Statistics and data types

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Statistics is the collection, organisation, presentation, analysis and interpretation of data.

Data is a collection of information which may include facts, numbers, measurements or other information.

Data may be gathered by observation, questioning or measurement and is often organised in graphs or charts for statistical analysis.

Types of data

data

qualitative data

Describes qualities, characteristics or categories.

quantitative data

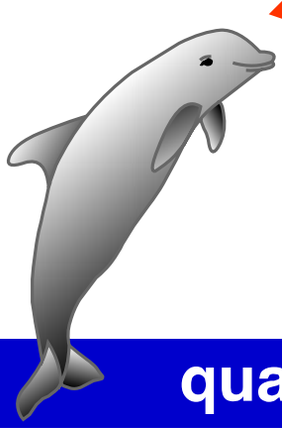
Data where quantities can be counted or measured.

discrete data

Data that is counted
e.g. days in the week.
(finite values)

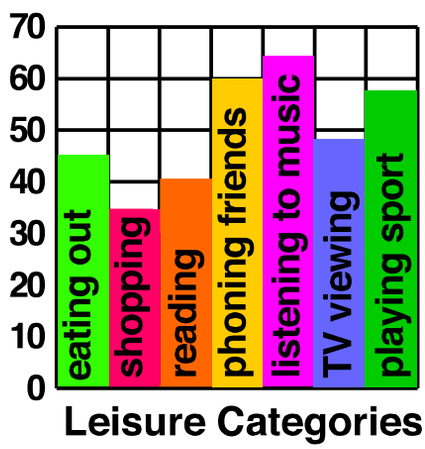
continuous data

Data that is measured
e.g. temperature.
(infinite values)



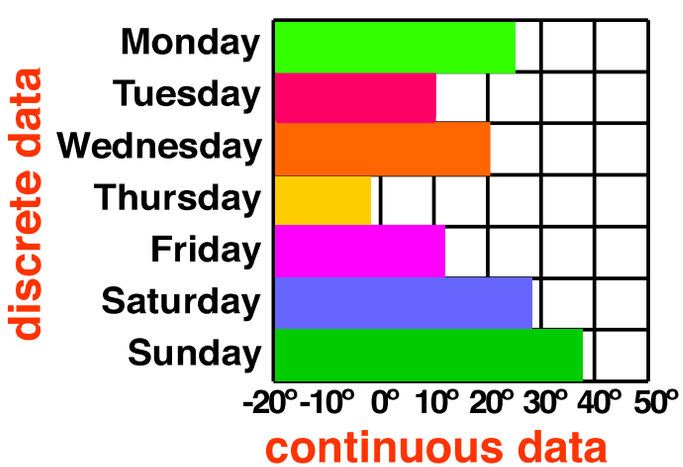
qualitative

Leisure Activities Popularity



quantitative

Daily Temperature Graph



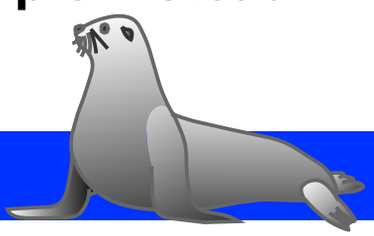
Population and sample

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

In statistics, the population is the whole set of individuals, items or data from which a statistical sample is drawn.

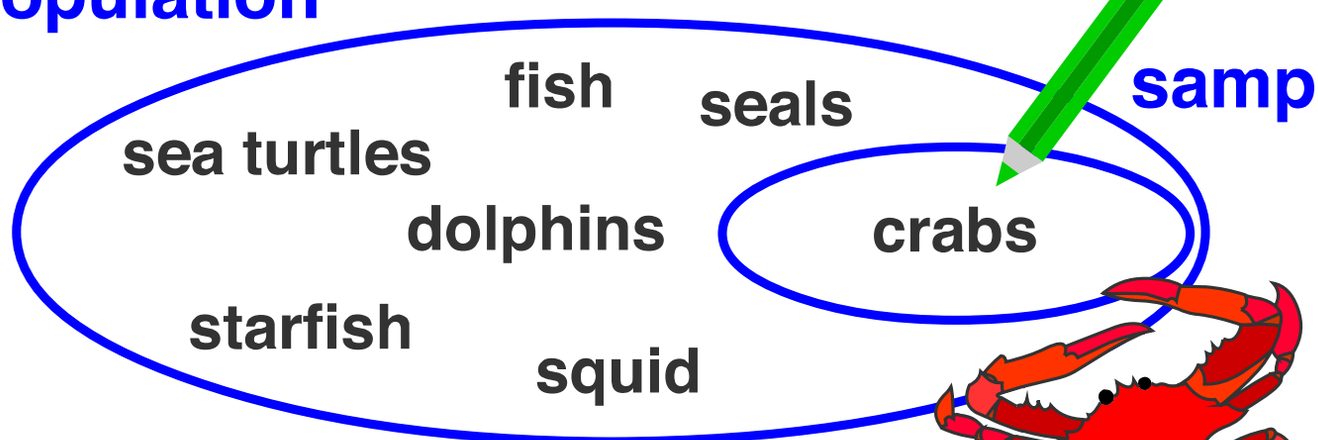
A sample is a selected part of the population.

When a population is too big to gather data from, data is collected from a manageable sample instead.

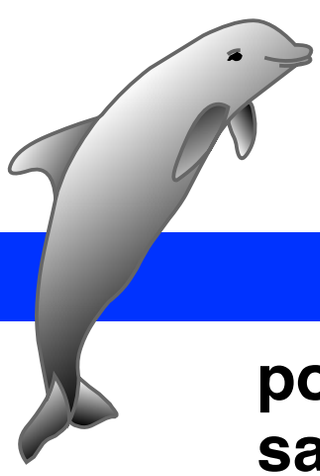


Oceanarium

population



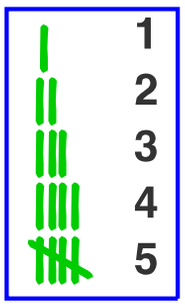
sample



population ... whole group
sample ... part of the group

Tally, score and frequency

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com



tally

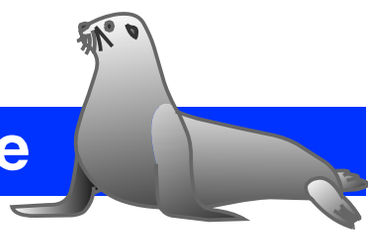
- using marks to record counting.
- count by 5's to get the total

score

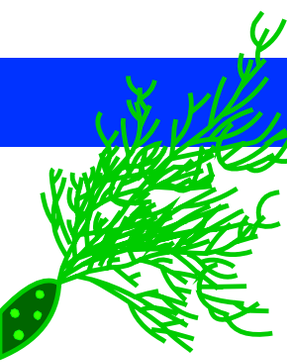
- numerical value.
- any kind of measurement or count.

frequency

- the number of times a particular item appears in a set of data.



Oceanarium - Frequency Table

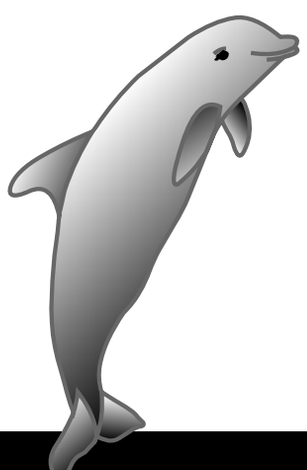


A survey was done at schools close to the Oceanarium to see how many classes had been sent to see the exhibits within the last year.

score	tally	frequency (f)
1	𝍸	4
2	𝍸	5
3	𝍸 |	6
4	𝍸 𝍸	10
5	𝍸	3
6	||	2

Number of class visits

Number of schools



Most schools had a score of 4 class visits.

Types of graphs

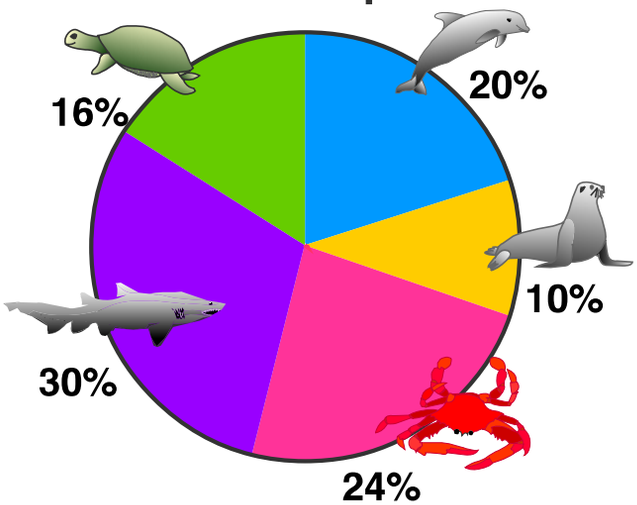
From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A graph is a visual diagram used to represent data values.

There are many types of graphs.

Examples

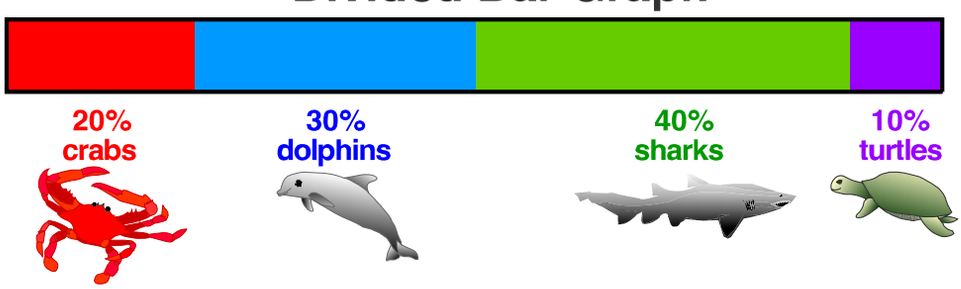
Pie Graph



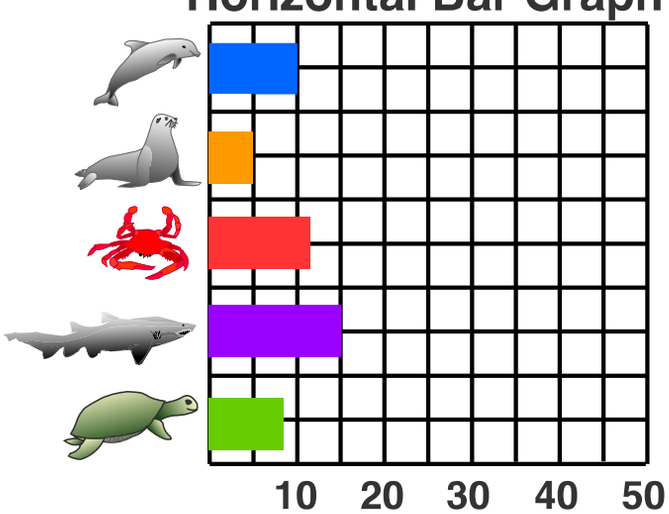
Picture Graph, Pictogram

dolphins	
seals	
crabs	
sharks	

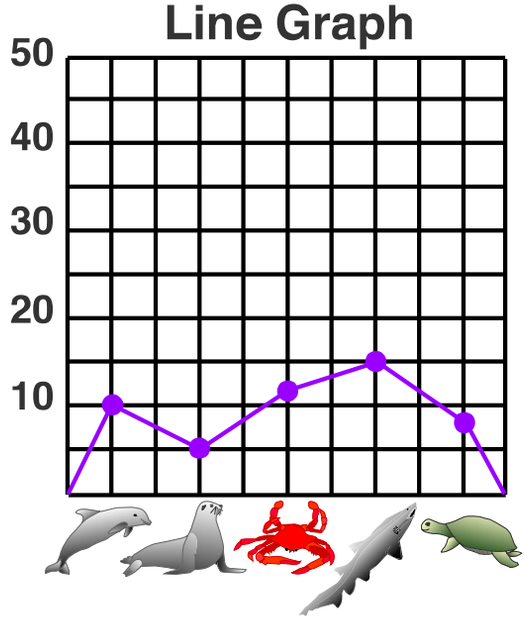
Divided Bar Graph



Horizontal Bar Graph



Line Graph



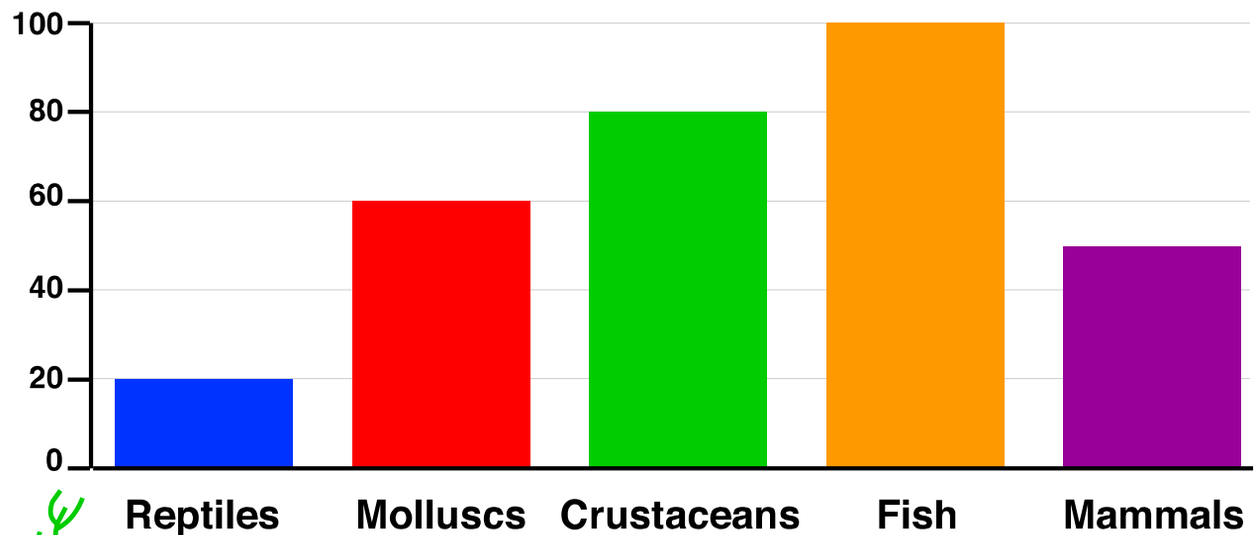
Bar graph, bar chart, column graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

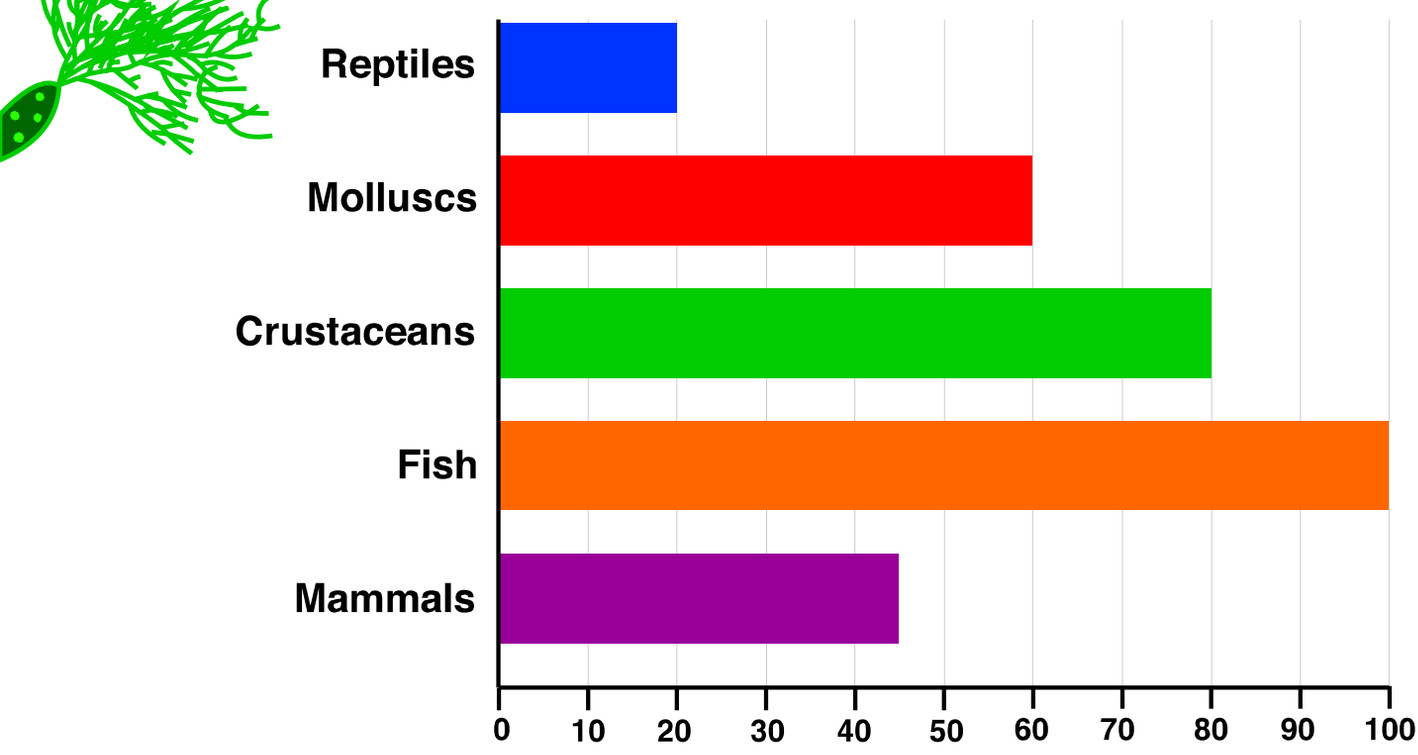
A bar graph or bar chart is a commonly used graph for organising and displaying data.

Bars are used to show quantities or numbers so they can be easily compared.

Oceanarium - numbers of marine creatures.



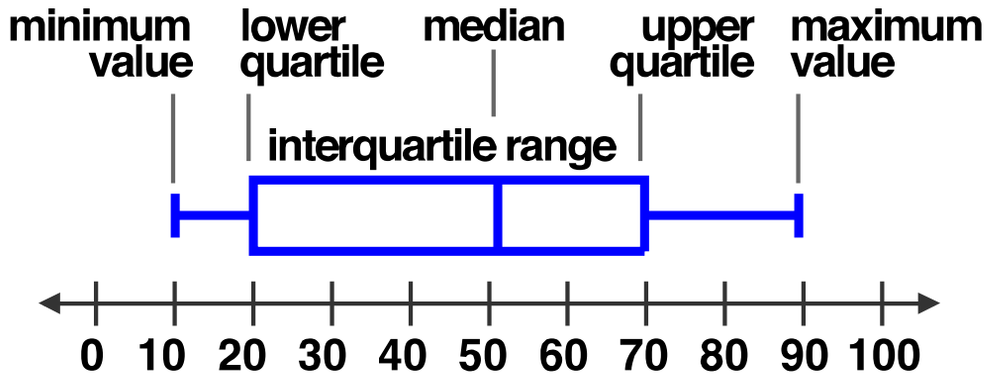
Bars may be vertical or horizontal.



Box-and-whisker plot, box plot

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A box plot is a diagram or graph using a number line to show the distribution of a set of data. It displays the median, upper and lower quartiles, and the maximum and minimum values of the data.

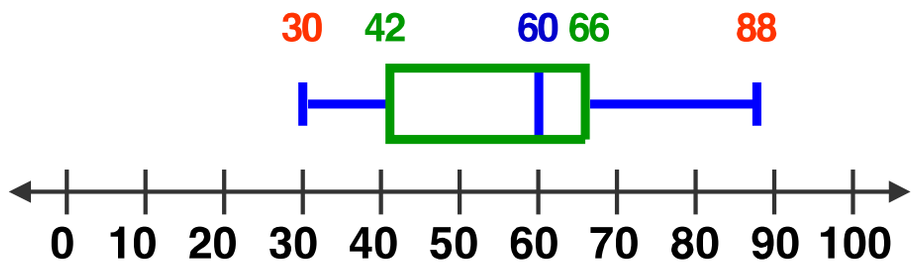


- the box shows the interquartile range.
- a line in the box marks the median.
- the 'whiskers' are lines running from the box to the maximum and minimum values.

- the lower quartile - median of the lower half of the scores.
- the upper quartile - median of the upper half of the scores.

EXAMPLE: 60 60 40 74 63 65 88 41 42 57 30 58 66 66 68

1. Arrange the values in ascending order.
   30 40 41 42 57 58 60 60 63 65 66 66 68 74 88
2. Identify the median (the value in the middle).
   30 40 41 42 57 58 60 60 63 65 66 66 68 74 88
3. Identify the lower quartile (median of the lower half) and the upper quartile (median of the upper half).
   30 40 41 42 57 58 60 60 63 65 66 66 68 74 88
4. Draw a box - from the lower to the upper quartile.
5. Draw a line in the box to show the median.
6. Draw the whiskers - to the minimum and maximum.



Dot plot

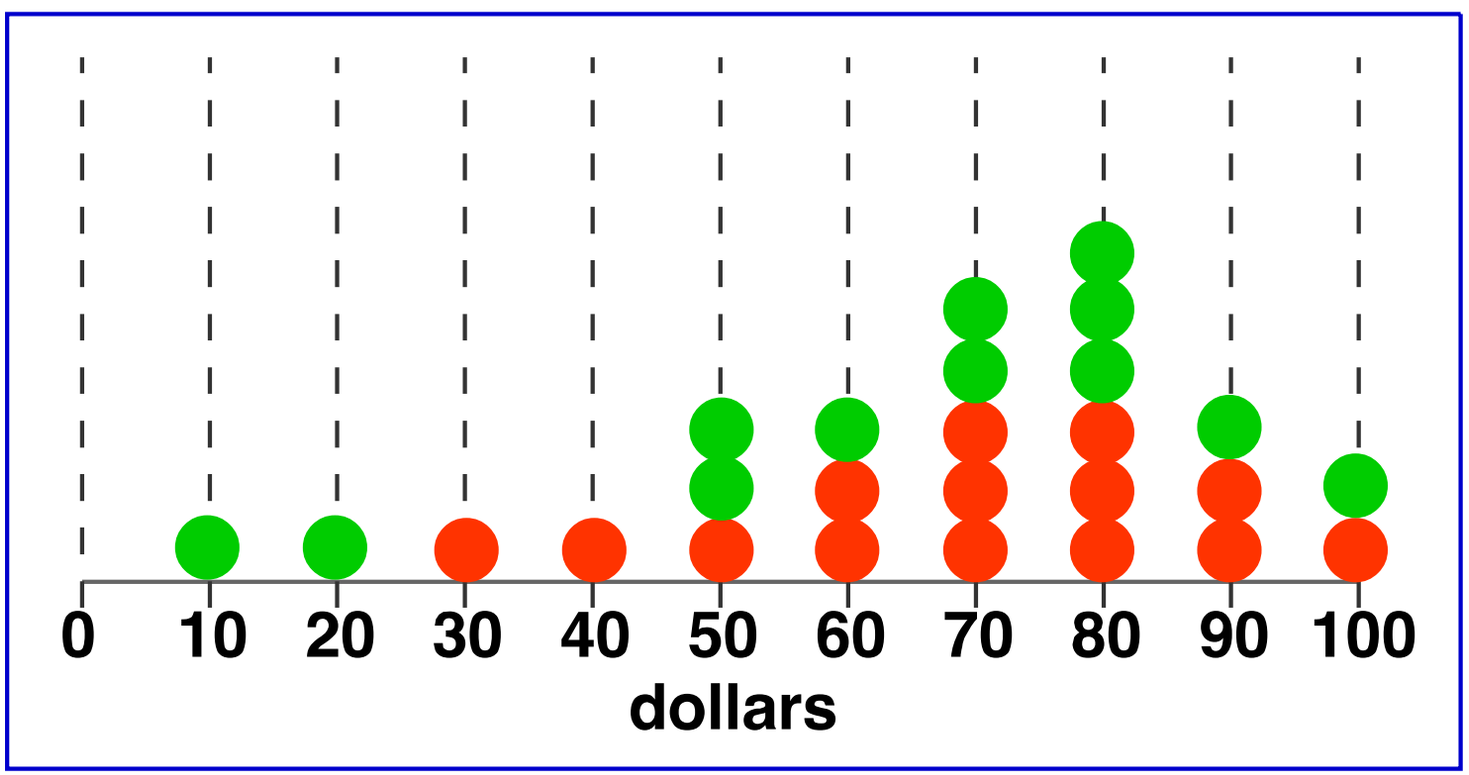
From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

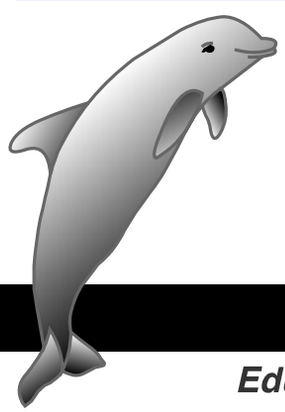
A dot plot uses a number line long enough to encompass all numbers in the sample, showing a dot over the position corresponding to each number.

If more than one dot falls in the same position, they are stacked up.

A dot plot of spending patterns.

The amount spent by members of a tour group visiting the Oceanarium.





male

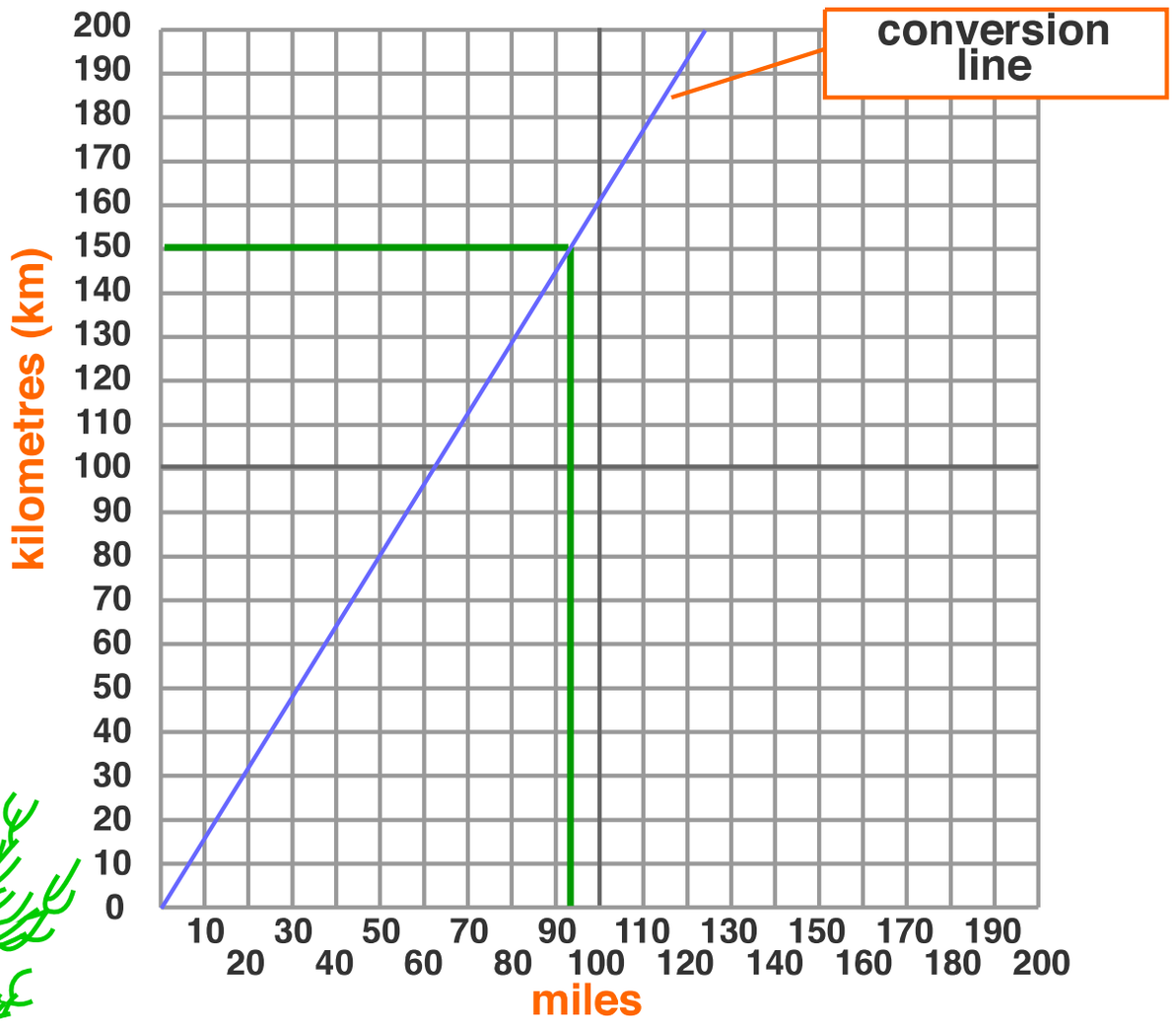
female

Conversion graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A conversion graph is a line graph used to convert one unit to another.

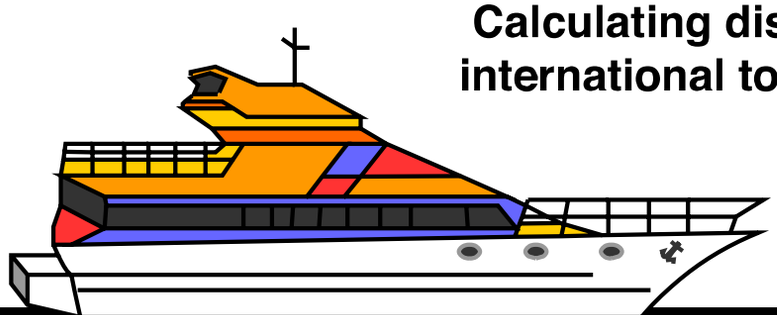
EXAMPLE: kilometres ... miles conversion

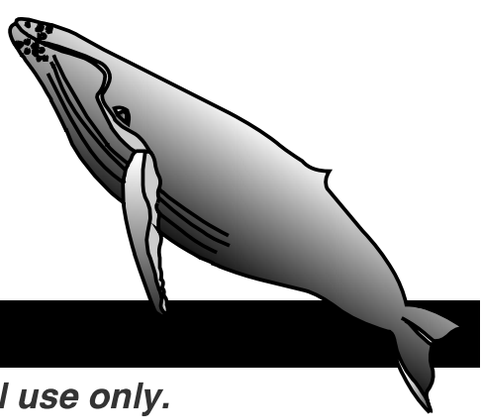


Read across and down: 150 km = 93 miles.

Whale Watching

Calculating distances to keep international tourists informed.

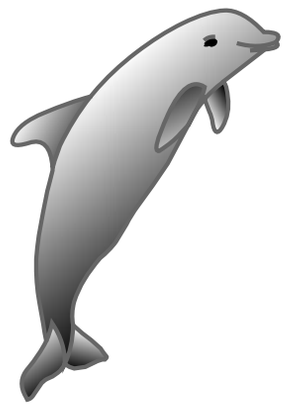


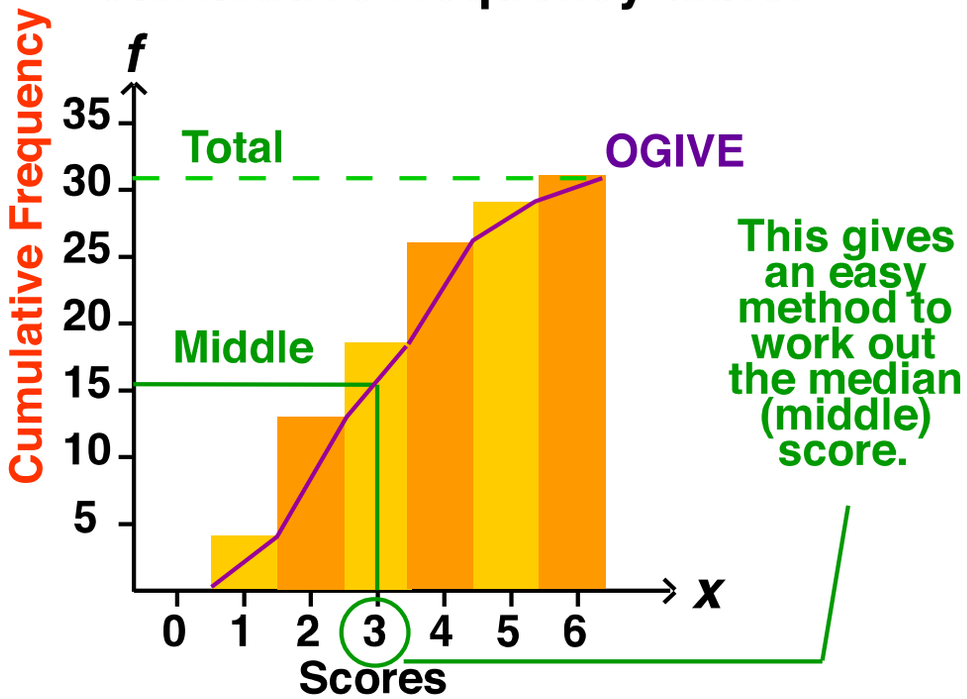


Cumulative frequency graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A cumulative frequency graph is a graph plotted from a cumulative frequency table.





An ogive or cumulative frequency polygon is a line joining the top right hand corners of the bars in a cumulative frequency graph.

Cumulative frequency

Cumulative frequency is a running total of frequencies.

score (x)	tally	frequency (f)	cumulative frequency
1	𝍸	4	4
2	𝍸 |	9	13
3	𝍸	6	19
4	𝍸 ||	7	26
5	|||	3	29
6	||	2	31

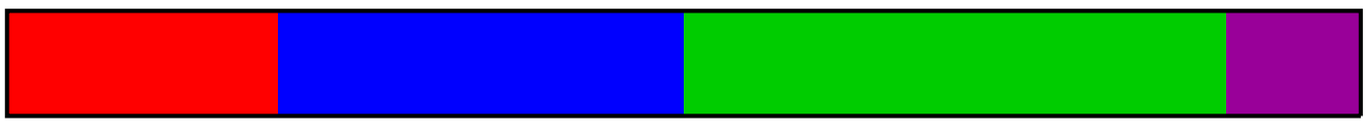
Divided bar graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

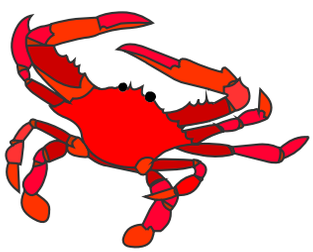
A divided bar graph is used for organising and displaying categorical data.

The bar is divided into percentages according to the frequency of items in each category to the total number of items.

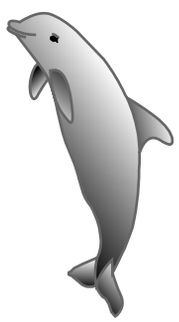
Grade 4 - Most Popular Creature



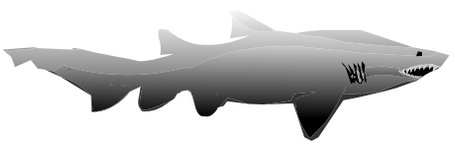
20% crabs



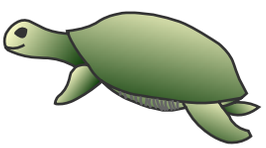
30% dolphins

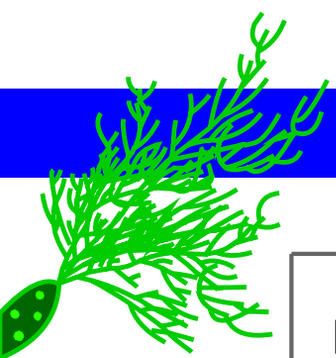


40% sharks



10% turtles





Making a divided bar graph.

Most Popular Creature	Number of Students (frequency)
crabs	10
dolphins	15
sharks	20
turtles	5
Total	50

1. Convert the frequencies to a percentage.
2. Draw a bar with 10 or 100 divisions.
3. Colour the divisions to match the frequencies.

EXAMPLE: crabs

1. 10/50 x 100 = 20%
2. Bar with 10 divisions.

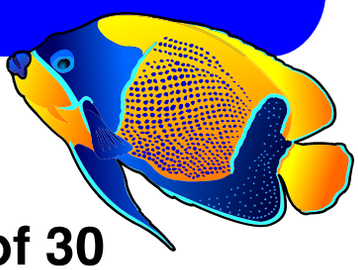
3. 20% = 2 divisions.

Frequency table, histogram

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A histogram is a graph using adjacent rectangles to represent the frequencies of certain ranges or intervals.

A histogram is built from information contained in a frequency distribution table.



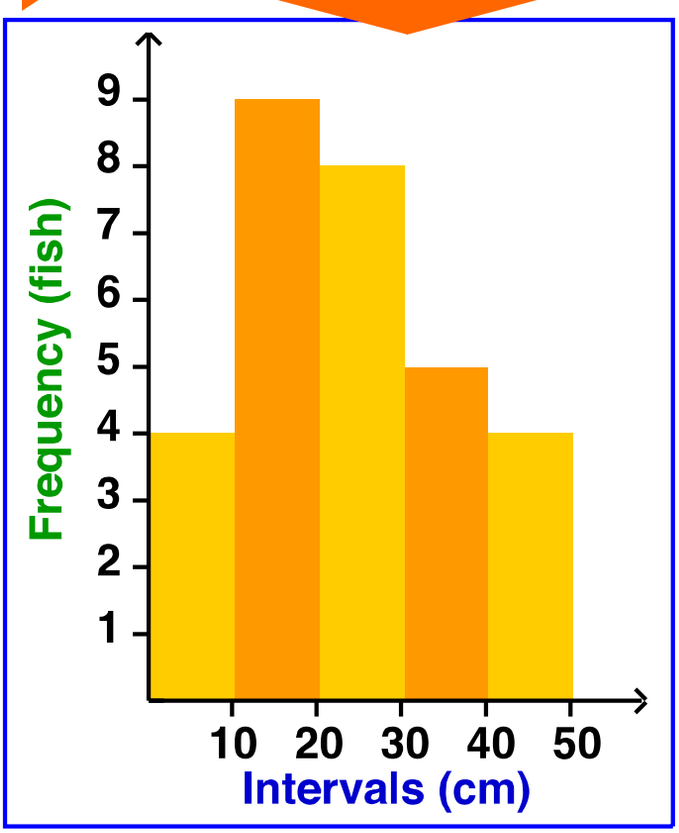
Oceanarium - fish sizes.

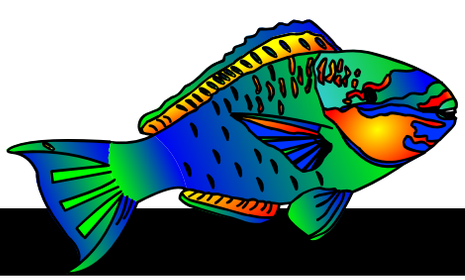
Marine biologists measure the lengths of 30 tagged fish each year to analyse growth patterns.

Each year, the information from a frequency table is used to make a histogram.

frequency distribution table → histogram

Fish lengths in centimetres (intervals)	Number of Fish (frequency)
0 - 10	4
11 - 20	9
21 - 30	8
31 - 40	5
41 - 50	4





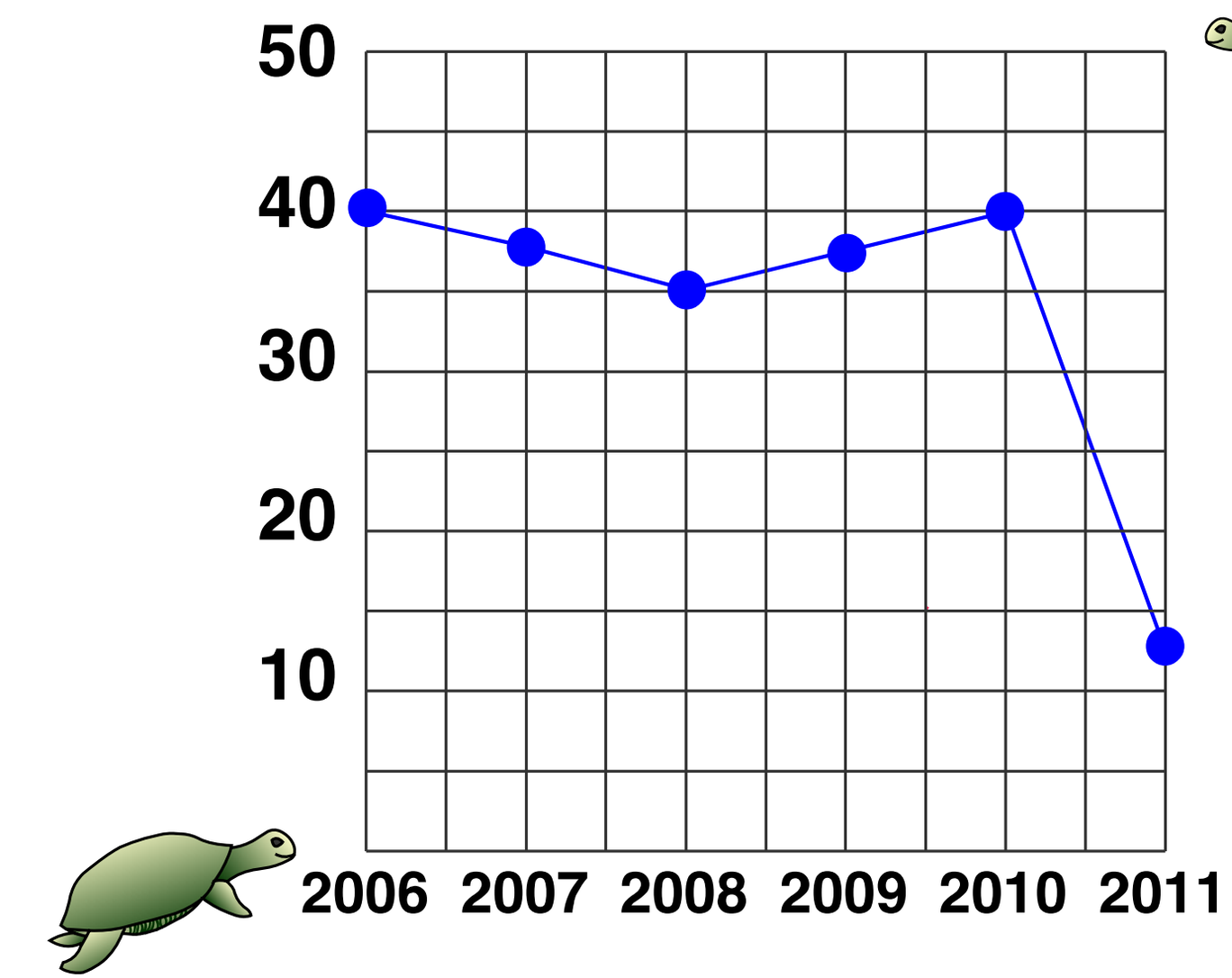
Line graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A line graph or line chart uses straight lines to join points which represent the data.

Line graphs are often used to show changes in data over a period of time.

Turtle Sightings - Far North Queensland



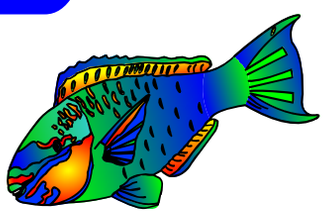
The sharp decline in turtle numbers seen in 2011 is believed to be a direct result of the devastating Queensland floods and cyclones experienced during the early part of the year.

Picture graph, pictogram

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

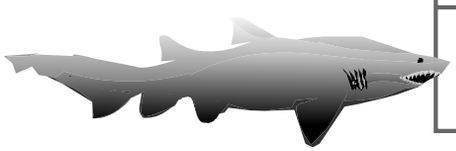
A picture graph or pictogram uses pictures to represent quantities.

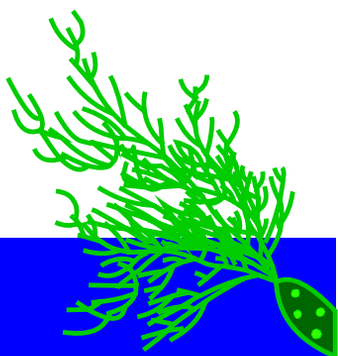
Pictures may represent one unit ...



Oceanarium - Area 2.

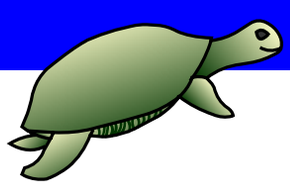
Type	Frequency
fish	
turtles	
crabs	
sharks	





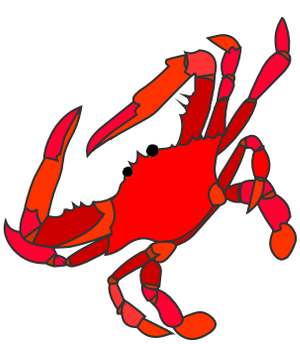
or a number of units.

 = 10  = 5



Oceanarium - Area 8.

Type	Frequency
fish	
turtles	
crabs	
sharks	



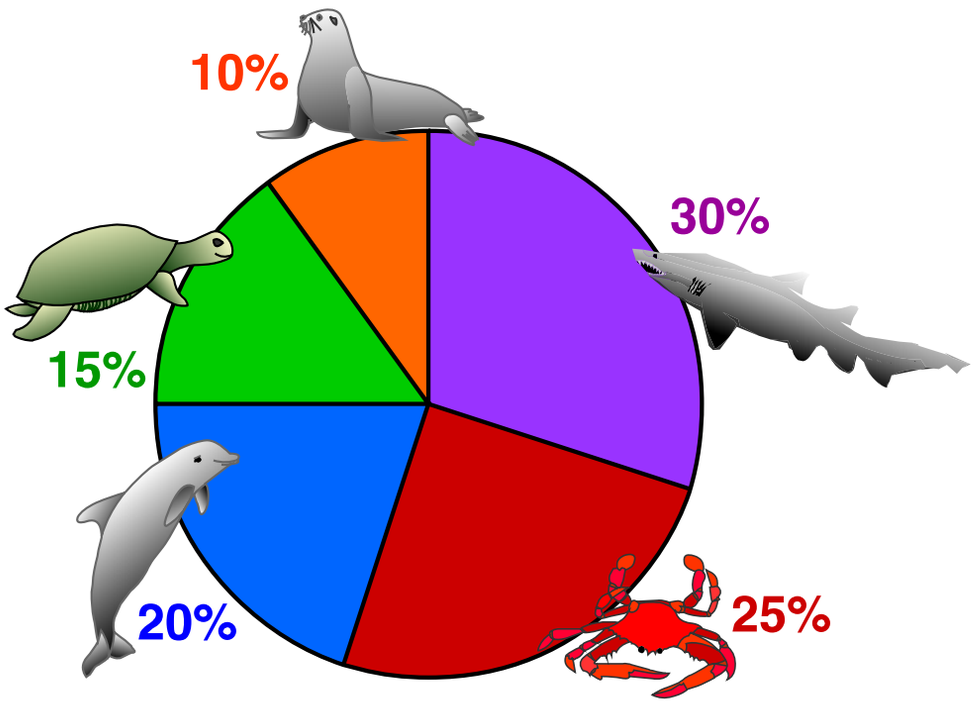
Pie or sector graph, pie chart

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A pie graph or pie chart uses a divided circle where each part represents a percentage of the total.

Each part is called a sector.

3J - Most Popular Marine Creature



Making a pie graph.

Most Popular Creature	Number of Students (frequency)
crabs	5
dolphins	4
sharks	6
turtles	3
seals	2
Total	20

1. Convert the frequencies to a percentage for the graph labels, e.g. 5/20 x 100 = 25%
2. Find the degrees for each sector angle, e.g. 5/20 x 360 = 90°
3. List the degrees in descending order, e.g. 108°, 90°, 72°, 54°, 36°
4. Draw a circle and radius. Use a protractor to draw the angles from largest to smallest in a clockwise direction, measuring each next angle from the dividing line of the previous one.
4. Label each sector with the category name and percentage. Write the title.

Scatter plot or diagram

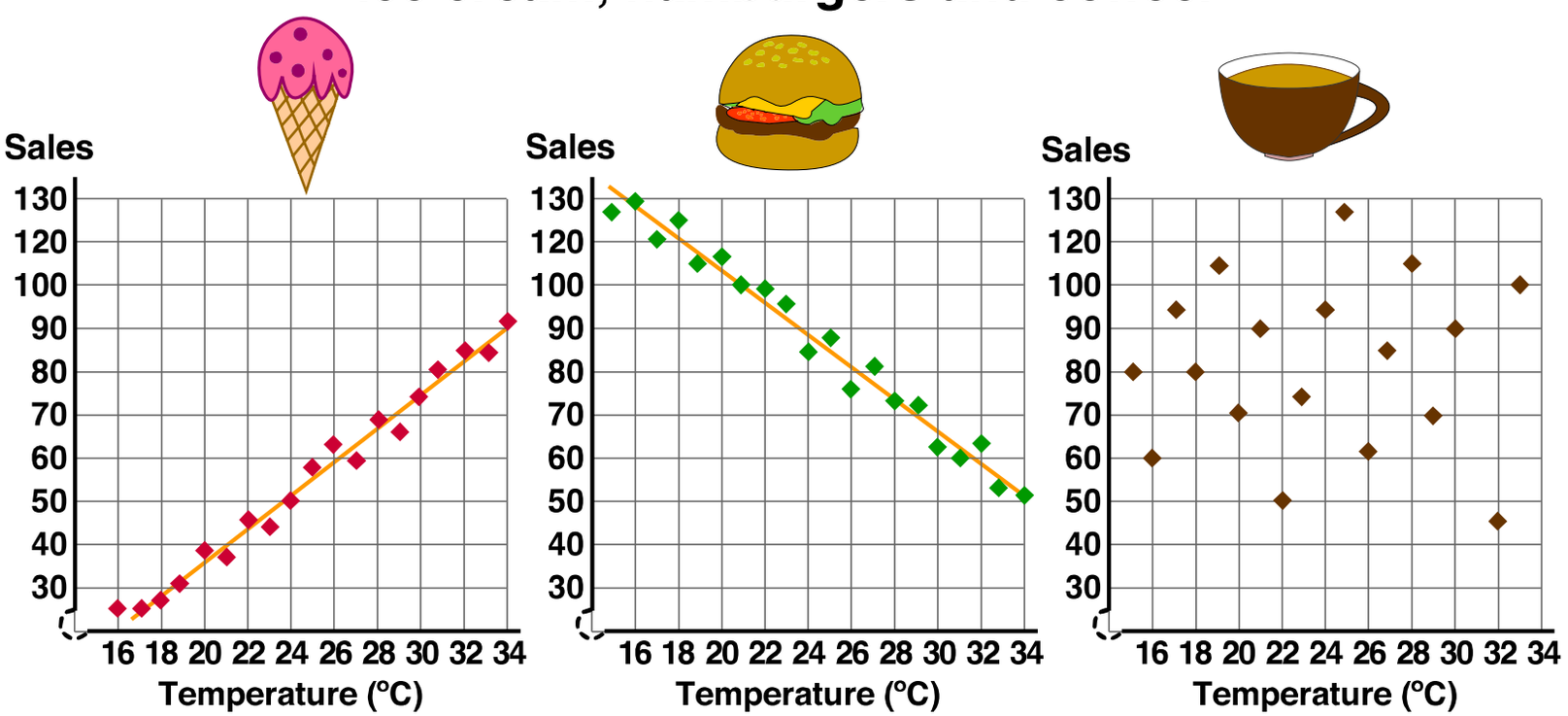
From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A scatter plot is a diagram where points are plotted to show the relationship (correlation) between two variables.

The points are placed as ordered pairs on a coordinate plane.

EXAMPLE: Oceanarium Kiosk Management

To manage ordering supplies more effectively, three scatter plots were made to see if there was any correlation between daily temperatures and sales of ice cream, hamburgers and coffee.



Positive Correlation

A positive trend - as one set of values increases, the other set increases.

For example, as the temperature went up ice cream sales went up.

Negative Correlation

A negative trend - as one set of values increases, the other set decreases.

For example, as the temperature went up hamburger sales went down.

No Correlation

No trend - the points are scattered randomly with no visible pattern.

For example, as the temperature went up there was no apparent effect on coffee sales.

A line of best fit or trend line is a straight line that best represents the values on a scatter plot.

Stem-and-leaf plot

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A stem-and-leaf plot is a graph where the values in a set of data are arranged by place value.

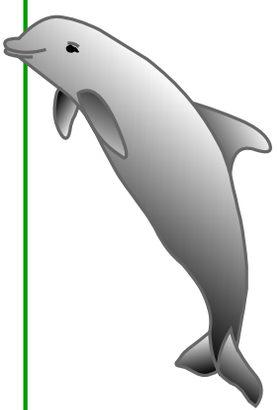
A stem-and-leaf plot is similar to a histogram but provides more detail because the individual values are shown.

EXAMPLE: Dolphin sightings - last 12 days.

A stem-and-leaf plot for the set of data
3, 6, 7, 24, 25, 29, 31, 34, 40, 42, 42, 49

stem	leaves
0	3 6 7
1	
2	4 5 9
3	1 4
4	0 2 2 9

stems = 10 leaves = 1

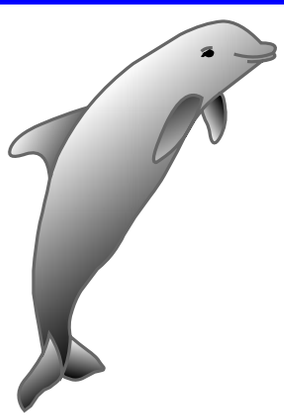


If a stem is displayed only once. the leaves are counted as ones.

A stem may be displayed 1, 2 or 5 times depending on the data.

Usually the leaf contains the last digit of the number and the stem contains all the other digits.

To make a stem-and-leaf plot:



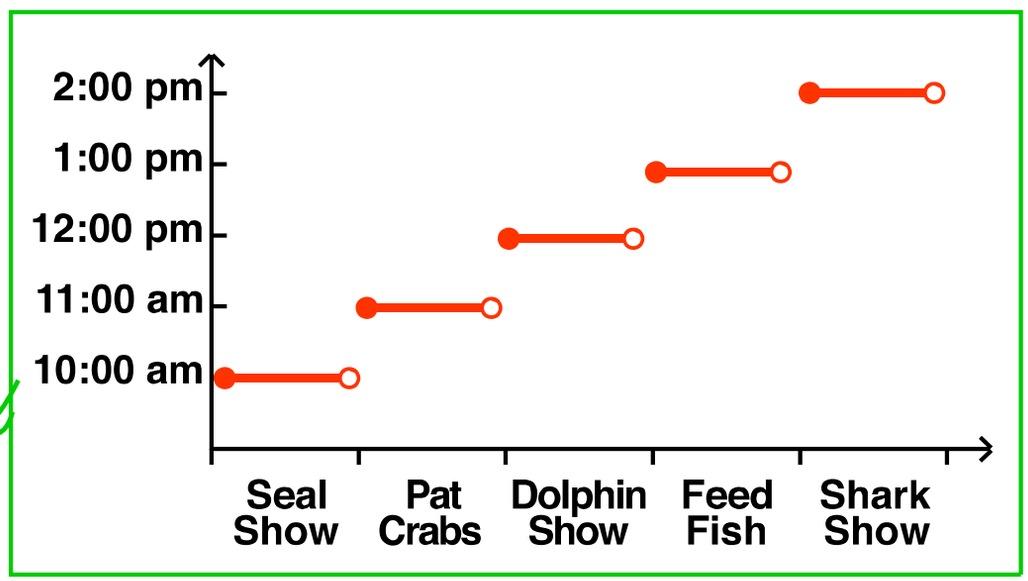
1. Sort the values in ascending order.
2. Draw a vertical line.
3. Determine what place value the stem(s) and and leaves will represent.
4. Write the stem values without skipping any numbers.
5. Write the leaf values in order (in a row to the right of each stem value).
6. Add a key and a title.

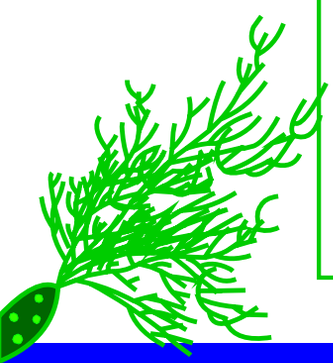
Step graph

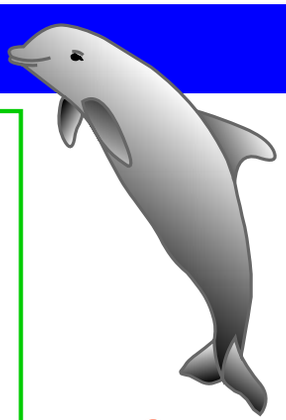
From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A step graph is a graph that increases in steps rather than a line.

Oceanarium - Activity Times

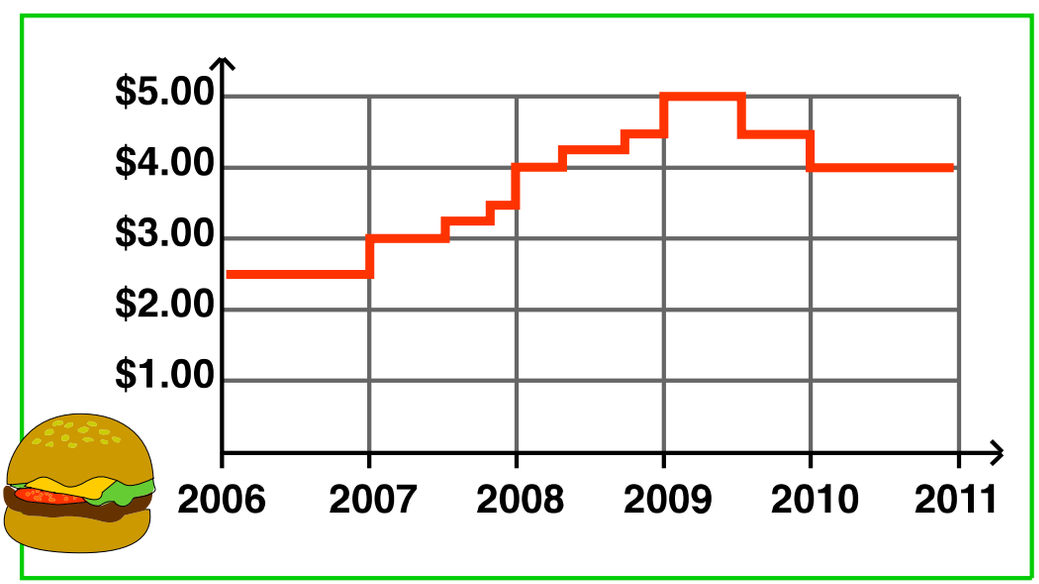






A step graph may display each value as a horizontal line connected to adjacent values by vertical lines.

Oceanarium Kiosk - Hamburger Prices



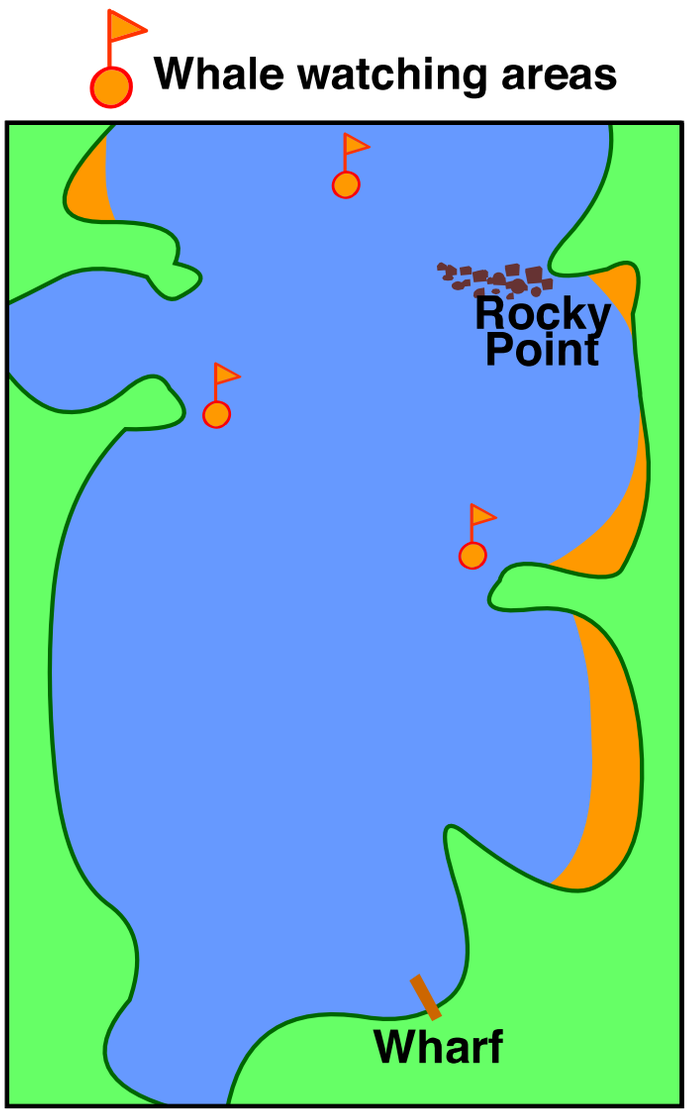
A step graph can be useful when analysing changes over time.

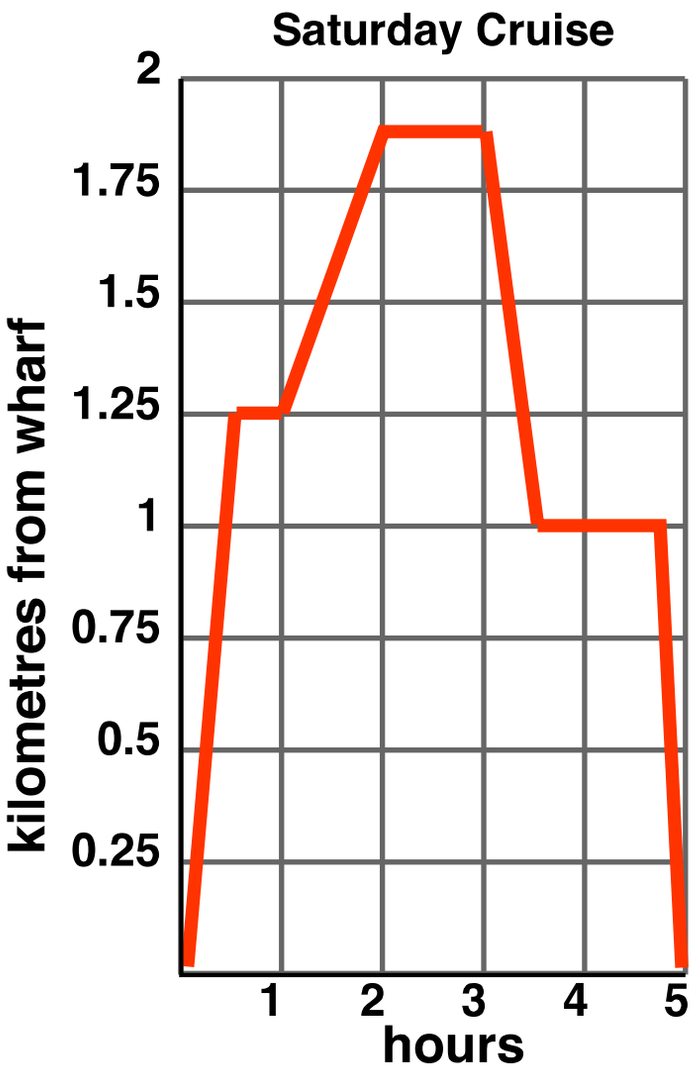
Travel graph

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A travel graph is a line graph showing the relationship between time and distance travelled.

Travel graph of a whale watching cruise.

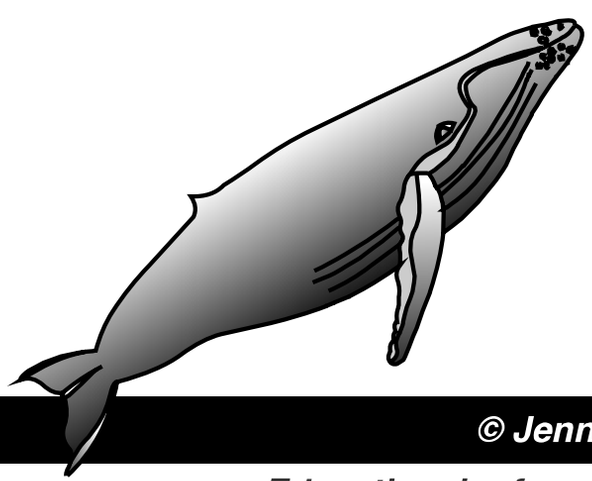


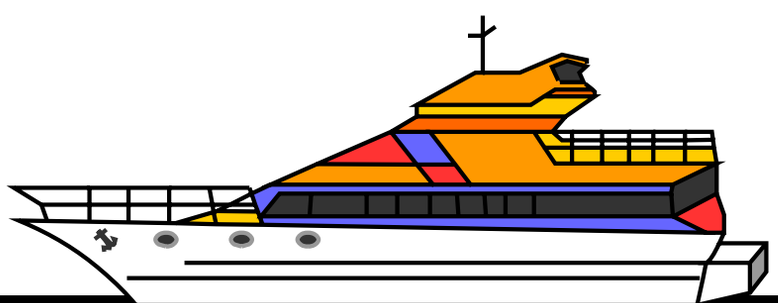


moving (travelling)

still (stationary)

steeper = faster





Mean, median, mode

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

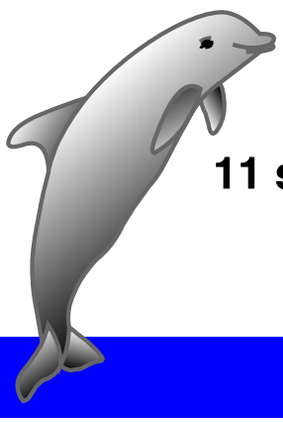
Mean, median and mode are all types of averages.

They are measures used to find the location of the middle (central tendency) of a data set.

Mean

The average of all the scores.

Add up all the scores, then divide by the total number of scores.

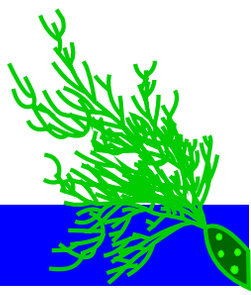


3, 4, 5, 5, 5, 6, 6, 7, 8, 8, 9

11 scores 3 + 4 + 5 + 5 + 5 + 6 + 6 + 7 + 8 + 8 + 9 = 66

66 ÷ 11 = 6

Mean = 6



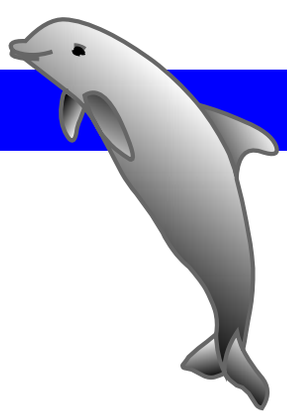
Median

The middle value of an ordered set of scores.

Order the scores from least to greatest.
Locate the middle score.

3, 4, 5, 5, 5, 6, 6, 7, 8, 8, 9

If the number of scores is even, the median is the average of the two middle scores.



Mode

The score that occurs the most.

Order the scores from least to greatest.
Locate the score that occurs the most.

3, 4, 5, 5, 5, 6, 6, 7, 8, 8, 9

There can be more than one mode.
If each score occurs only once there is no mode.

Range

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Range is a measure of spread and is the difference between the highest score and the lowest score in a data set.

Range

highest score - lowest score = range

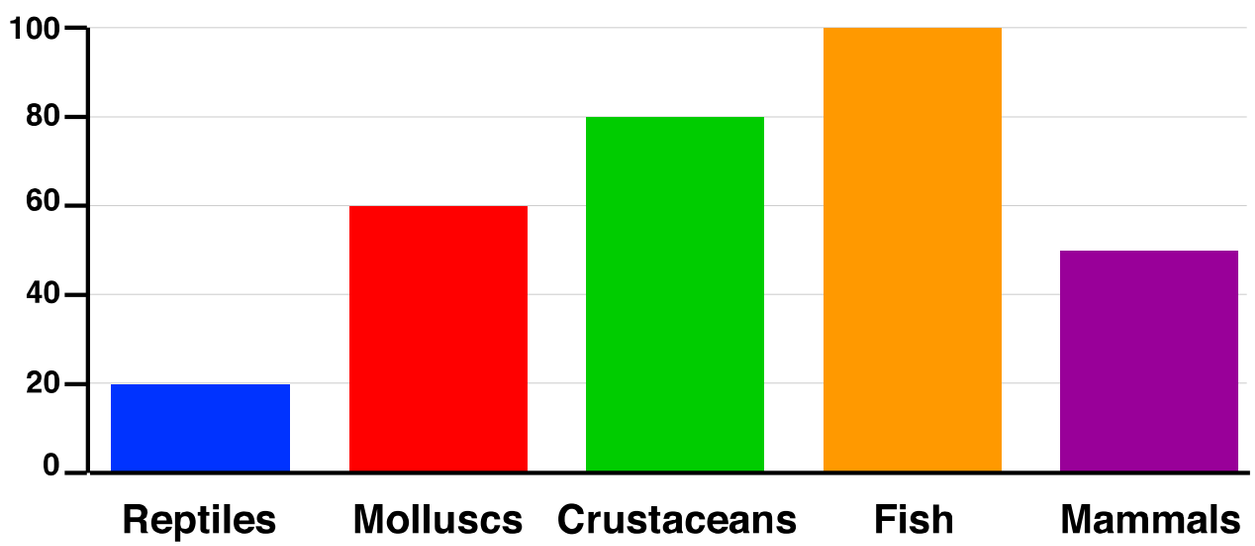
3, 4, 5, 5, 5, 6, 6, 7, 8, 8, 9

9 - 3 = 6

Range = 6

Range - bar graph.

Oceanarium - numbers of marine creatures.



highest score - lowest score = range

100 - 20 = 80

Range = 80

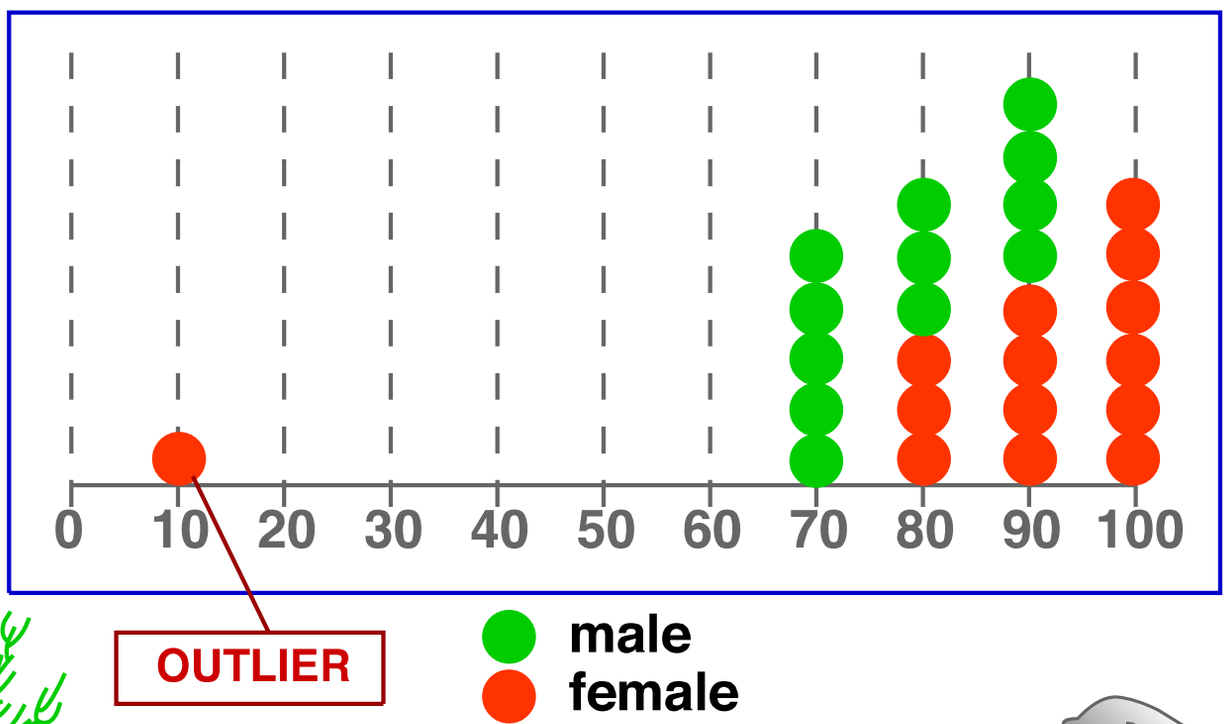
Outlier

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

An outlier is a value far away from most of the other scores in a set of data.

Outlier in a Dot Plot

Oceanarium - marine quiz results.



Considerations

When calculating averages, outliers may skew a mean so it becomes misleading.

In this case, it may be better to use the median or mode to give a more accurate picture.

Outliers can occur in any data set but it is advisable to check in case an error was made when recording the data.