Section 3.2: Modeling with exponential functions.

$$y = a b^{x}$$

doubling: $y = a(2)^{x/\text{doubling time}}$

Half life: $y = a\left(\frac{1}{2}\right)^{x/\text{Half life}}$

$$y = a\left(2^{-1}\right)^{x/\text{half life}}$$

$$y = a(2)^{-x/\text{half life}}.$$

Ex: The half life of a radioactive substance is 14 days. there are 5.2 g present initially.

a) Express the amount remaining as a function of time.

$$f(x) = 5.2\left(\frac{1}{2}\right)^{x/14}$$

b) when will there be less than 1 g remaining?

$$1 = 5.2\left(\frac{1}{2}\right)^{x/14} \quad (\text{calc})$$

$x = 34$ days.

after 34 days.

5 g

↓ 14 days

2.5 g

↓ 14 days

1.25

1 g

less than 1g

34 days

Ex2: Bellwork fordson population (12/11)

p 271 # 15-18
33, 34

Homework p 271 : 29-32

29. In 2021

30. 2012

31. a) 12,315 , 24 265

b) 1966

32. a) 6554, 9151

b) 1980

p 314 # 19-22

19- $y = 24\,(1.053)^x$

20- $y = 67{,}000\,(1.0167)^x$

21- $y = 18\,(2)^{t/21}$ → 3 weeks

22- $y = 117\left(\frac{1}{2}\right)^{t/262}$

practice problems: p 271 # 15-18
33, 34

15- $y = 0.6(2)^{x/3}$

16- $y = 250\,(2)^{\frac{2x}{15}}$

17- $y = 592\,(2^{-1})^{\frac{x}{6}} = 592\,(2)^{-x/6}$

18- $y = 17\left(\frac{1}{2}\right)^{x/32}$

33-

34-

31. Exponential Growth The population of Smallville in the year 1890 was 6250. Assume the population increased at a rate of 2.75% per year. $r = 0.0275$ $b > 1$

I.V

$1890 \rightarrow 6250$

(a) Estimate the population in 1915 and 1940.

(b) Predict when the population reached 50,000.

32. Exponential Growth The population of River City in the year 1910 was 4200. Assume the population increased at a rate of 2.25% per year.

(a) Estimate the population in 1930 and 1945.

(b) Predict when the population reached 20,000.

31. a) $y = a \cdot b^{x}$

$= 6250 \cdot (1 + 0.0275)^{t}$

$1915 - 1890 = 25$

$y = 6250 \cdot (1.0275)^{50}$

b) $50{,}000 = 6250(1.0275)^{t}$ (ca'c)