Date: ______________________

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) use exponential functions to model exponential growth and decay.

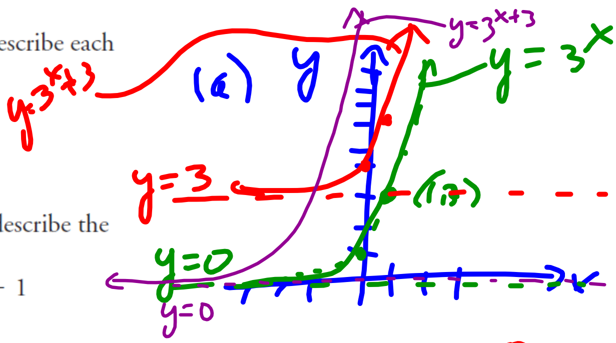
Last day's work: pp. 251-253 #(1,2)ab, 3, 4ab, 5ab, 9
(Oponal Wkst 4.6 Extra Pracce)
(text quesons at end of lesson)

1a) 1b

p. 251

1. Each of the following are transformations of $f(x) = 3^x$. Describe each transformation.
   a) $g(x) = 3^x + 3$ c) $g(x) = \frac{1}{3}(3^x)$
   b) $g(x) = 3^{x+3}$ d) $g(x) = 3^{\frac{x}{3}}$

2. For each transformation, state the base function and then describe the transformations in the order they could be applied.
   a) $f(x) = -3(4^{x+1})$ c) $h(x) = 7(0.5^{x-4}) - 1$
   b) $g(x) = 2\left(\frac{1}{2}\right)^{2x} + 3$ d) $k(x) = 5^{3x-6}$



3. State the y-intercept, the equation of the asymptote, and the domain and range for each of the functions in questions 1 and 2.

1b) $y=3^{x+3}$ y-int (at $x=0$)
$g(0)=3^{0+3}$
$=27$

$\therefore$ y-int $=27$

Eq'n of HA: $y=0$

D: $\{x \in \mathbb{R}\}$

R: $\{y \in \mathbb{R} \mid y>0\}$

1a) y-int: 4 (at $x=0$)

or $g(0)=3^0+3$
$=1+3$
$=4$

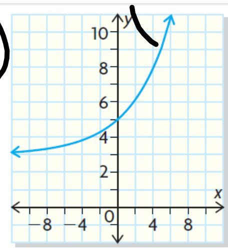
HA: $y=3$

D: $\{x \in \mathbb{R}\}$

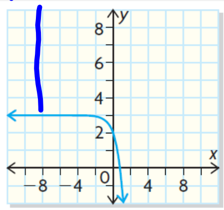
R: $\{y \in \mathbb{R} \mid y>3\}$

9. Match the equation of the functions from the list to the appropriate graph at the top of the next page.

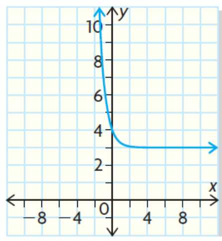
i) d) h(x)



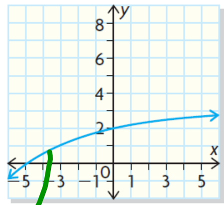
iii) a) f(x)



ii) b)



iv) c) g(x)



a) $f(x) = -\left(\frac{1}{4}\right)^{-x} + 3$

$= -\left(\frac{4}{1}\right)^{x} + 3$

$= -(4)^{x} + 3$

$\therefore$ growth, reflected in x-axis, vt up 3 units

Check on graph

$f(0) = -(4)^0 + 3 = -(1) + 3 = 2$

$f(1) = -(4)^1 + 3 = -4 + 3 = -1$

c) $g(x) = -\left(\frac{5}{4}\right)^{-x} + 3$

$= -\left(\frac{4}{5}\right)^{x} + 3$

$\therefore$ decay, reflected in x, vt up 3

Check on graph

$g(0) = -\left(\frac{4}{5}\right)^0 + 3 = -(1) + 3 = 2$

$g(1) = -\left(\frac{4}{5}\right)^1 + 3 = \frac{-4}{5} + 3 = 2.2$

d) $h(x) = 2\left(\frac{5}{4}\right)^{x} + 3$

$\therefore$ growth, v.s. by factor 2, v.t. up 3 units

check on graph

$h(0) = 2\left(\frac{5}{4}\right)^0 + 3 = 2(1) + 3 = 5$

$h(1) = 2\left(\frac{5}{4}\right)^1 + 3 = \frac{5}{2} + 3 = 5.5$

b) $y = \left(\frac{1}{4}\right)^{x} + 3$

$\therefore$ decay, v.t. up 3

4.7 Applications Involving Exponential Functions

Date: Apr. 17/18

Ex.1 You invest \$1000 at 8% /a compounded annually.

a) Model the amount of money as a growth function.

b) How much will you have after 20 years?

# of years	0	1	2	3			n
Amount	1000	1080	1166.40				

$1000(1.08)^1$ $1000(1.08)^2$ $1000(1.08)^3$ $1000(1.08)^n$

Simple Interest : $I = Prt$

Shortcut

$I_1 = 1000(0.08)(1)$

$= 80$

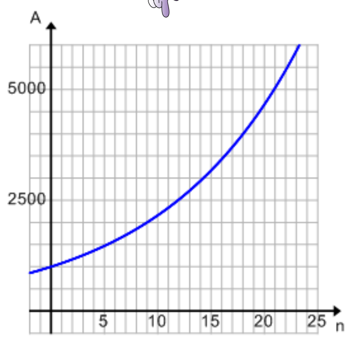
$A = P + I$

$= 1000 + 80$

$= 1080$

$A = 1000(1.08)$

$= 1080$



$A = 1000(1.08)^n$

Initial Amount

Growth Factor

Initial Amount	1000
Growth Rate	0.08
Growth Factor	1+0.08 =1.08

$I_2 = 1080(0.08)(1)$

$= 86.40$

$1000(1.08)(1.08)$

$A_2 = 1080 + 86.40$

$= 1166.40$

\$4660.96

b) $A_{20} = 1000(1.08)^{20}$

$\doteq 4660.957$

$\doteq \$4660.96$

Ex.2 A superball loses 10% of its height after each bounce.
It was dropped from 12 *m*.
Model the bounce height with a decay function.

Initial Amount 12

Decay Rate 0.1

Decay Factor 1-0.1
= 0.9

$$H = 12(0.90)^n$$

Initial Amount

Decay Factor

$1 \pm r$

Each bounce is 90% of the previous bounce.

The function $f(x) = a(b^x)$ can be used as a model to solve problems involving exponential growth and decay.

$$f(x) = a\,(b^x)$$

Where a is the initial value,
b is the growth factor and
x is the number of compounding periods.

Ex.3 A hockey card is purchased in 1990 for \$5.00.
The value increases by 6% each year.
a) Write an equation and b) determine it's value in 2011.

Let V represent the value of the hockey card, in dollars.
Let n represent the number of years since 1990.

$b = 1 + r$

a) $V = 5(1.06)^n$

$b = 1 + 0.06$
$= 1.06$

\$17.00

b) $V = 5(1.06)^{21}$
$\doteq 16.997$
$\doteq \$17.00$

$n = 2011 - 1990$
$= 21$

$* \; V = 5(1.06)^{n-1990}$

Ex.4 In 1980 the population of the town of St. Albert, Alberta was 20 000.
If the town grows at a rate of 2% a year, what was the population in 2014?

Let P represent the population.
Let n represent the number of years since 1980.

$P = 20000(1.02)^n$

$= 20000(1.02)^{34}$

$\doteq 39213.5$

$n = 2014 - 1980 = 34$

39 213

$\therefore$ the population was $\underline{39213}$.

There are growth and decay applications that involve doubling times or half-lives. The formula can be altered to:

$$N(t) = N_o(2)^{\frac{t}{d}}$$

t ⟵ total time
d ⟵ doubling time

$$N(t) = N_o\left(\frac{1}{2}\right)^{\frac{t}{d}}$$

t ⟵ total time
d ⟵ amount of time to have **50%** left
= half-life

Ex.5 A biology experiment starts with 1000 cells.
After 4 hours the count is estimated to be 256 000.
What is the doubling period for the cells?

Let N represent the number of cells.
Let d represent the doubling period, in hours

$N = N_0 (2)^{\frac{t}{d}}$

$256\,000 = 1000(2)^{\frac{4}{d}}$

$\frac{256000}{1000} = 2^{\frac{4}{d}}$

$256 = 2^{\frac{4}{d}}$

$d = 1 \therefore 2^{\frac{4}{1}} = 2^4 = 16$

$d = 2 \therefore 2^{\frac{4}{2}} = 2^2 = 4$

$\therefore$ try $d = -1$

the doubling period for cells is a 1/2 hour.

½ hour

$(2)^8 = 2^{\frac{4}{d}}$

$\therefore 8 = \frac{4}{d}$

$2^{\frac{4}{-1}} = 2^{-4} = \frac{1}{2^4} = \frac{1}{16}$

$d = \frac{1}{2}$

$\therefore = 2^{\frac{4}{\frac{1}{2}}} = 2^8 = 256$

$4 \div \frac{1}{2} = 4 \times \frac{2}{1} = 8$

Are there any Homework Questions you would like to see on the board?

Last day's work: pp. 251-253 #(1,2)ab, 3, 4ab, 5ab, 9

(*Oponal Wkst 4.6 Extra Pracce*)

(text quesons on following screens)

Today's Homework Practice includes:

pp. 261-262 # 1 – 8

SWYK NEXT CLASS