

Lab 1

1 The Quadratic Equation

Write a program that solves an equation of the form

$$ax^2 + bx + c = 0$$

The general solution to this equation has two solutions:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Prompt the user to enter $a, b,$ and c , and then solve for x . Print the solution to the console.

Your program must account for several possibilities:

1. If $a = 0$ the solution above is invalid. In this case, the equation is of the form

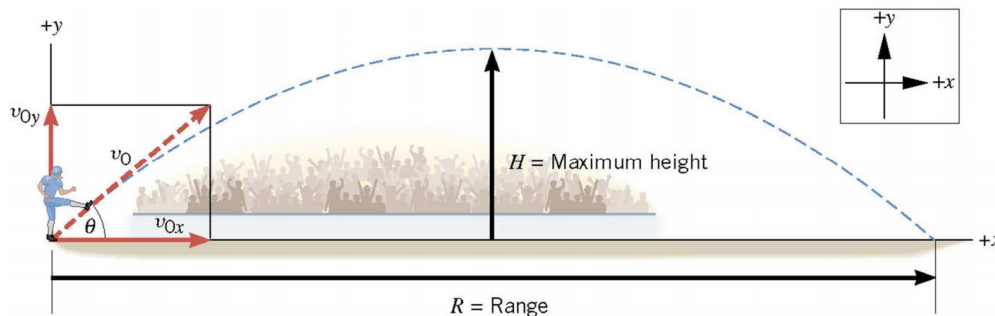
$$bx + c = 0$$

which has the solution:

$$x = -\frac{c}{b}$$

2. If both $a = 0$ AND $b = 0$, the equation cannot be solved. Either the user has entered a true statement ($c = 0$) or not ($c \neq 0$). Test this and tell the user whether or not they have entered a true statement.
3. Finally, the term under the square root ($b^2 - 4ac$), called the discriminant, might be negative. If this is the case, the solution is complex and cannot be solved. Print a message to the user stating that this is the case.

2 Projectile Motion



A football place kicker kicks a football at an angle of θ degrees above the horizontal. The initial speed of the ball is $v_0 = 22$ m/s. Ignore air resistance and find the maximum height that the ball attains at the angles of 25, 45, 65, and 85 degrees.

The equation for maximum height is:

$$H = \frac{v_0 \sin^2 \theta}{2g}$$

Where $g = -9.8$ m/s².

Write a program which loops over the requested angles, calculates the max height H , and prints the output. Use the `io manip` library from the discussed last week to format your output to a fixed width. See the sample output below:

Sample Output

Angle [deg]	Max Height [m]
25	4.41048
45	12.3469
65	20.2834
85	24.5063