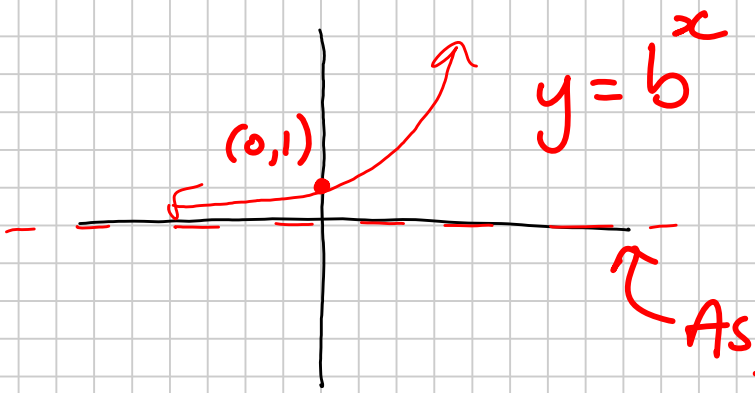
5.1 Exponents Pt. 2

Note Title 2012-10-14

Exponential Graphs



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

R: $y > 0$

(1) State the domain & range & sketch graphs.

a) $y = 2^{x-1} + 3$

Right 1, Up 3

y-int = (0, 3.5)

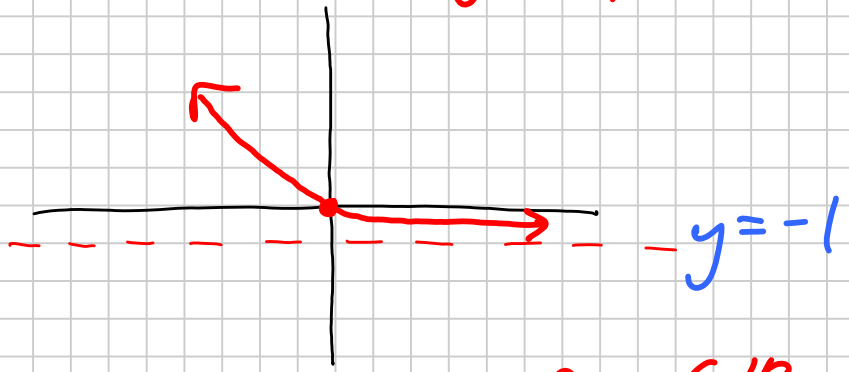
D: $x \in \mathbb{R}$

R: $y > 3$

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

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

Reflected in y-axis, down



y-int (0,0)

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

R: $y > -1$

HALF-LIFE

– The half-life of a substance is the length of time it takes for the substance to decay to half of its original amount.

$$A = A_0\left(\frac{1}{2}\right)^{\frac{t}{c}}$$

the half-life is always on the bottom of the exponent

half-life = c "chunk of time"

total time = t

(2) a) Given a substance has a half-life of 8.2 days and the initial count is 500mg, how much is left after 15 days?

$$A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{c}}$$

$$A = 500 \left(\frac{1}{2}\right)^{\frac{15}{8.2}}$$

$$\boxed{A = 140.70\text{mg}}$$

b) After how long should only 25% be remaining?

$$\frac{1}{4} = 1\left(\frac{1}{2}\right)^{\frac{t}{8.2}}$$

$$\left(\frac{1}{2}\right)^{2} = \left(\frac{1}{2}\right)^{\frac{t}{8.2}}$$

$$2 = \frac{t}{8.2}$$

$$16.4 \text{ days} = t$$

(3) After 30h a sample of plutonium-243 decays to $\frac{1}{64}$ of its original amount. What is its half-life?

$$\frac{1}{64} = 1\left(\frac{1}{2}\right)^{\frac{30}{c}}$$

$$\left(\frac{1}{2}\right)^{6} = \left(\frac{1}{2}\right)^{\frac{30}{c}} \qquad 6 = \frac{30}{c}$$

$$\boxed{c = 5 \text{ hours}}$$

(4) A bacteria culture triples every 25h. The initial count of a sample shows 1000 bacteria present.

a) Approximately how many bacteria will there be in 4 days?

$A = A_0 r^{\frac{t}{c}}$

$A = (1000)(3)^{\frac{96}{25}}$ $\quad 4 \times 24 = 96h$

$A = 67943$ bacteria

b) How many bacteria were there 3 days prior to the initial count?

$3 \times 24 = 72$ hours

$$A = 1000(3)^{-\frac{72}{25}} = \boxed{42 \text{ bacteria}}$$

OR

$$A = 1000\left(\frac{1}{3}\right)^{\frac{72}{25}}$$

A logarithmic scale is used to measure values that increase exponentially.

Ex RICHTER SCALE - measure the intensity of earthquakes.

5.5 on the Richter Scale = Intensity of $10^{5.5}$

$$\text{INTENSITY} = 10^{\text{RICHTER SCALE}}$$

(5) An earthquake measures 6.2 on the R.S. and a 2nd earthquake measures 4.1 on the R.S. How many times more intense/powerful is the 1st earthquake?

$$\frac{10^{6.2}}{10^{4.1}} = 10^{2.1} = \underline{126 \text{ times}} \text{ more intense/powerful}$$

(6) If an earthquake in San Francisco had an amplitude 1000 times larger than an earthquake that measured 4.9 on the R.S., what would the San Fran. earthquake measure on the R.S.?

$4.9 \rightarrow 10^{4.9}$

$(10^{4.9})(1000) = (10^{4.9})(10^{3})$

$= 10^{7.9}$

7.9

Pg 204 # 3-5, 8

9(a, b, d)