R for Kids

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R is a computer program that was originally invented so that people can do statistical calculations. Although it is usually used at universities, it can also be used to do elementary and high school math calculations.

In order to use R, you first need to install it. You can follow these steps:

1. Use your internet browser to link to `https://cran.r-project.org/bin/windows/base/`

2. Click on the link which will download the program.

3. Choose 'Run' when asked.

4. Normally, there is no reason to customize the installation, so click "Next" each time you are prompted. This might happen around 6 or 7 times.

When the program is installed, an "R" icon appears on your Desktop. Clicking on it starts the program, and a screen will open, and something like the following will appear in the screen:

```
R version 4.2.0 (2022-05-29)  -- "Unsuffered Consequences"
Copyright (C) 2022 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

>
```

The > sign tells you that R is ready for you to type in a command. For example, you can do addition

```
> 123+456
```

If you hit the 'Enter' key, you should see the result:

```
[1] 579
```

Try some other addition problems or try subtraction:

```
> 999-555
[1] 444
```

or try division

```
> 78/13
[1] 6
```

or multiplication

```
> 56*12
[1] 672
```

The following multiplications show some interesting patterns:

```
> 11*11
[1] 121

> 111*111
[1] 12321
> 1111111*1111111
[1] 1.234568e+12
```

The last example didn't quite work right, because R doesn't automatically print enough digits. You can control the number of digits in the output by typing

```
> options(digits=14)
```

Now, you can try the example again:

```
> 1111111*1111111
[1] 1234567654321
```

What kind of pattern do you think you will see if you multiply 11111111 by itself? How about 111111111?

Patterned Sequences

You can make other kinds of number patterns. For example,

```
> 1:10
 [1]  1  2  3  4  5  6  7  8  9 10
```

Here is what happens when you add a number to the above sequence:

```
> (1:10)+3
 [1]  4  5  6  7  8  9 10 11 12 13
```

You can subtract or multiply a number too:

2

```
> (1:10)-3
 [1] -2 -1  0  1  2  3  4  5  6  7
> (1:10)*3
 [1]  3  6  9 12 15 18 21 24 27 30
```

Here are some other patterns that you can make:

```
> (1:10)^2
 [1]   1   4   9  16  25  36  49  64  81 100
> (1:10)^3

 [1]    1    8   27   64  125  216  343  512  729 1000
```

Graphing Ordered Pairs

R can be used to create graphs. You can plot ordered pairs such as $(4, 6), (1, 2), (8, 4), (9, 3)$. To do this, note that the 'x' coordinate is the first coordinate of each pair. The 'y' coordinate is the second coordinate.

The way to get R to plot the ordered pairs is to collect all of the 'x' values together into something that we will call x:
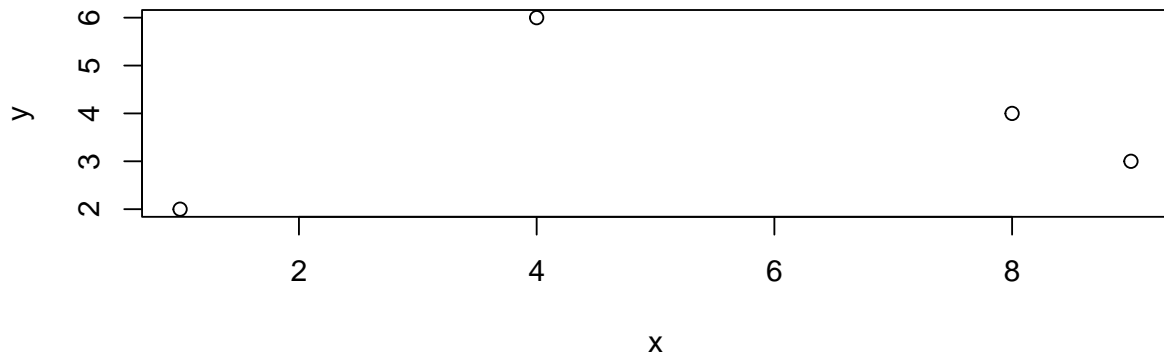
```
x <- c(4, 1, 8, 9)
```

Note the use of the two symbols <- to make an arrow. This indicates that what is to the right of the arrow is assigned to an object with the name given on the left side of the arrow.

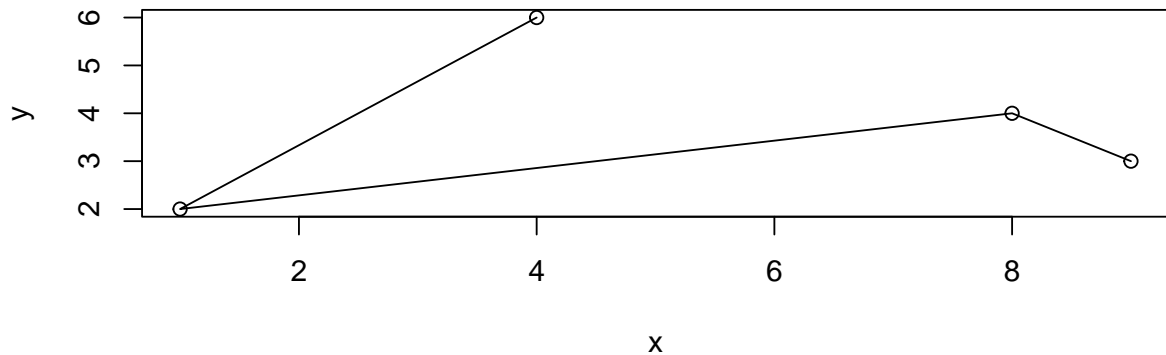You also need to collect the 'y' values:

```
y <- c(6, 2, 4, 3)
```

Then you can plot the ordered pairs by plotting x and y: This is pictured below.
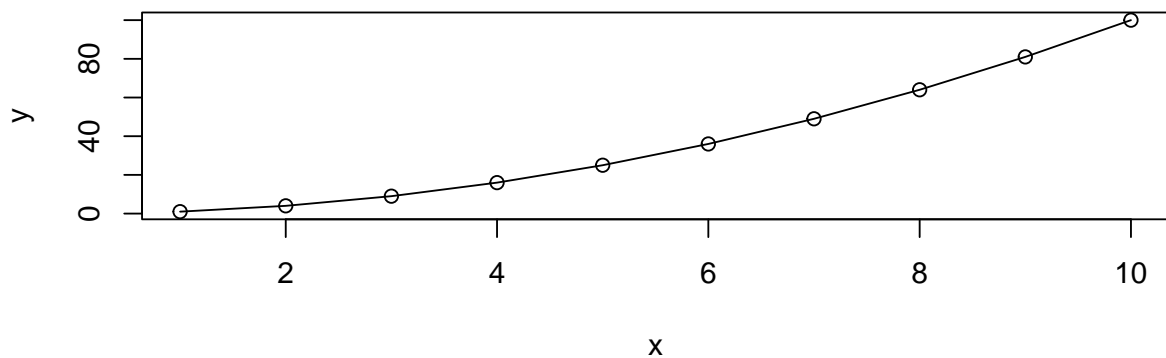
```
plot(x, y)
```


You can join the plotted points using the `lines` function:

```
plot(x,y)
lines(x, y)
```


Here is another example. This time we can see a specific pattern:

```
x <- 1:10
y <- x^2
plot(x,y)
lines(x,y)
```


Graphing Data

Finally, here are some examples of pie charts and bar charts. In the first example, the amount of time spent by a person watching 4 different types of TV shows were measured. 15% of the time was spent on sports, 10% on game shows, 30% on movies, and 45% on comedies.

First, you need to set up an object that contains the information to be plotted. Here, an object called `tv` is assigned the required information.

```
tv <- c("sports" = 15, "game shows"= 10, "movies" = 30, "comedies" = 45)
```
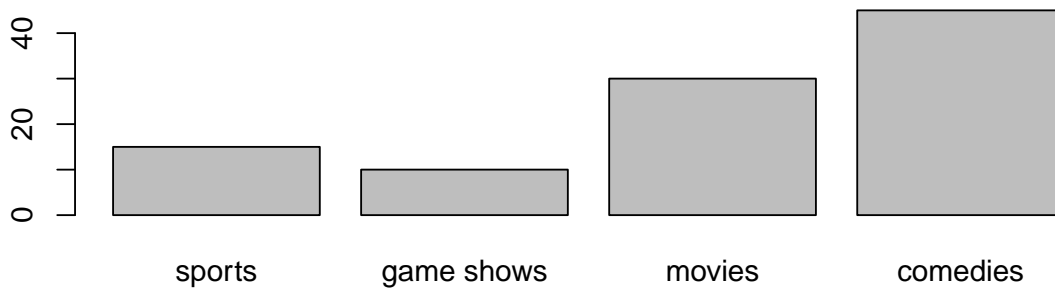
The `pie` function can then be used to create the pie chart:

```
pie(tv)
```
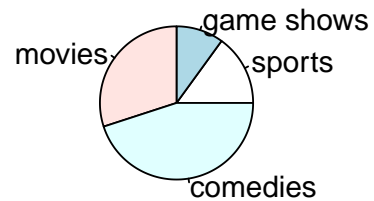

The `barplot` function is used to create the bar chart:

```
barplot(tv)
```


Another example: Suppose you have a budget of $100 which is to be spent on four different kinds of things: $21 is spent on video games, $50 on clothes, $9 on candy and $20 on movies. The pie chart and bar chart are shown below.

```
budget <- c("video games" = 21, "clothes" = 50, "candy" = 9, "movies" = 20)
pie(budget)
```
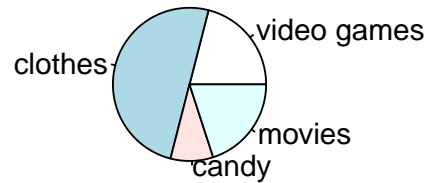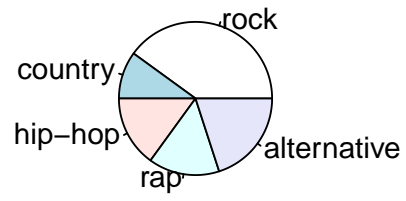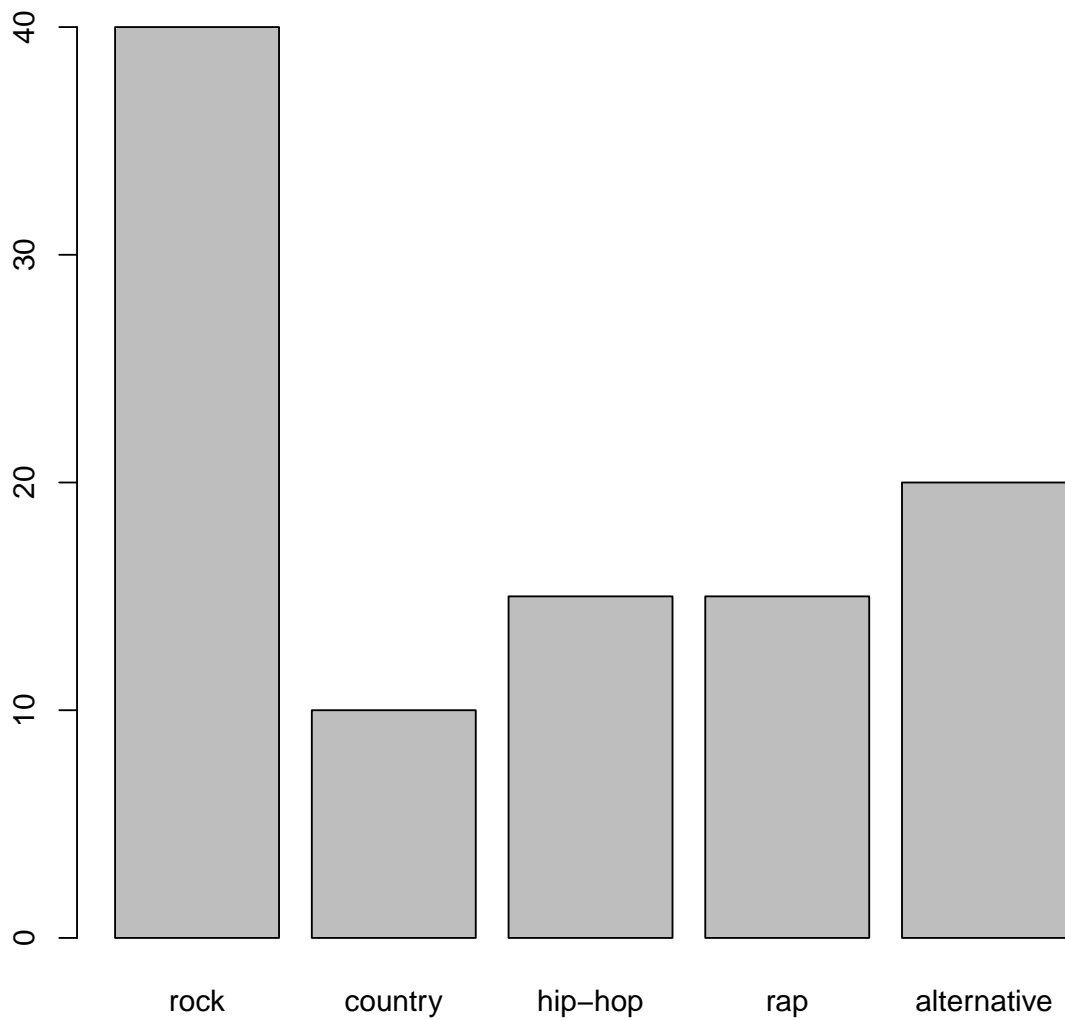


```
barplot(budget)
```


A final example shows the breakdown of music preferences for a class of Grade Seven students: 40% prefer rock, 10% prefer country, 15% prefer hip-hop and the rest prefer alternative.

```
music <- c("rock" = 40, "country" = 10, "hip-hop" = 15, "rap" = 15,
    "alternative" = 20)
pie(music)
```

```
barplot(music)
```

Where you can learn more about R

If you want to learn more about R, you can find lots of information on the web. One place to look is:

`http://www.burns-stat.com/pages/Tutor/hints_R_begin.html`

You might also want to explore the main R site at

`http://www.r-project.org`

References

[1] R Development Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Practice With R

(Answers are on the next page.)

1. Calculate

$$35 + 777.$$

$$13 \times 47.$$

$$675/15.$$

$$849 - 629.$$

2. The area of a rectangle can be calculated by multiplying the length by the width. You have 5 rectangles with lengths 3, 7, 12, 15 and 20. The widths are 2, 5, 8, 11 and 15. Find all of the areas of these rectangles.

3. Plot the rectangle lengths and widths as ordered pairs.

4. When you type

```
> (1:10)*2
```

you make R count by 2's. How would you make R count by 4's? How would you make R count by 6's? How about by 17's?

5. Joe has lots of homework. He spends 30 minutes on math, 20 minutes on spelling, 40 minutes on science and 10 minutes on French. Construct a bar chart and a pie chart which describe how much time Joe spends on these kinds of homework.

1.
```
> 35 + 777
[1] 812
> 13*47
[1] 611
> 675/15
[1] 45
> 849 - 629
[1] 220
```

2.
```
> length <- c(3, 7, 12, 15, 20)
> width <- c(2, 5, 8, 11, 15)
> length*width
[1]    6   35   96 165 300
```

3.
```
plot(width, length)
```

4.
```
> (1:10)*4

 [1]   4   8 12 16 20 24 28 32 36 40
> (1:10)*6
 [1]   6 12 18 24 30 36 42 48 54 60
> (1:10)*17
 [1]  17  34  51  68  85 102 119 136 153 170
```

5.
```
homework <- c("math"=30, "spelling"=20, "science"=40, "French"=10)
barplot(homework)
pie(homework)
```