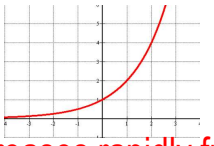
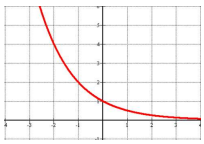
3.4b Exponential Relations: Problem Solving

Review... Recall it....don't write it

- When multiplying same base → add exponents
  eg: $4^2 \times 4^5 = 4^7$
- When dividing same base → subtract exponents
  eg: $6^2 \div 6^{-5} = 6^7$
- When taking the power of a power → multiply exponents
  eg: $(2^3)^5 = 2^{15}$
- Any base to the power of 0 → equals 1
  eg: $234^0 = 1$
- A negative exponent is → reciprocal to the positive exponent
  eg: $3^{-4} = \left(\frac{1}{3}\right)^4$
- Exponential Growth → increases rapidly from L to R by the same factor (ratio) each step



- Exponential Decay → decreases rapidly from L to R by the same factor (ratio) each step



- $y = b^x$, where $b>0$ and $b \neq 1$ → exponential function

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Ex 1: The Musical Scale

Frequency of the 8 A notes on a piano

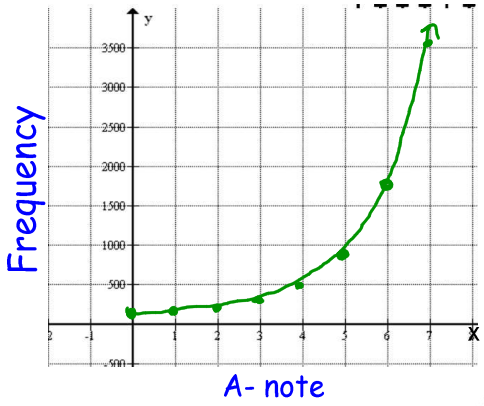
A-note	0	1	2	3	4	5	6	7
Frequency (Hz)	27.5	55	110	220	440	880	1760	3520
ratio		x2	x2	x2	x2	x2	x2	x2

ratio is the same ∴ exp. function.

notice the ratio is 2 this is the base in your equation

$y = 27.5 \cdot 2^x$

a) Graph the relation



b) What is the y intercept, explain the value

27.5 is the initial value

c) If there was an 9th A note, what would its frequency be?

notice you start at 0

From your chart:

$x = 8 \rightarrow 7040$

$x = 9 \rightarrow 14080$

or

From your equation:

$= 27.5 \cdot 2^8$

$= 7040$

$x = 8$, it is the 9th note

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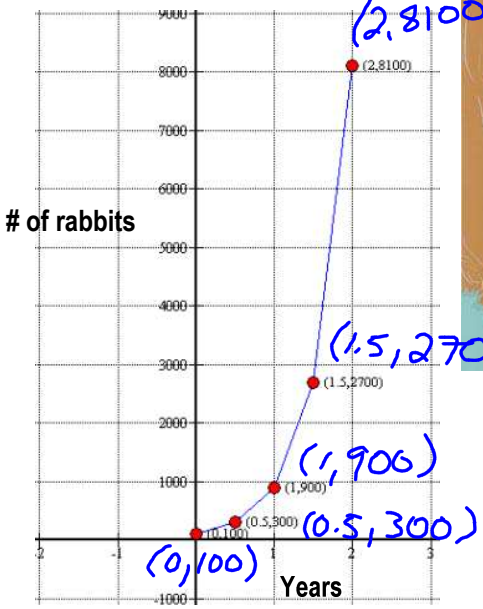
Ex 2: Wabbit Season



Rabbits breed very quickly.

Points (0, 100)
(0.5, 300)
(1 , 900)
(1.5, 2700)
(2 , 8100)

a) By what factor (ratio) is the population increasing every 6 months? $\frac{900}{300} = 3$

$y = 100 \cdot 3^x$

b) What will the population be at year 3?

3 yrs ? = 6 6 month periods

$y = 100 \cdot 3^6$

$= 72900$

$y \rightarrow$ population

$x \rightarrow$ # of 6 month periods

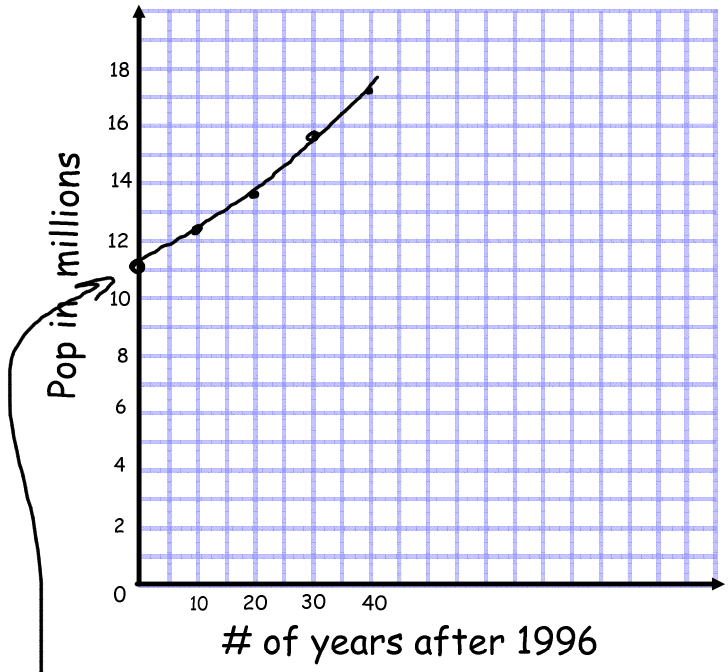
Ex 3: Popultion Growth

Ontario's Population is projected to grow according to the relation $P = 11\,000\,000(1.0112)^n$, where P is the estimated population and n is the number of years after 1996.

(this formula is expectd to be valid until 2031)

a) Sketch a graph of the relation

# of years after 1996	Population
0	11 000 000
10	12 295 984
20	13 744 657
30	15 364 008
40	17 174 145



b) What is Ontario's population in 1996? Show this on the graph

11 000 000

c) What is the projected population for 2031?

$n = 2031 - 1996$
$= 35$

$P = 11000000(1.0112)^{35}$
$\doteq 16\,243\,882$

Nov 30-6:28 PM

Practice
pg 391-394
6,7,8,9,12

Nov 30-6:26 PM