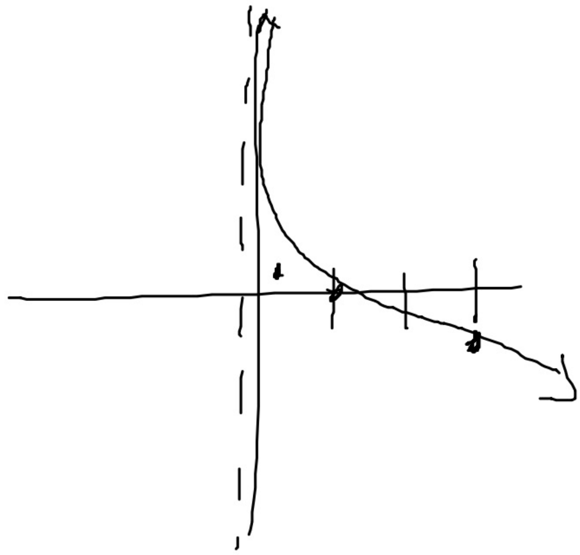
47.)

$y = \log_{1/3} x$

x	y
$1/3$	1
* 3	-1
* 1	0

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

x	y
3	-1
1	0
$1/3$	1



$x=0$

D: $(0, \infty)$

R: $(-\infty, \infty)$

51.) $f(x) = \log_4(x+2) - 1$

$x + 2 = 0$

$x = -2$

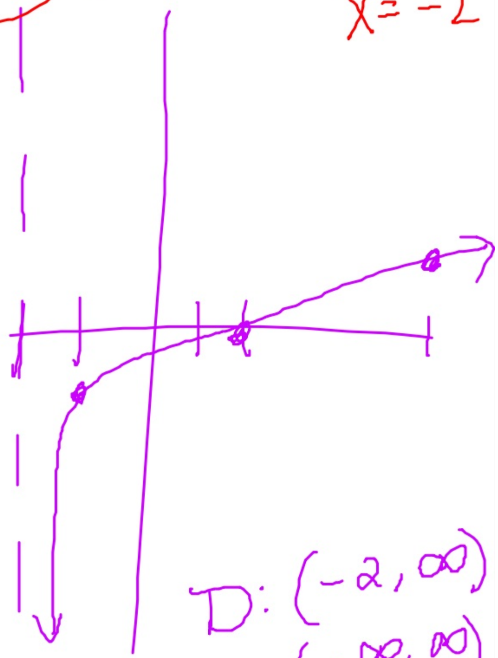
x	y
2	0
-1	-1
14	1

$y + 1 = \log_4(x+2)$

$4 \quad 4$

$4^{y+1} = x + 2$

$4^{y+1} - 2 = x$



$x = -2$

D: $(-2, \infty)$

R: $(-\infty, \infty)$

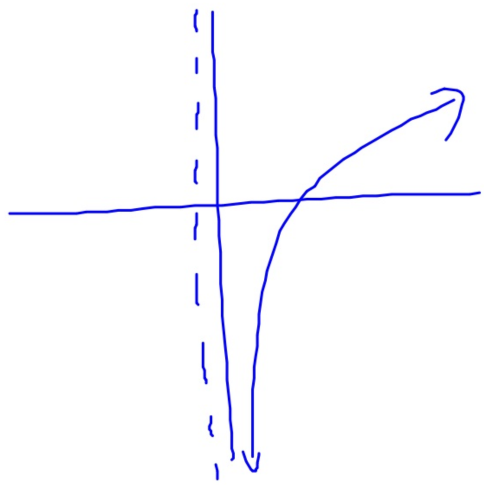
$$y = \log_3\left(x - \frac{1}{2}\right)$$

$$D: \left(\frac{1}{2}, \infty\right)$$

$y = \ln x - 5$

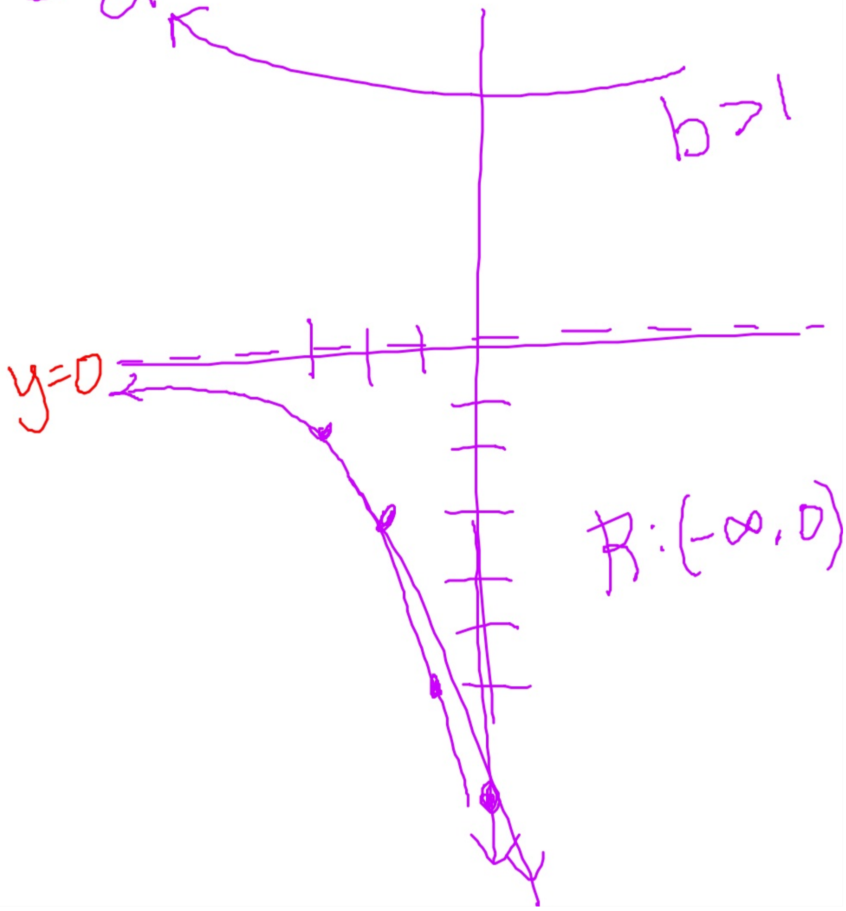
x	y
e	-4
1	-5
$1/e$	-6

$e^{y+5} = x$



15.) $y = -3 \cdot 2^{x+2}$

x	y
0	-12
-1	-6
-2	-3
-3	$-3/2$



4.7 Exponential Word Problems

Two Types

1. Compound Interest

2. Growth/ Decay Models

Compound Interest

For interest compounded n times per year:

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

Where:

A Accumulated amount

P Principal (starting amount)

r rate (decimal)

n number of times compounded

t time

		n
	Annually	1
	Quarterly	4
	Monthly	12
	Weekly	52
	Daily	365
twice a year	Semiannually	2
twice a month	Bimonthly	24

Compound Interest

For interest compounded continuously: $A = Pe^{rt}$

$$A = Pe^{rt}$$

Where:

A Accumulated amount

P Principal

r rate (decimal)

t time

ex 1: Find the total value of a $7,300 investment it is invested at 7% annual interest compounded semiannually for 3 years.

P

$r = .07$ $n = 2$ $t = 3$

$$A = 7300\left(1 + \frac{.07}{2}\right)^6$$

$8973.56

*See printout.

ex 2: Find the total value of a $7,300 investment it is invested at 7% annual interest compounded continuously for 3 years.

$$A = 7300e^{.07 \cdot 3}$$

$$A = 7300e^{.21}$$

$9005.85

ex 3: Find the total value of a \$1.17 investment it is invested at 9% annual interest compounded daily since 1927. $t = 89$

$$A = 1.17\left(1 + \frac{.09}{365}\right)^{365 \cdot 89}$$

\$3519.30

ex 3: ABC Bank is offering to double your money! They say that if you invest with them at 6% interest compounded continuously they will double your money. If you invest \$1500 in the account, how long will it take to double your money.

t

$$A = Pe^{rt}$$

$$3000 = 1500e^{.06t}$$

$$\ln 2 = \ln e^{.06t}$$

$$\ln 2 = .06t$$

$$\frac{\ln 2}{.06} = t \approx 11.55 \text{ years}$$

ex 5: An investment of \$7,000 becomes \$10,000 when invested for 5 years in a bank that compounds interest quarterly. What interest rate does the bank use?

$$10000 = 7000\left(1 + \frac{r}{4}\right)^{20}$$

$$\sqrt[20]{\frac{10}{7}} = \left(1 + \frac{r}{4}\right)^{20}$$

$$1.01799 = 1 + \frac{r}{4}$$

$$.07197 = r$$

7.20%

Growth/Decay Models

$$y = ab^x$$
$$a \neq 0, \quad b > 0, \quad b \neq 1$$

Where:

- y new amount
- a starting amount
- b growth/decay factor
- x time

Growth: $b > 1$ Decay: $0 < b < 1$

ex 6: From 1997 to 2002 the number n (in millions) of DVD players sold in the United States can be modeled by

$$n = 0.42(2.47)^t$$

a) Does this model represent a growth or decay model? Explain?

Growth because b > 1 (which is 2.47)

ex 6: From 1997 to 2002 the number n (in millions) of DVD players sold in the United States can be modeled by

$$n = 0.42(2.47)^t$$

b) What is the initial amount?

0.42 (in millions)
which is
420,000

ex 6: From 1997 to 2002 the number n (in millions) of DVD players sold in the United States can be modeled by

$$n = 0.42(2.47)^t$$

c) What is the growth factor/decay factor?

growth : 2.47

ex 6: From 1997 to 2002 the number n (in millions) of DVD players sold in the United States can be modeled by

$$n = 0.42(2.47)^t \quad A = P\left(1+\frac{r}{n}\right)^{nt}$$

d) What is the annual percent of increase/decrease?

$n=1$

$$2.47 = 1 + \frac{r}{n}$$

$$2.47 = 1 + r$$

$$1.47 = r$$

$$147\% = r$$

ex 7: A species of dolphins is decreasing at a rate of 3.1% per year. If there are currently 20,000 dolphins, how many will there be in 30 years? Round to the nearest dolphin.

$n=1$

whole number

$$A = P\left(1 - \frac{r}{n}\right)^{nt}$$

$$= 20{,}000\left(1 - \frac{.031}{1}\right)^{30}$$

$$= 20{,}000(.969)^{30}$$

$$\approx 7776$$

ex 8: If you buy a new car for $18,000 and cars depreciate at a rate of roughly 7% per year, how much could you sell it for in 3 years?

$$A = 18{,}000(1 - .07)^3$$

$14,478.43

ex 9: If you bought a car 5 years ago for $15,000 and today you can sell it for $7,000, what was its rate of depreciation?

$$7{,}000 = 15000(1 - r)^5$$

14.14%

ex 10: Dinner at your grandfather's favorite restaurant now costs $25.25 and has been increasing steadily at 4% per year. How much did it cost 35 years ago when he was courting your grandmother?

$$25.25 = P(1+.04)^{35}$$

$6.40

ex 11: If a gallon of milk costs \$3 now and the price is increasing 10% per year, how long before milk costs \$10 a gallon?

$$10 = 3(1+.10)^t$$

12.6 years