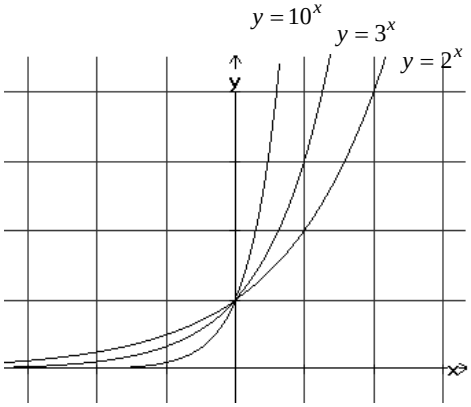
AChor/MBF3C **Name: _____**

Date: _____

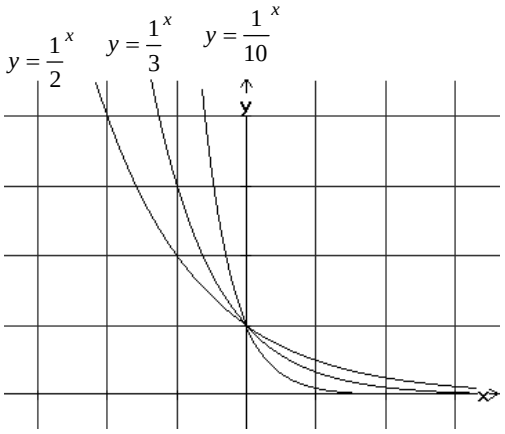
Worksheet 5-6: Exponential Relations: $y = b^x$ and $y = a(b)^x$

Properties of Exponential Relations $y = b^x$:

- **A relation of the form $y = b^x$, where $b > 0$ and $b \neq 1$, is exponential.**
- **If $b > 1$, moving left to right, the graph increases very slowly for negative *x*-values and increases more rapidly for positive *x*-values. The graph is almost horizontal on the left and very steep on the right.**



- **If $0 < b < 1$, moving from left to right, the graph decreases very rapidly for negative *x*-values and decreases more slowly for positive *x*-values. The graph is almost horizontal on the right and very steep on the left.**



- **The *y*-intercept is 1.**
- **There is no *x*-intercept.**
- **The "growth" factor or "decay" factor is the base of the power, *b*, which is the common ratio between successive *y*-values.**

Assigned Work: WS 5-6; p. 391 #4-8, #15

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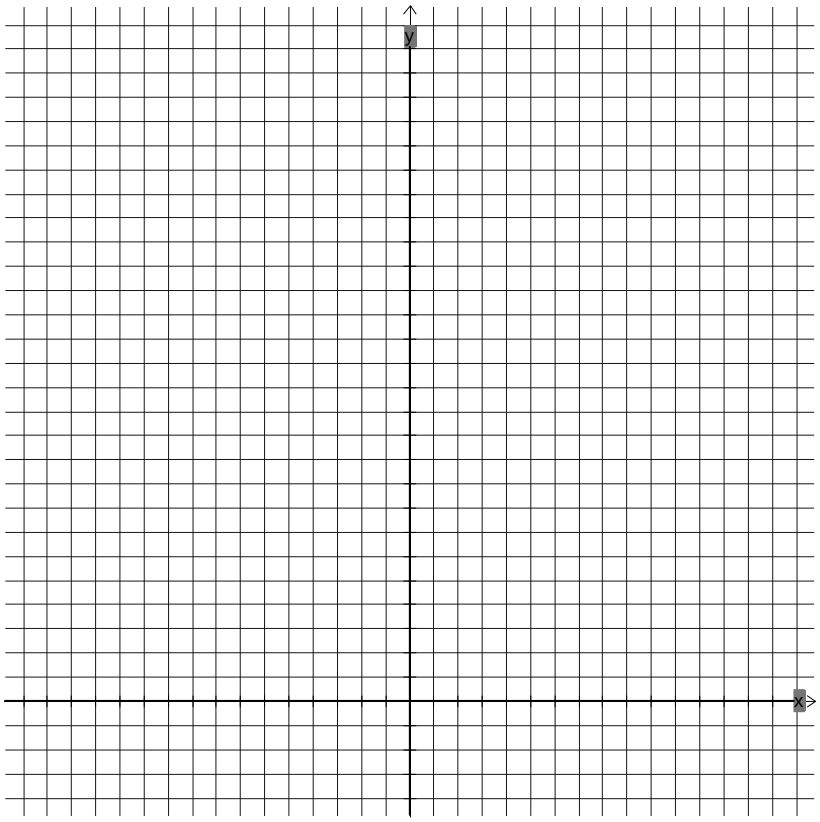
Investigation: Exponential Relations $y = a(b)^x$, where *a* is the initial amount or *y*-intercept

1. Graph $y = 2^x$, $y = 3(2^x)$, and $y = 5(2)^x$ on the same axes and compare.

x	$y = 2^x$
-3	
-2	
-1	
0	
1	
2	
3	

x	$y = 3(2^x)$
-3	
-2	
-1	
0	
1	
2	
3	

x	$y = 5(2)^x$
-3	
-2	
-1	
0	
1	
2	
3	



Conclusions: Compare the shape and *y*-intercept of the relations.

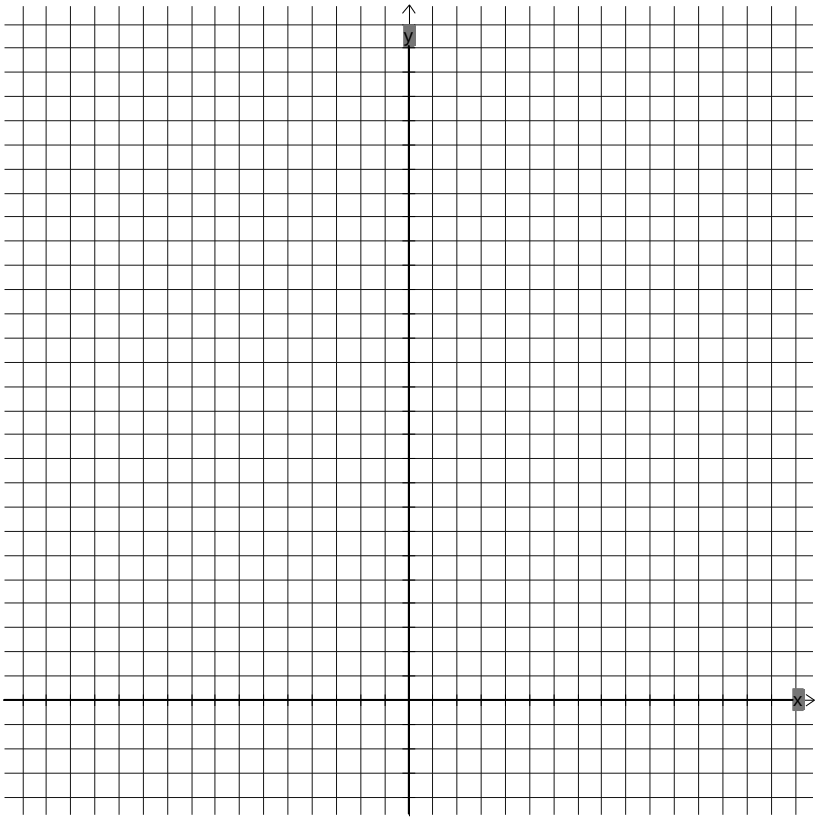
Investigation: Exponential Relations $y = b^x$, where *x* is multiplied or divided

2. Graph $y = 2^x$, $y = 2^{2x}$, and $y = 2^{\frac{x}{2}}$ on the same axes and compare.

x	$y = 2^x$
-3	
-2	
-1	
0	
1	
2	
3	

x	$y = 2^{2x}$
-3	
-2	
-1	
0	
1	
2	
3	

x	$y = 2^{\frac{x}{2}}$
-3	
-2	
-1	
0	
1	
2	
3	

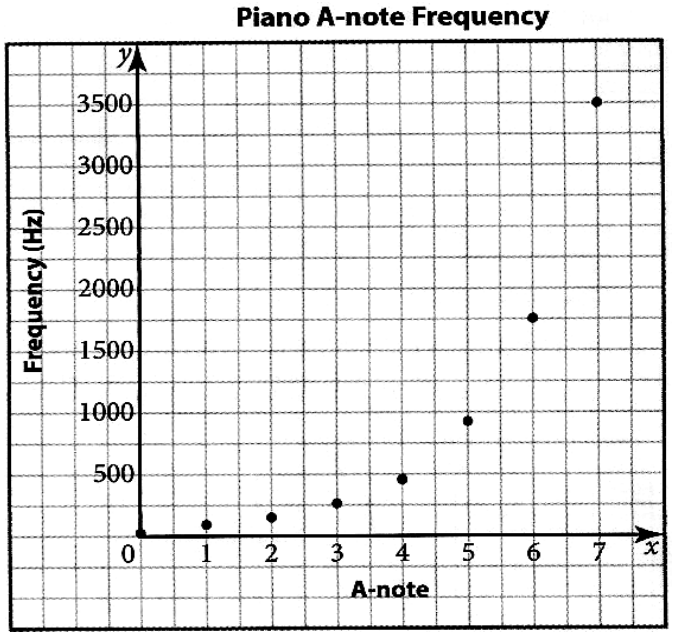


Conclusions: Compare the shape and *y*-intercept of the relations.

3. Musical Scale

Middle A on a piano is known as A4. Its sound wave has a frequency of 440 cycles per second, also written as 440 Hertz (Hz). The table and the graph show the frequencies of each of the eight A-notes on a piano.

A-note	0	1	2	3	4	5	6	7
Frequency (Hz)	27.5	55	110	220	440	880	1760	3520



(a) Describe the graph.

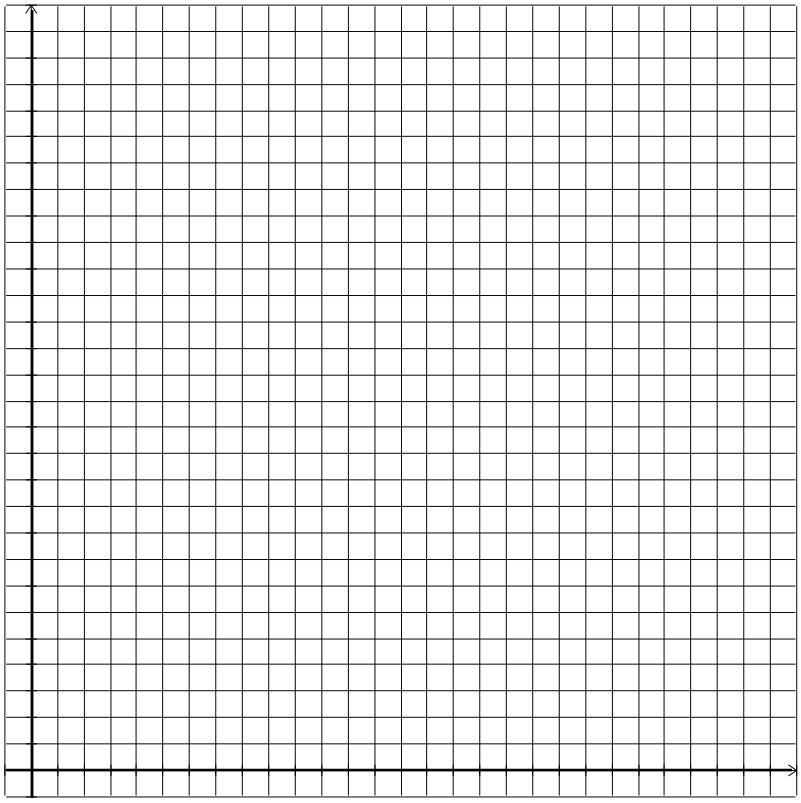
(b) Does the relationship between the A-notes on a piano and their frequencies model an exponential growth?

4. Musical Scale

Ontario's population is projected to grow exponentially every year based on the relation $P = 11000000(1.0112)^n$, where P is the estimated population and n is the number of years after 1996. The formula is expected to be valid until 2031.

(a) Sketch a graph of this relation.

n	$P = 11000000(1.0112)^n$
0	
10	
20	
30	
40	



(b) What was Ontario's population in 1996? Show this on the graph.

(c) What is the projected population for Ontario 2031?

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Name: _____ WS 3-6

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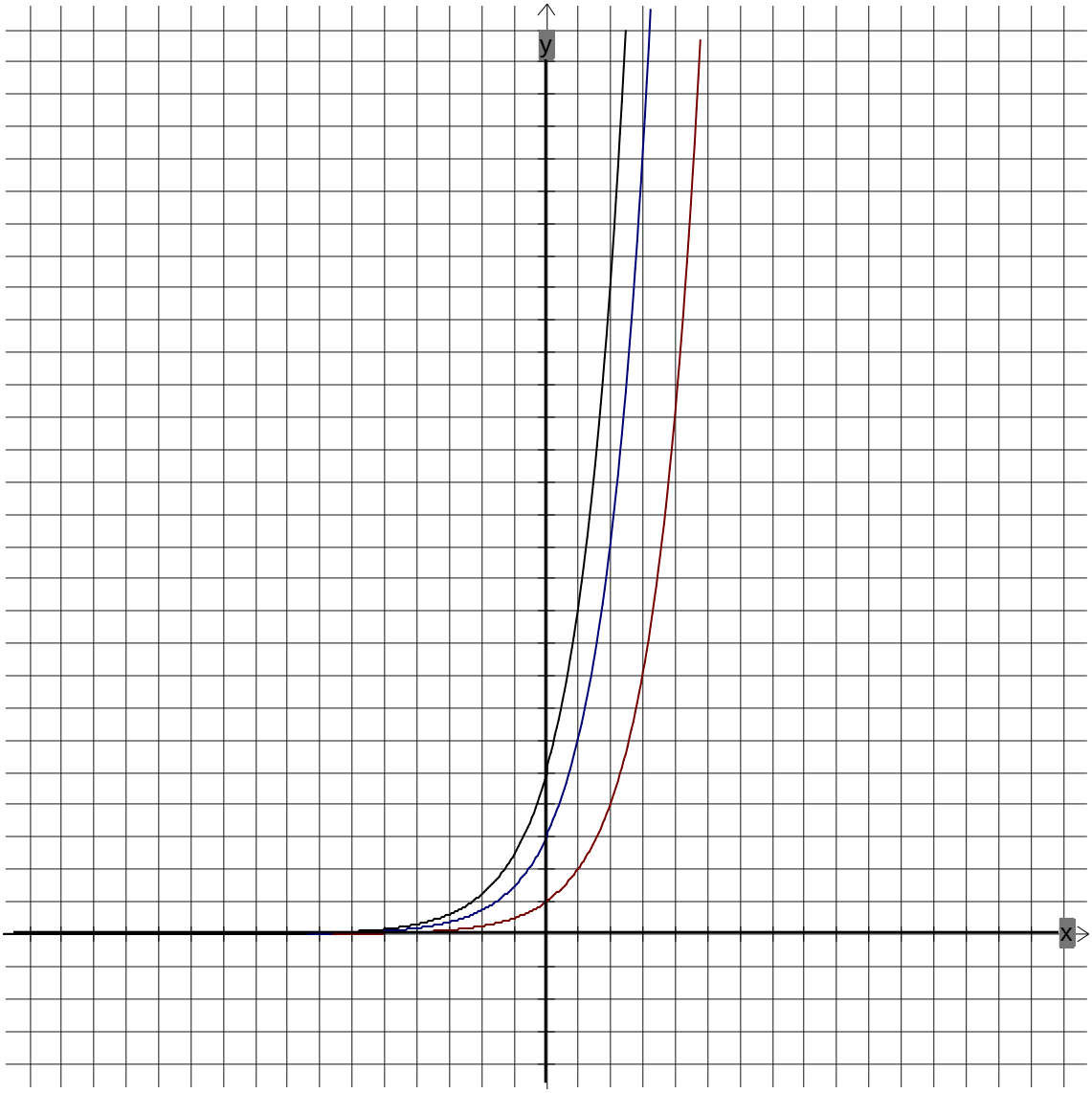

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Name: _____ WS 3-6

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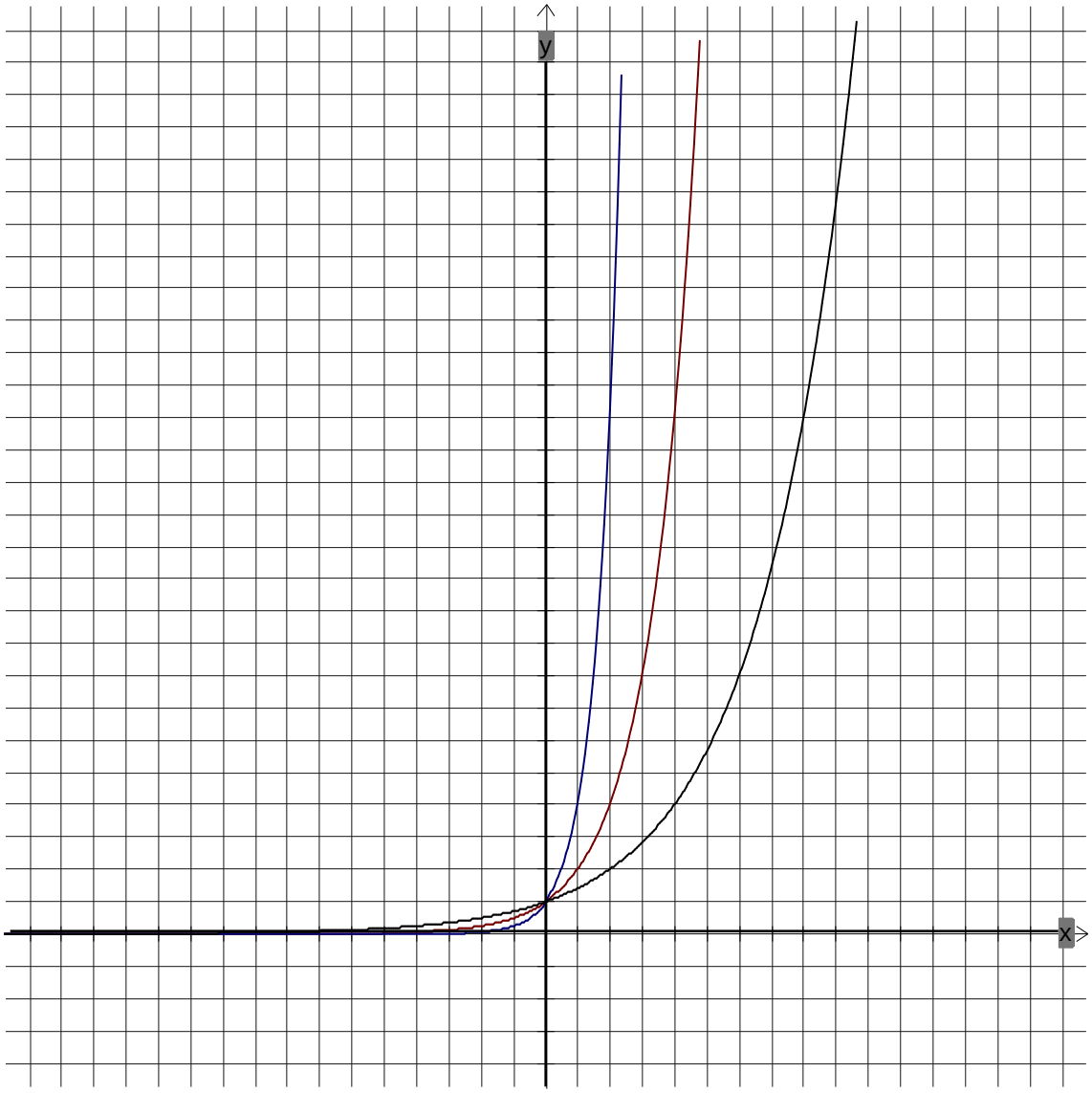

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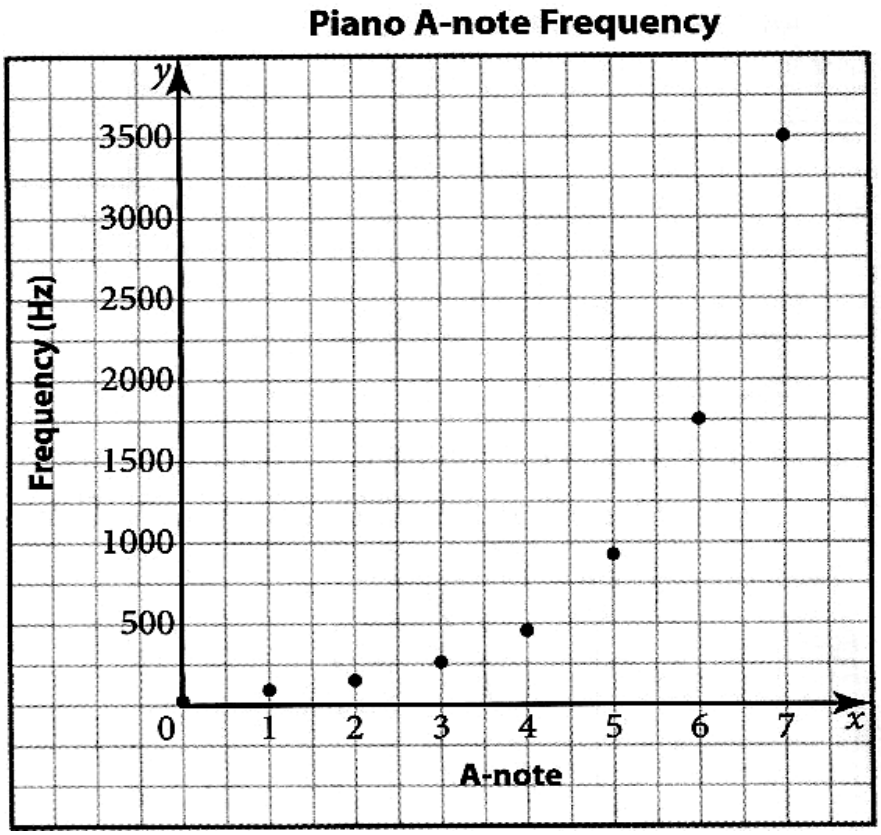

Name: _____ WS 3-6
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Number of Years After 1996	Population
0	11 000 000
10	12 295 985
20	13 744 657
30	15 364 008
40	17 174 145