

## FERRET FIGURES

### Teaching Guidelines

<p><b>Subject:</b> Mathematics</p> <p><b>Topics:</b> Problem Solving</p> <p><b>Grades:</b> 6-12</p>
<p><b>Concepts:</b></p> <ul style="list-style-type: none"> <li>• Rate (expressed as percent)</li> </ul>
<p><b>Knowledge and Skills:</b></p> <ul style="list-style-type: none"> <li>• Can apply the problem-solving strategy “Identify the variables”</li> <li>• Can apply the problem-solving strategy “Use a chart or table”</li> <li>• Can solve complex, multi-step problems</li> </ul>

**Procedure:**

Prepare the Futures Channel movie “The Black-Footed Ferret” for presentation. Tell students that as they watch the movie, you want them to think about this question (which should be posted):

*How would you accurately predict whether or not an animal species in the wild is likely to become extinct?*

At the end of the movie, discuss some answers to the question. Then, as you distribute the handout, tell students that you want them to think about a very specific example, as follows:

*50 ferrets (25 males, 25 females) are re-introduced into the wild, in a region of Colorado, one year in February. What would you need to know in order to make a good guess as to whether or not that population of ferrets will increase or decrease?*

Arrange the students in teams of 2-3 members and ask them to work together for 10 minutes to list answers to the question.

In discussing answers, you will find that they fall into two categories—those in the list below, or other factors which affect those in the list below (for example, student lists may include “having enough food,” a factor which affects how many ferrets survive each year). In the course of the discussion, guide students to understand that if they knew the numbers below, they would know everything they needed to know to predict the survival of the species.

- How many ferrets are born each year
- How many ferrets die each year
- How many ferrets come into the area from somewhere else each year
- How many ferrets leave the area to go somewhere else each year

Distribute the second page of the handout, and review it. Tell students that they have already applied one problem-solving strategy to this situation: “Identify the variables.” Ask them if they can think of another strategy to help them solve this problem, and elicit or present the strategy: “Make a chart or table.”

Create the following chart, with these figures filled in. Explain that the figures represent the number of ferrets of each age.

Age of ferrets (months)	Start of 1st year	born	died	Start of second year
0 up to 12	0			
12 up to 24	0			
24 up to 36	50			
36 up to 48	0			
48 up to 60	0			
60 up to 72	0			
72 up to 84	0			

Start filling out the chart, as a class activity. Begin by determining the number of kits born in the first year:

$$\begin{aligned}
 \text{Number of kits born} &= 80\% \text{ of females 12 months and older } \times 4 \text{ kits per female} \\
 &= .8 * 25 * 4 \\
 &= 80
 \end{aligned}$$

Next, compute the number of kits expected to die before the end of the first year:

$$\text{Number of kits that don't survive} = 70\% \text{ of kits born} = 70\% \text{ of } 80 = 56$$

Next, find the difference to compute the total number of 12-month-olds that you have after the first year:

$$\text{Number of 12-month olds} = 80 - 56 = 24$$

The chart would now look like this:

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year
0 up to 12	0	<b>80</b>	<b>56</b>	
12 up to 24	0			<b>24</b>
24 up to 36	50			
36 up to 48	0			
48 up to 60	0			
60 up to 72	0			
72 up to 84	0			

Point out to students that the final figure, the number of 12 month-olds, goes in the next line down.

Next do the computations for ferrets who were 12-24 months old at the start of the first year. Since there weren't any, this is easy:

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year
0 up to 12	0	80	56	
12 up to 24	0	<b>0</b>	<b>0</b>	24
24 up to 36	50			<b>0</b>
36 up to 48	0			
48 up to 60	0			
60 up to 72	0			
72 up to 84	0			

Next, do the computations for the ferrets in the 24-35 month age range—this includes the 50 that were re-introduced. Since no ferrets were born into that age range, you only need to compute the number that die: 40% of them, according to the figures (20 ferrets). That leaves 30 of them alive as 36-month-old ferrets at the beginning of the second year:

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year
0 up to 12	0	80	56	
12 up to 24	0	0	0	24
24 up to 36	50	<b>0</b>	<b>20</b>	0
36 up to 48	0			<b>30</b>
48 up to 60	0			
60 up to 72	0			
72 up to 84	0			

Since there were no ferrets in any other age ranges at the beginning of the first year, the rest of the figures are all “0.”

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year
0 up to 12	0	80	56	
12 up to 24	0	0	0	24
24 up to 36	50	0	20	0
36 up to 48	0	<b>0</b>	<b>0</b>	30
48 up to 60	0	<b>0</b>	<b>0</b>	<b>0</b>
60 up to 72	0	<b>0</b>	<b>0</b>	<b>0</b>
72 up to 84	0	<b>0</b>	<b>0</b>	<b>0</b>
				<b>54</b>

Total population at beginning of second year

Next, you will compute the population changes from the beginning of the second year to the beginning of the third year:

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year	born	died	Start of 3rd year
0 up to 12	0	80	56				
12 up to 24	0	0	0	24			
24 up to 36	50	0	20	0			
36 up to 48	0	0	0	30			
48 up to 60	0	0	0	0			
60 up to 72	0	0	0	0			
72 up to 84	0	0	0	0			
				<b>54</b>			

Again, begin by determining the number of kits born:

$$\begin{aligned}
 \text{Number of kits born} &= 80\% \text{ of females older than 12 month} \times 4 \text{ kits per female} \\
 &= .8 \times 27 \times 4 = 86 \text{ (this assumes that the number of females is} \\
 &\quad \text{half of the total population)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Number of kits that don't survive} &= 70\% \text{ of kits born} \\
 &= 70\% \text{ of } 86 \\
 &= 60
 \end{aligned}$$

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year	born	died	Start of 3rd year
0 up to 12	0	80	56		<b>86</b>	<b>60</b>	
12 up to 24	0	0	0	24			<b>26</b>
24 up to 36	50	0	20	0			
36 up to 48	0	0	0	30			
48 up to 60	0	0	0	0			
60 up to 72	0	0	0	0			
72 up to 84	0	0	0	0			
				<b>54</b>			

Then use the survival rate data given to determine the number of ferrets that die in each of the other age ranges, to fill in the rest of the chart:

Age of ferrets (months)	Start of 1st year	born	died	Start of 2nd year	born	died	Start of 3rd year
0 up to 12	0	80	56		86	60	
12 up to 24	0	0	0	24	<b>0</b>	<b>14</b>	26
24 up to 36	50	0	20	0	<b>0</b>	<b>0</b>	<b>10</b>
36 up to 48	0	0	0	30	<b>0</b>	<b>12</b>	<b>0</b>
48 up to 60	0	0	0	0	<b>0</b>	<b>0</b>	<b>18</b>
60 up to 72	0	0	0	0	<b>0</b>	<b>0</b>	<b>0</b>
72 up to 84	0	0	0	0	<b>0</b>	<b>0</b>	<b>0</b>
				<b>54</b>			<b>54</b>

At this point, you can turn the problem over to students, working in teams of 2-3 members each and continuing to fill out the chart for the next three years. Remind them to take into account the change in survival rates for ferrets in their fifth and sixth years. The final chart should look like the one on the next page.

As an extra-credit exercise, ask students to re-compute the chart based on a survival rate of 40% in the first year, instead of 30%. They will be surprised at the results.

Note: This activity is an excellent context for teaching the use of spreadsheets.

### Ferret Population Projection

	start	born	died	end of 1st year	born	died	end of 2nd year	born	died	end of 3rd year	born	died	end of 4th year	born	died	end of 5th year
0 through 11 mos	0	80	56	0	86	60	0	86	60	0	86	60	0	76	53	0
12 through 23 mos	0	0	0	24	0	14	26	0	15	26	0	15	26	0	15	23
24 through 35 mos	50	0	20	0	0	0	10	0	4	11	0	4	11	0	4	11
36 through 47 mos	0	0	0	30	0	12	0	0	0	6	0	2	7	0	2	7
48 through 59 mos	0	0	0	0	0	0	18	0	7	0	0	0	4	0	1	5
60 through 71 mos	0	0	0	0	0	0	0	0	0	11	0	7	0	0	0	3
72 through 83 mos	0	0	0	0	0	0	0	0	0	0	0	0	4	0	3	0
				<b>54</b>			<b>54</b>			<b>54</b>			<b>52</b>			<b>49</b>

## Ferret Figures

*50 ferrets are re-introduced into the wild, in a region of Colorado. What would you need to know in order to make a good prediction as to whether or not that population of ferrets will increase or decrease?*

Factors leading to population increase	Factors leading to population decrease

Suppose that the figures below represent what usually happens to ferrets in the wild. Can you predict how many ferrets you would have 10 years after the re-introduction of twenty five 22-month-old old male ferrets and twenty five 22-month-old year old female ferrets?

Assume that

- No ferrets come into the area or leave the area
- The ferrets are introduced in February and mate in early March, with kits born in late April

Figures:

- 1) Female ferrets can only get pregnant (are fertile) after their full first year of life (in the spring of their second year).
- 2) 80% of the fertile females in a ferret group become pregnant every year.
- 3) Ferrets give birth, on average, to two females and two males each year.
- 4) 30% of ferrets survive their first year.
- 5) 60% of ferrets survive their second, third and fourth years.
- 6) 30% of ferrets survive their fifth year.
- 7) 10% of ferrets survive their sixth year.
- 8) No ferrets live longer than seven years.