Calc2S1.1

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

1.4 and 1.5: Exponential Growth and Decay and Function Manipulation

R: how to calculate functions and plot. How to take differences and plot. We'll begin by first plot 2^x

```
x <- c(-13, -5, -4, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,101)
plot(x, 2^x, main = "y = 2^x", ylab = "2^x", type = "l", col = "blue" )
```

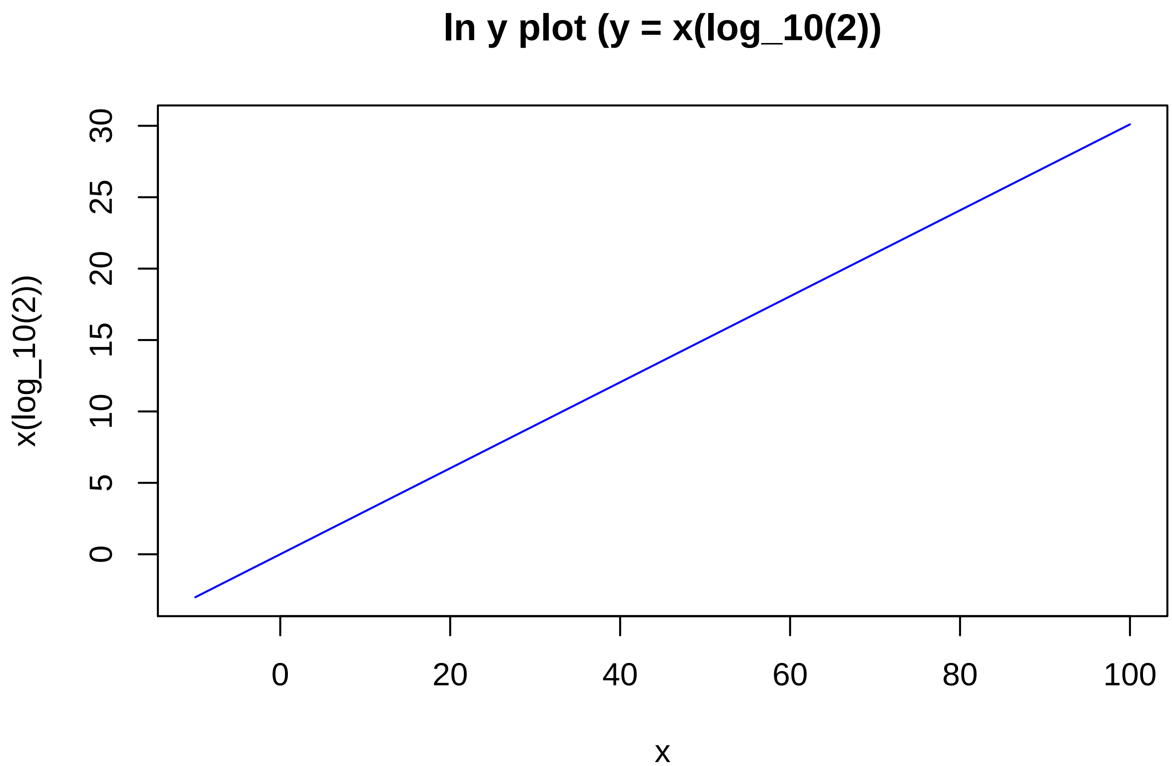
As x increases, the function tends to infinity, blows up

Given $y = 2^x$ lets try to plot $ln(y)$ against x. $ln(y) = xln2$: **Note that in R natural log(ln) appears as log, and other defined logarithms with bases appear as log10, log2 e.t.c

```
x <- c(-10, -5, -4, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot(x, x*log(2), main = "ln y plot (y = x(log(2))", ylab = "x(log(2))", type = "l", col = "blue")
```

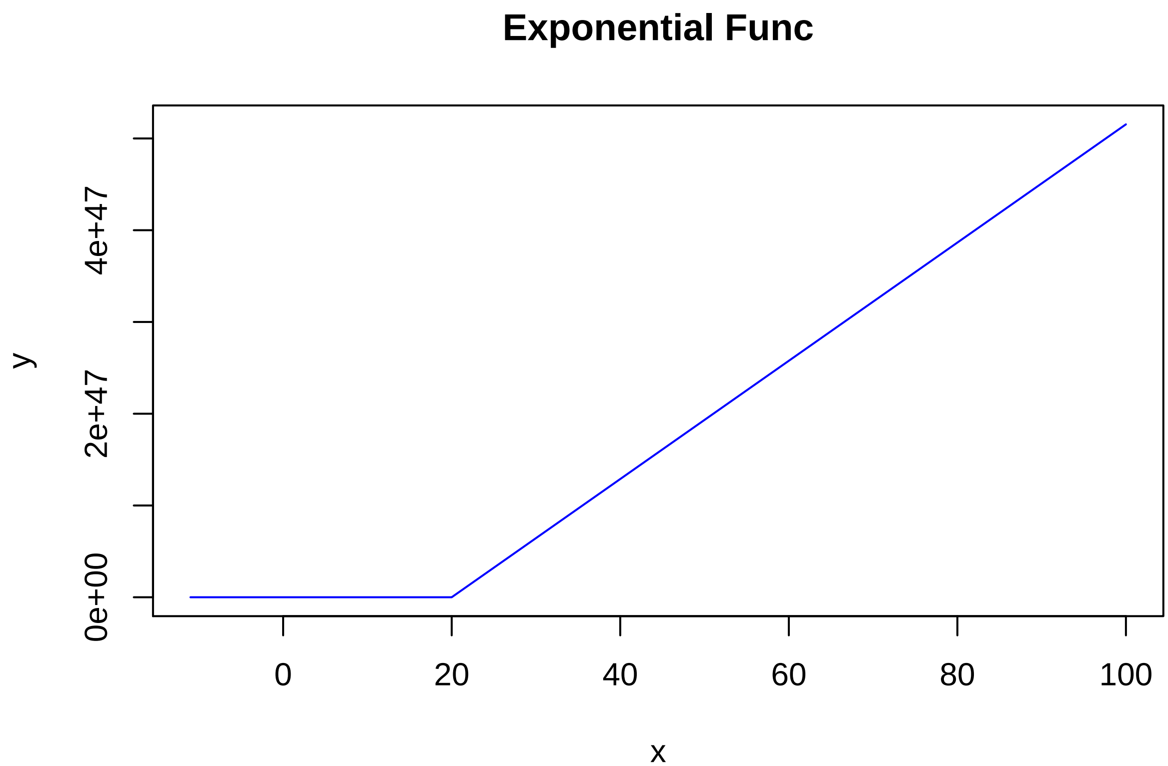
What do we observe about the slope of of the function? We'll try log base 10 as well:

```
x <- c(-10, -7, -5, -4, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot(x, x*log10(2), main = "ln y plot (y = x(log_10(2))", ylab = "x(log_10(2))", type = "l", col = "blu
```



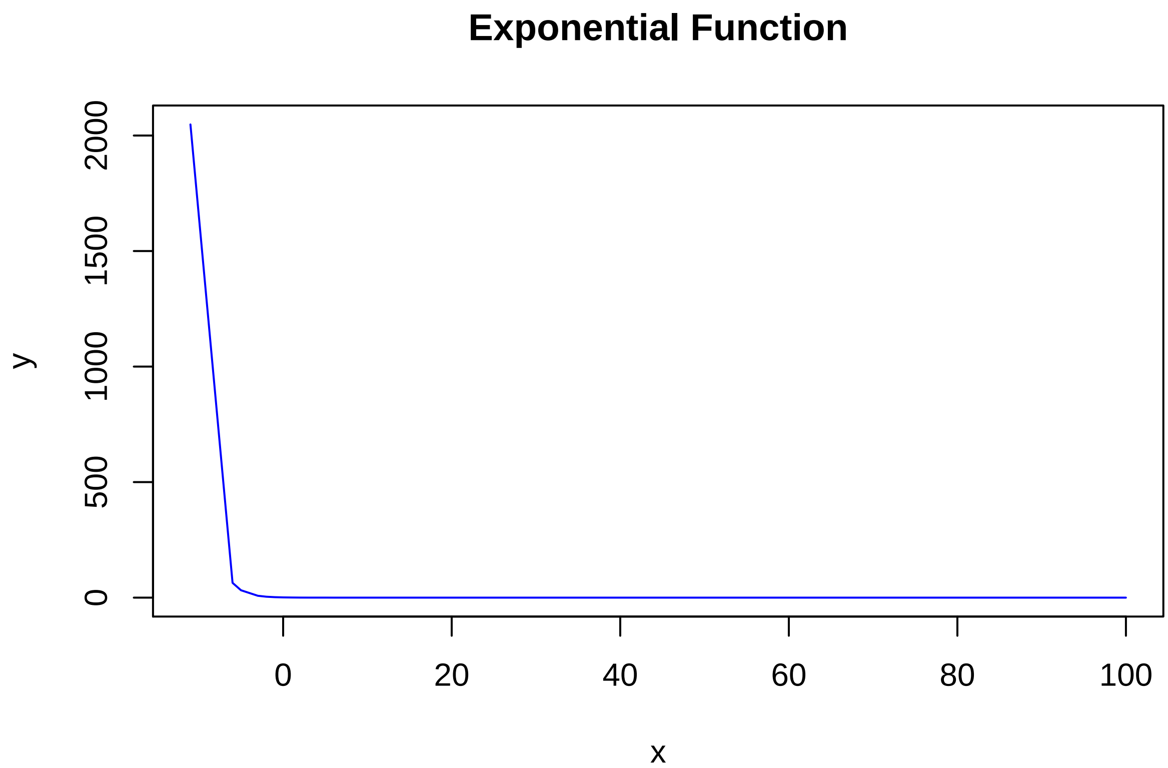
Next up we'll create a few data points to plot: $y = 3^x$: I'll pick a few plotting points using for my x values and use the function *plot* to make my plot

```
x <- c(-11, -6, -5, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot(x, 3^x, main = "Exponential Func", ylab = "y", type = "l", col = "blue" )
```



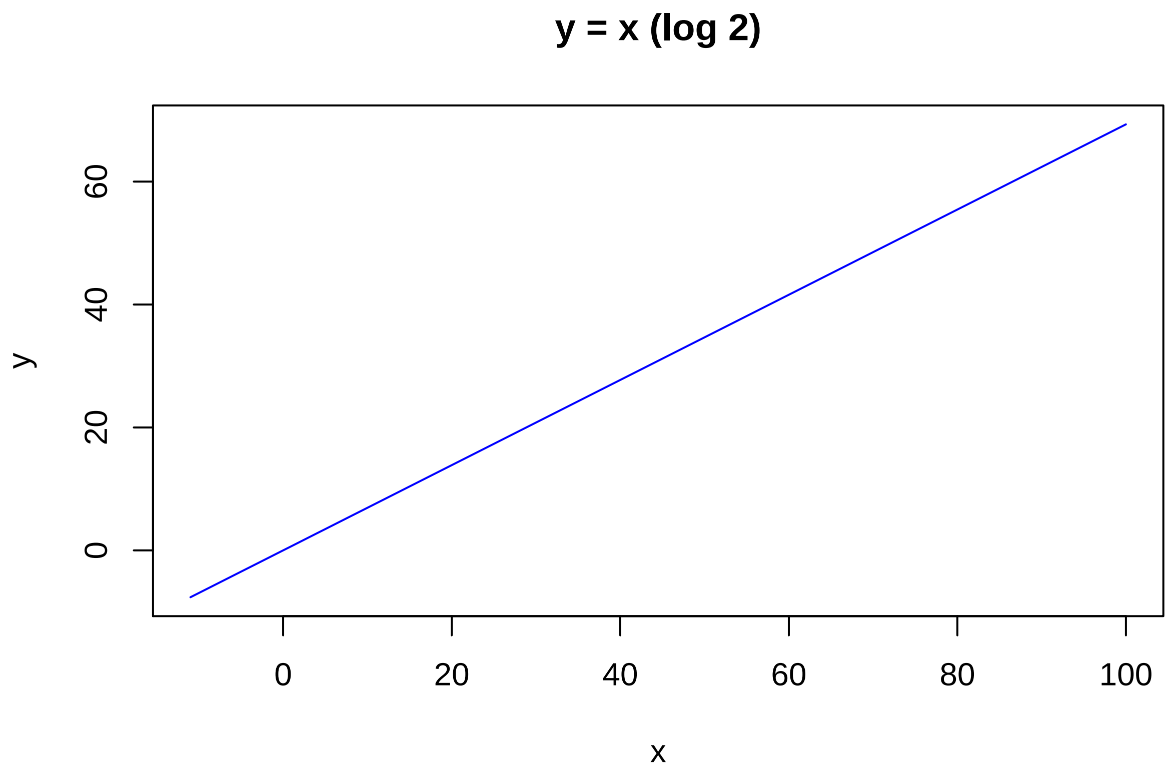
We'll do the same for $1/2^x$:

```r
x <- c(-11, -6, -5, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot(x, 1/2^x, main = "Exponential Function", ylab = "y", type = "l", col = "blue" )
```



Now let $y = 2^x$ we'll attempt to plot $ln(y)$ which in R is written as $log(y)$ such that $log(y) = xlog2$. Then we'll plot it to observe:

```
x <- c(-11, -6, -5, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot(x, x * log(2), main = "y = x (log 2)", ylab = "y", type = "l", col = "blue" )
```



What do we observe to be the slope of the line?

On our next exercise, we'll try to plot the derivative of y against y

For $y = 2^x$: $d(2^x)/dx = 2^x log(2)$ Then we plot:

```
x <- c(-11, -6, -5, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot((2^x), (2^x) * log(2), main = "y = (2^x)(log (2))", ylab = "y", type = "l", col = "blue" )
```

What do we observe the slope of the line to be?

For $y = 3^x$: $d(3^x)/dx = 3^x log(3)$ Then we plot:

```
x <- c(-12, -6, -5, -4, -3, -2, -1, 0,1,2,3,4,5,6,7,8,10,20,100)
plot((3^x), (3^x) * log(3), main = "y = (3^x)(log (3))", ylab = "y", type = "l", col = "blue" )
```

Can you repeat the same for $(1/2)^x$? Observe and try to explain what is happening in the plots

1.6 Inverse Functions- Logs and Inverse Trigs(Convert Lecture 4 into worksheet inverse trigs)

We'll tan(x) for x in $[2 - 2]$:

```
x <- c(-1.9, -1.8, -1.6, -1.4, -1.2, -1, 0,1.1,1.2,1.4,1.6,1.8,1.9)
plot(x, tan(x), main = "y = tan(x)", ylab = "y", type = "l", col = "blue" )
```

Is tangent invertible? Plot $arctan(x)$ (atan(x)) in R) for x in $[-2, 2]$:

```
x <- c(-1.9, -1.8, -1.6, -1.4, -1.2, -1, 0,1.2,1.4,1.6,1.8,1.9)
plot(x, atan(x), main = "y = tan(x)", ylab = "y", type = "l", col = "blue" )
```

Find the derivative of $arctan(x)$. Then taking $y = arctan(x)$ we'll plot dy/dx against x.

```
x <- c(-2, -1.8, -1.6, -1.4, -1.2, -1, 0,1.2,1.4,1.6,1.8,2)
plot(x, (1)/(1 + (x^2)), main = "y = d(arctan(x)) /dx", ylab = "y", type = "l", col = "blue" )
```

What function does this look like? Then plot the derivative you found on top of the dy/dx plot above. What do you notice?

1.7 Sequences and Difference Equations

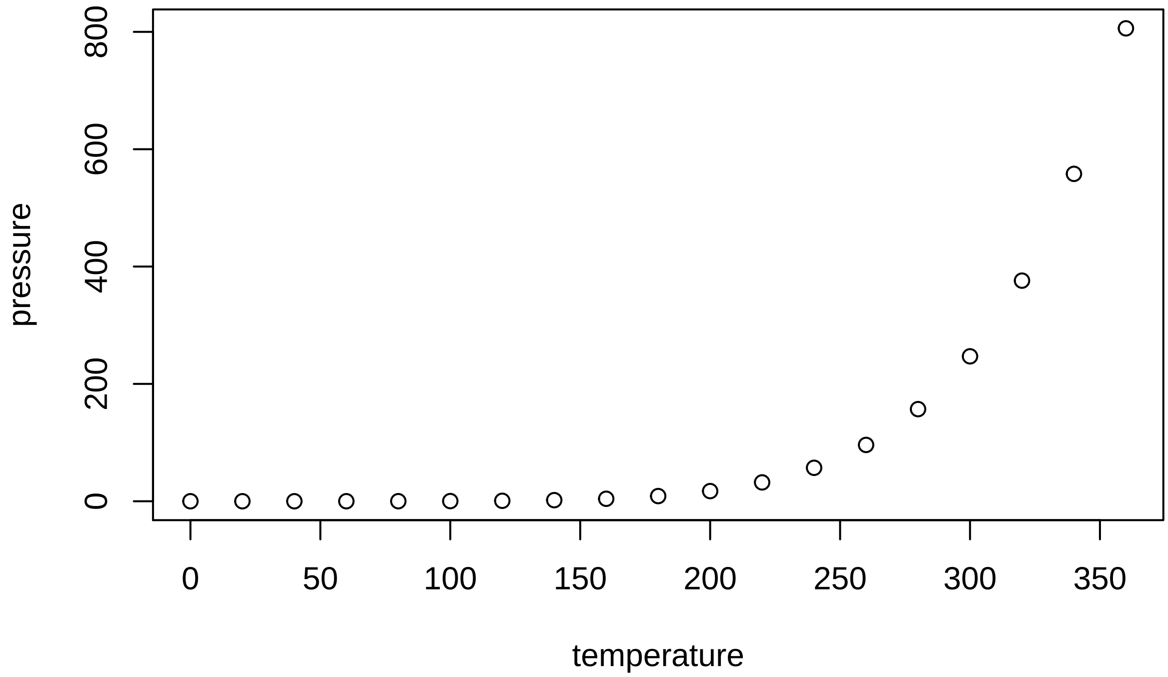
2.5 Program the Bellows

```r
summary(cars)
```

```
##      speed           dist       
##  Min.   : 4.0   Min.   :  2.00  
##  1st Qu.:12.0   1st Qu.: 26.00  
##  Median :15.0   Median : 36.00  
##  Mean   :15.4   Mean   : 42.98  
##  3rd Qu.:19.0   3rd Qu.: 56.00  
##  Max.   :25.0   Max.   :120.00  
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.