

Problem set 1: Quadratic equation

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Exercise 6

Create a markdown page with the results for this last set of values, but this time showing the code.

Lesson: Quadratic Equation

- **Definition:** is a polynomial equation of a second degree, it is expressed as $f(x) = ax^2 + bx + c = 0$ where a, b and c are the numerical coefficients.
- **Solution:** the solution of a quadratic equation is called the roots or zeros, and they can be found with the following formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ in which $b^2 - 4ac$ is the discriminant.
- **Discriminant:** The discriminant helps to identify how many solutions the equation will have and if the solutions are real or complex.
 - If the discriminant is greater than 0 (positive) there are 2 real roots.
 - If the discriminant is equal to 0 (zero) there is 1 repeated root.
 - If the discriminant is less than 0 (negative) there is no real roots.

How to apply the quadratic equation?

First we must define the variables a, b and c. *Note:* Use a different name for c as c is a predefined function in R.

```
a=1
b=3
# c will be called k
k=2
```

Second, we have to determine if the quadratic equation have real solutions using the discriminant.

```
real_soln<-b^2-4*a*k

if (real_soln>=0){
  soln_1<-(-b+sqrt(real_soln)/2*a)
  soln_2<-(-b-sqrt(real_soln)/2*a)

  cat("Real Solutions: \n")
  cat("x =", soln_1, "\n")
  cat("x =", soln_2, "\n")
} else {
  cat("No real solutions. \n")
}
```

Real Solutions:

x = -2.5

x = -3.5

```
roots<-c(soln_1,soln_2)
```

Third, now that we have the solution, we can graph the equation solution.

```
library (ggplot2)
x<-seq(-4,1) #values for x
y<-a*x^2+b*x+k #values for y

ggplot(
  #values
  data.frame(x,y), aes(x,y)) +
  #defining the color for the quadratic function
  geom_line(color = "blue") +
  #an horizontal line in the origin
  geom_hline(yintercept = 0, linetype = "dashed", color = "red") +
  #include the roots points
  geom_point(data = data.frame(x = roots, y = rep(0, length(roots))),
            color = "green", size = 3) +
  #graph labeling
  labs(title = "Quadratic Equation Graph",
        x = "x",
        y = "f(x)") +
  #modify y axis
  ylim(c(-1, max(y)))
```

