

Exponential Decay – Practice Problems

1. Garden City introduced a recycling program. The goal of the program is to reduce the number of pounds of trash sent to landfills by 25% each year. In 2000, Garden City produced 100,000 tons of trash. If the recycling program were to reach its goal, how many tons of trash can Garden City expect to produce in the year 2018?

25% decay rate \rightarrow Factor = 0.75

$$y = 100,000 (0.75)^x$$

in 2018

$$y = 100,000 (0.75)^{18}$$

$$y = 563.8$$

In 2018 they can expect to produce \sim 563.8 tons of trash.

2. A city of 2,950,000 has a 2.5% annual decrease in population. Determine the city's population after each of the following:

2.5% decrease \rightarrow Factor = 0.975

a. 1 year

b. 5 years

c. 15 years

d. 25 years

a. $y = 2,950,000 (0.975)^1$
 $= 2,876,250$ people
 after 1 year

d. $y = 2,950,000 (0.975)^{25}$
 $= 1,566,525$ people
 after 25 years

b. $y = 2,950,000 (0.975)^5$
 $y = 2,599,232$ people
 after 5 years

c. $y = 2,950,000 (0.975)^{15}$
 $= 2,017,861$ people
 after 15 years

3. Several species of whale have been declared endangered. When the populations of a particular whale species fall dangerously low, biologists encourage governments to agree to a ban on hunting the species. Suppose that, in the year 2000, there were only 5,000 whales of a particular species and that the population was predicted to continue to decline as shown in the table.

Year (y)	Whales (w)
0 (2000)	5,000
1	4,500
2	4,050
3	3,645
4	3,281
5	2,952
6	2,657

- a. Which equation below models this population pattern?

A. $W = 5,000(0.1^y)$

B. $W = 5,000(0.9^y)$

C. $W = 5,000 - 500^y$

D. $W = 5,000^y$

- b. What is the decay factor for the relationship? Explain how you determined your answer.

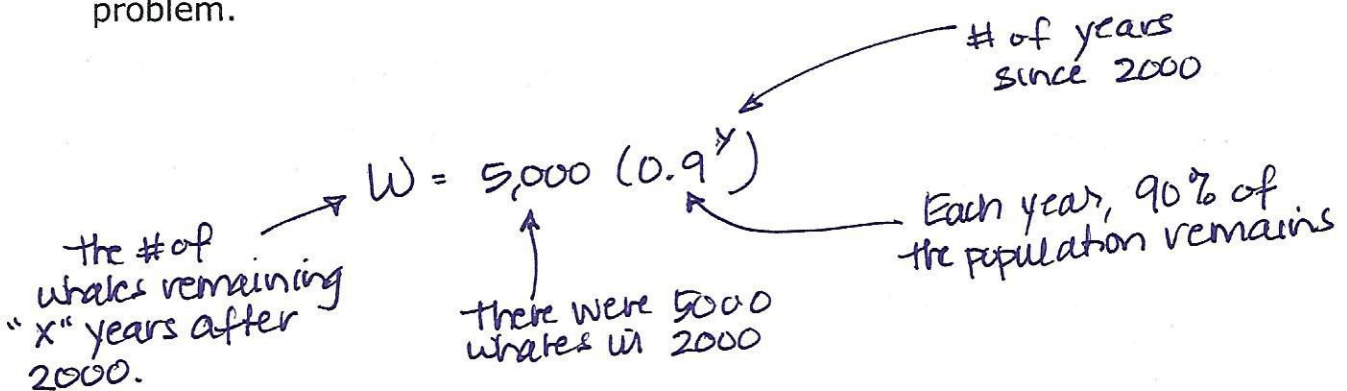
$$\frac{2657}{2952} = 0.90 \quad \frac{3281}{3645} = 0.90 \quad \frac{4050}{4500} = 0.9$$

$$\frac{2952}{3281} = 0.90 \quad \frac{3645}{4050} = 0.9 \quad \frac{4500}{5000} = 0.9$$

Decay Factor = 0.9

work to support that the factor = 0.9

- c. Define all the numbers and variables in the equation in the context of the problem.



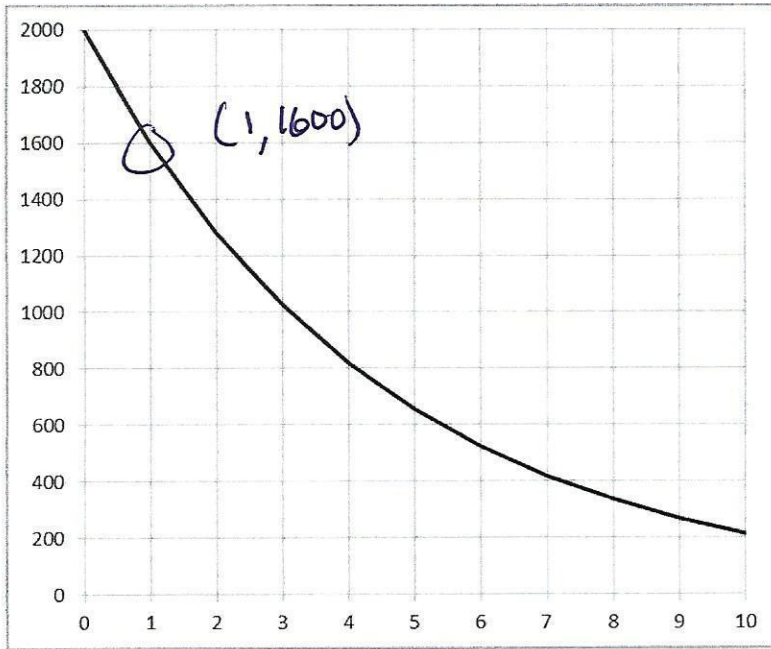
- d. According to this model, what will the whale population be in 2007?

$$W = 5,000(0.9^7)$$

$$= 2391.5$$

There are approximately 2392 whales in 2007.

4. Write an equation for the exponential relationship in the graph below. Show your work.



x	y
0	2000
1	1600

$$\frac{1600}{2000} = 0.8$$

↑
Decay Factor

$$y = 2000(0.8)^x$$

5. The population of a certain species of bird is decreasing by 10% each year. If the population in year 0 is 15,000, which of the following statements are true? *Select all that apply.*

- In year 7, there will be fewer than 7,000 of this species of bird.
- After 5 years, there will be approximately 8,857 of this species of bird.
- The graph of this relationship shows exponential decay.
- The decay factor is 0.10.
- After 1 year, there will be 13,500 of this species of bird.

$$y = 15,000(0.9)^x$$

Year 1
 $y = 15,000(0.9)^1$
 $= 13,500$

Year 5
 $y = 15,000(0.9)^5$
 $y = 8857$

Year 7
 $y = 15,000(0.9)^7$
 $y = 7174$

6. In some areas, home values have decreased over the past 10 years. The table shows the decrease in the home value of one house.

Year	Home Value
0	\$250,000
1	\$242,500
2	\$235,225
3	\$228,168
4	\$221,323
5	\$214,684

↗ x. 97
 ↗ x. 97
 ↗ x. 97
 ↗ x. 97
 ↗ x. 97

Using the tiles, write an equation that represents the value of the home, v , after t years.

1.03 0.03 250,000

0.97 1.30 t

$$v = (250,000) (0.97)^t$$