intersection, the ordered pair corresponding to that point should appear.



e) Use your graph to determine how many days after Raj discovered the word game that Helen caught up to his score.

f) Use your graph to determine what will their scores be at that point?

g) Now algebraically determine when Helen's score will equal Raj's score.

QUESTION 2

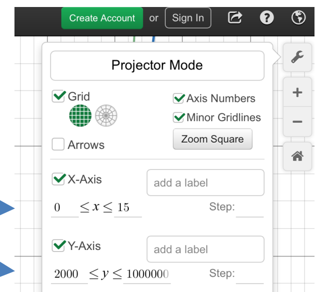
Someone starts a rumour that the year-end exams will be cancelled. If every student who hears the rumour tells three friends every day, the number of students, who have heard the rumour, x, days after it is started is given by the equation $S = 3^x$.

Six days after the start of this rumour, a teacher starts a counter-rumour that the exams will be the hardest ones ever. If every student tells nine friends every day, then the number of students, S, who have hear the counter-rumour is given by the equation $S = 9^{(x-6)}$.

a) How many people will have heard the initial rumour after 4 days?

b) How many people will have heard the initial rumour when the counter-rumour started?

c) Using "Desmos," graph both equations on the same set of axes. Use your graph to approximate after how many days will there be an equal number of people who have heard the rumour and the counter-rumour?
You will need to adjust the scales on the axes to find this.



d) How many people will have heard each rumour at this point?

QUESTION 3

The population of two towns, Telmira and Dancaster are each described by an equation relating population, *p*, in thousands, to time, d, in decades following the year 1950.

Telmira: $p = 5 \times 2^d$

Dancaster: $p = 3^d$

a) Determine the population of each town in 1950.

b) Using "Desmos", graph both equations on the same set of axes. Use your graph to determine when the towns will have the same population?

c) What is the population?

QUESTION 4

The population of a bacteria colony, p, is doubling every day, *x*, according to the equation $p = 2^x$. Five days later, the population of another bacteria colony is quadrupling every day, *x*, according to the equation $p = 4^{(x-5)}$. Use "Desmos", to approximate when the populations of the two bacteria will be equal?