

Excercises 6

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Working with functions

1. Create a vector of numbers from -10 to 10 with 0.1 increments, i.e. $[-10, -9.9, -9.8, \dots, 9.8, 9.9, 10]$. Store those values in a variable as `x`.
2. Consider the mathematical function `y` :

$$y = -2x^2 + 10x - 12.5.$$

Create `y` values of the function for given `x` values you've created in the earlier step.

3. Plot a line graph of the function above
4. Find the maximum value of `y` in the vector you created. Save it to a variable called `maxy`. Print it out to see the value of it.
5. Put a vertical line on the graph using this maximum value. You can change its color to red.
6. We would like to have an R function described above which gives us the `y` value when we give the `x` value. The function should look like this: `calculate_y(0)`, `calculate_y(-5)` etc. Write that function and check if the numbers you wrote match well with the graph you've created. (Keep in mind that you can copy paste your function definition above.)
7. Try to find the `x` value that maximizes the function, by plugging different values in your function.

Matrices and Linear Systems

1. Consider these equations:

$$v + 2x - 3y + 12z = -2$$

$$v + x + 2y + 3z = 6$$

$$2v + 2x + 2y + 2z = 2$$

$$3v + x - 2y + z = -10$$

You can write this linear system in a matrix algebraic form: $AX = B$.

Write the left side of the equation as a coefficient matrix. Save it as `A`. (You can first create a vector, then convert it to a matrix).

2. Create the vector of constants (the right hand side of equations). Save it as `v`.
3. First get the determinant of matrix `A`. Is the determinant non-zero? If so, get the inverse of `A` (A^{-1}) and save it as `invA`.
4. Assume that you multiplied both sides with A^{-1} . Get the multiplication of the right hand side: $A^{-1}B$ (use matrix multiplication `%*%`). This will give you `X`, i.e. solution of the system. Confirm that you got the correct values by trying out these values on equations.