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Data Analysis and Graphing in Biology

Introduction

Many of the experiments conducted in science are **quantitative**, meaning they incorporate numerical measurements. This type of data must be analyzed and presented in such a way that the audience can quickly determine the outcome and match it with the conclusion.

I. Line Graphs: Predator-Prey Interactions

A survey was taken in the 19th century of lynx and snowshoe hare in part of the Ontario province of Canada. The data was based on the number of skins taken from animals caught by trappers. Showshoe hare are the main prey of the Canadian lynx. Very few other predators compete with the lynx for the hares.

Year	Population of Snowshoe Hare (in thousands)	Population of Lynx
1845	20000	320
1847	20000	500
1849	52000	120
1851	83000	100
1853	64000	130
1855	68000	360
1857	83000	150
1859	12000	120
1861	36000	60
1863	150000	60
1865	110000	650
1867	60000	700
1869	7000	400
1871	10000	90
1873	70000	200
1875	100000	340
1877	92000	450
1879	70000	400
1881	10000	150
1883	11000	150
1885	137000	600
1887	137000	800
1889	18000	260
1891	22000	180
1893	52000	370
1895	83000	500
1897	18000	350
1899	10000	120

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In every experiment, there is an **independent variable** that the researcher is manipulating. The **dependent variable** is the one that is measured as a result of changes to the independent variable. When something is measured over a given time period, time is considered to be the independent variable.

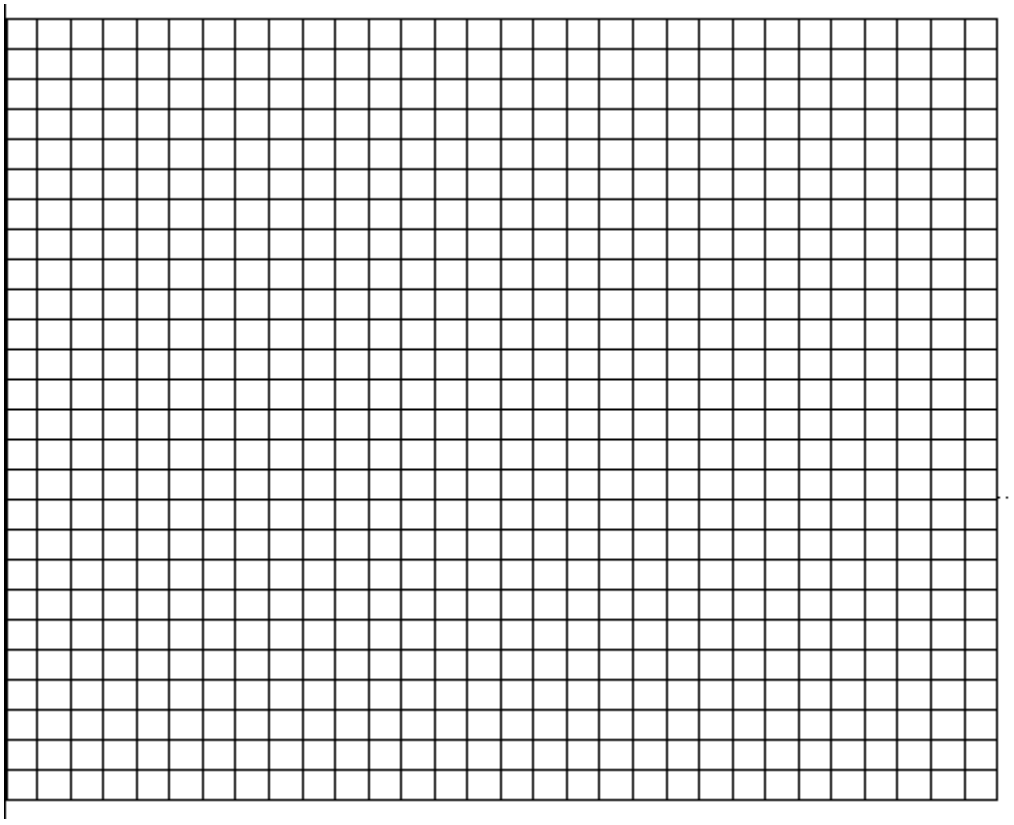
Before you graph the results, **hypothesize** about what you believe the relationship will be between the snowshoe hare and Canadian lynx populations.

_____

_____

Make a line graph showing the change in showshoe hare and lynx populations over the given time period. Remember each of the following rules in making a properly formatted graph:

- Independent variables are graphed on the x-axis, while dependent variables are graphed on the y-axis.
- Both the x- and y-axis should have labels indicating what measurement is shown and the units used in that measurement, if applicable.
- An appropriate scale should be chosen that makes the graph small enough to confine to a single page, but large enough to show the differences between the points on the graph.



1. Based on the graph you completed above, do the results support your hypothesis, or should it be rejected? Explain.

2. Why are **line graphs** a good option when displaying data over time?

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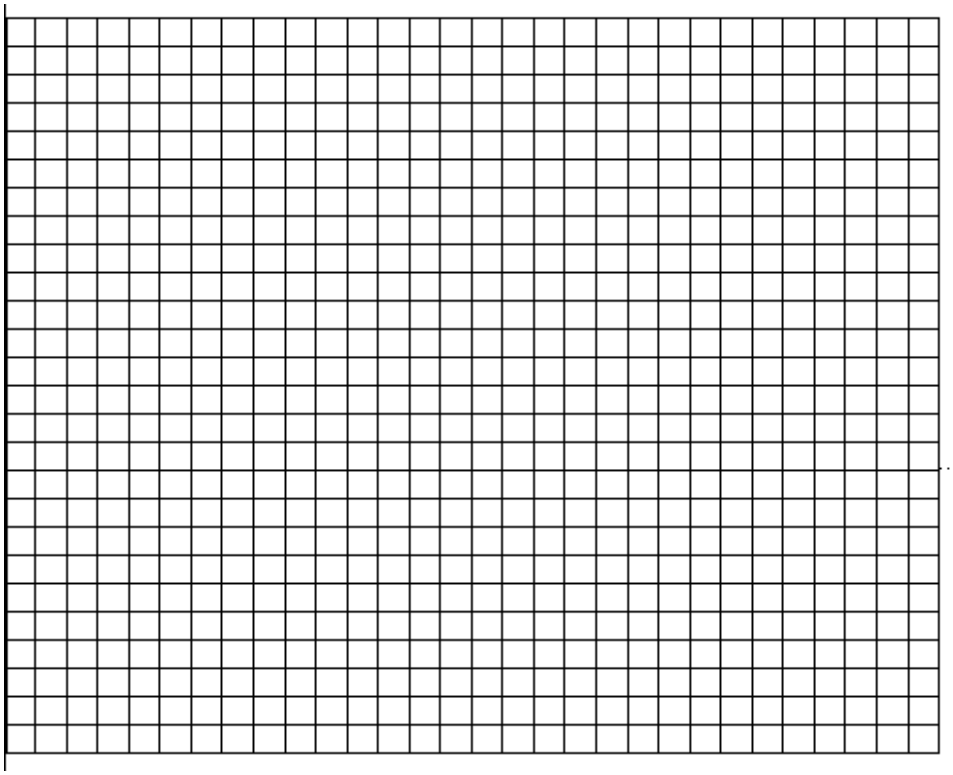
II. Bar Graphs: Fatality Rates with Snake Bites

Data was collected on all recorded cases of bites from each of these different species of venomous snakes. The death rate percentage was calculated for each snake.

Type of Snake	Death Rate (%)
Black Mamba	75
Bushmaster	80
Copperhead	1
Eastern coral snake	15
European viper	5
Asp Viper	20
Indian krait	77
King cobra	33
Death adder	50
Tiger Snake	60

The purpose of this study is to make a comparison of the different types of venomous snakes. In this case, a bar graph would be the most appropriate type to use. Below, make a bar graph of the venomous snake death rate data. Remember, to follow all the rules of graph construction you learned!



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3. Which snake is the deadliest, according to this data?

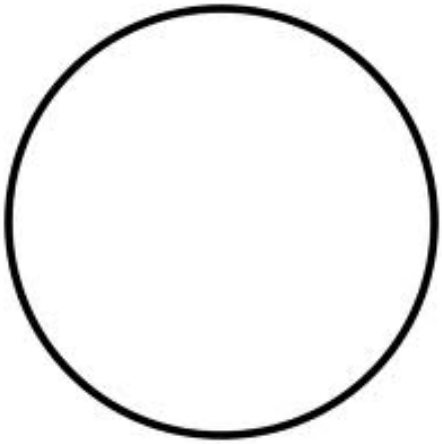
4. Why are **bar graphs** a good option for displaying data that is for comparison?

III Pie Graphs: Elements of the Human Body

The human body contains a consistent mix of only handful of the known elements. The chart below represents the percentage by mass of each of these elements. Note: Trace elements that account for less than 0.1% of the human body mass have been excluded from this data.

Element	Percent by Mass	Element	Percent by Mass
Oxygen	65	Phosphorus	1.0
Carbon	18	Potassium	0.4
Hydrogen	10	Sulfur	0.3
Nitrogen	3	Sodium	0.2
Calcium	1.5	Magnesium	0.1

Data like this that adds up to a full 100% can be conveniently displayed using a **pie chart**. To make one of these charts, start with a circle and create a segment for the largest percentage first. Then, begin making smaller segments to account for each of the other data points. Label each portion of the pie chart.



5. Why are pie charts a good way to display data that adds up to 100%?