28072023-exercises

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# Solutions:

## Roots of the quadratic equation using the polyroot function:

# Given values  
a = 1  
b = 3  
c = 2  
  
# Coefficients of the quadratic equation  
coefficients <- c(a, b, c)  
  
# Solve the quadratic equation  
roots <- polyroot(coefficients)  
  
# Print the roots  
cat(" Root 1:", roots[1], "\n", "Root 2:", roots[2], "\n")

Root 1: -0.5+0i   
 Root 2: -1-0i

## Roots of the quadratic equation calculated using the quadratic equation formula:

# Quadratic equation: ax^2 + bx + c  
quadratic\_equation <- function(x) {  
 a \* x^2 + b \* x + c  
}  
  
# Calculate the discriminant  
discriminant <- b^2 - 4 \* a \* c  
  
# Check if the discriminant is non-negative  
if (discriminant >= 0) {  
 # Calculate the two solutions  
 root1 <- (-b + sqrt(discriminant)) / (2 \* a)  
 root2 <- (-b - sqrt(discriminant)) / (2 \* a)  
   
 roots <- c(root1, root2)  
   
 # Print the solutions  
 cat("Root 1:", root1, "\n")  
 cat("Root 2:", root2, "\n")  
} else {  
 cat("The quadratic equation has complex roots. \n")  
}

Root 1: -1   
Root 2: -2

## x-values for the plot:

# x values  
x\_vals <- seq(from = -5, to = 5, length.out = 100)  
print(x\_vals)

[1] -5.00000000 -4.89898990 -4.79797980 -4.69696970 -4.59595960 -4.49494949  
 [7] -4.39393939 -4.29292929 -4.19191919 -4.09090909 -3.98989899 -3.88888889  
 [13] -3.78787879 -3.68686869 -3.58585859 -3.48484848 -3.38383838 -3.28282828  
 [19] -3.18181818 -3.08080808 -2.97979798 -2.87878788 -2.77777778 -2.67676768  
 [25] -2.57575758 -2.47474747 -2.37373737 -2.27272727 -2.17171717 -2.07070707  
 [31] -1.96969697 -1.86868687 -1.76767677 -1.66666667 -1.56565657 -1.46464646  
 [37] -1.36363636 -1.26262626 -1.16161616 -1.06060606 -0.95959596 -0.85858586  
 [43] -0.75757576 -0.65656566 -0.55555556 -0.45454545 -0.35353535 -0.25252525  
 [49] -0.15151515 -0.05050505 0.05050505 0.15151515 0.25252525 0.35353535  
 [55] 0.45454545 0.55555556 0.65656566 0.75757576 0.85858586 0.95959596  
 [61] 1.06060606 1.16161616 1.26262626 1.36363636 1.46464646 1.56565657  
 [67] 1.66666667 1.76767677 1.86868687 1.96969697 2.07070707 2.17171717  
 [73] 2.27272727 2.37373737 2.47474747 2.57575758 2.67676768 2.77777778  
 [79] 2.87878788 2.97979798 3.08080808 3.18181818 3.28282828 3.38383838  
 [85] 3.48484848 3.58585859 3.68686869 3.78787879 3.88888889 3.98989899  
 [91] 4.09090909 4.19191919 4.29292929 4.39393939 4.49494949 4.59595960  
 [97] 4.69696970 4.79797980 4.89898990 5.00000000

## The corresponding y values using the quadratic equation:

# Corresponding y values  
y\_vals <- quadratic\_equation(x\_vals)  
print(y\_vals)

[1] 12.00000000 11.30313233 10.62667075 9.97061524 9.33496582 8.71972248  
 [7] 8.12488522 7.55045404 6.99642894 6.46280992 5.94959698 5.45679012  
 [13] 4.98438935 4.53239465 4.10080604 3.68962351 3.29884706 2.92847669  
 [19] 2.57851240 2.24895419 1.93980206 1.65105601 1.38271605 1.13478217  
 [25] 0.90725436 0.70013264 0.51341700 0.34710744 0.20120396 0.07570656  
 [31] -0.02938476 -0.11406999 -0.17834915 -0.22222222 -0.24568922 -0.24875013  
 [37] -0.23140496 -0.19365371 -0.13549638 -0.05693297 0.04203653 0.16141210  
 [43] 0.30119376 0.46138149 0.64197531 0.84297521 1.06438119 1.30619325  
 [49] 1.56841139 1.85103561 2.15406591 2.47750230 2.82134476 3.18559331  
 [55] 3.57024793 3.97530864 4.40077543 4.84664830 5.31292725 5.79961228  
 [61] 6.30670340 6.83420059 7.38210387 7.95041322 8.53912866 9.14825018  
 [67] 9.77777778 10.42771146 11.09805122 11.78879706 12.49994898 13.23150699  
 [73] 13.98347107 14.75584124 15.54861749 16.36179982 17.19538823 18.04938272  
 [79] 18.92378329 19.81858994 20.73380267 21.66942149 22.62544638 23.60187736  
 [85] 24.59871442 25.61595756 26.65360677 27.71166208 28.79012346 29.88899092  
 [91] 31.00826446 32.14794409 33.30802979 34.48852158 35.68941945 36.91072340  
 [97] 38.15243343 39.41454954 40.69707173 42.00000000

## Plot of the quadratic equation curve:

# Plot of the quadratic equation  
plot(x = x\_vals, y = y\_vals, type = "l", col = "blue", xlab = "x", ylab = "y", main = "Quadratic Equation")

