

Section 3.2: Modeling with exponential functions.

$$y = a b^x$$

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

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

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

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.

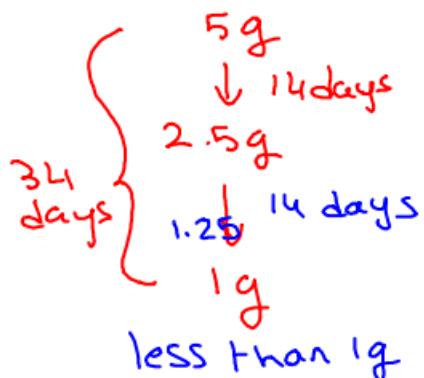
$$S(x) = 5.2 \left(\frac{1}{2}\right)^{x/14}$$

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

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

$$x = 34 \text{ days.}$$

after 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, 915)  
b) 1980

P 314 # 19-22

$$\begin{aligned} 19. \quad y &= 24 (1.053)^x \\ 20. \quad y &= 67,000 (1.0167)^x \\ 21. \quad y &= 18 (2)^{\frac{t}{12}} \rightarrow 3 \text{ weeks} \\ 22. \quad y &= 117 \left(\frac{1}{2}\right)^{\frac{t}{262}} \end{aligned}$$

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

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

$$16 - y = 250 (2)^{\frac{2x}{75}}$$

$$17 - y = 592 (2)^{\frac{-x}{15}} = 592 (2)^{-\frac{x}{15}}$$

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

- 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.

$$r = 0.0275 \quad b = 6250$$

- (a) Estimate the population in 1915 and 1940.  
(b) Predict when the population reached 50,000.

$$1890 \rightarrow 6250 \quad I.V$$

- 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)  $y = a \cdot b^x$   $\leftarrow t = \frac{1915 - 1890}{25} = 25$

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

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

b)  $50,000 = 6250 \cdot (1.0275)^t$  (calc)