In [1]:
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import math
```

PFDS: FINAL EXAM -- TERM ONE (QUESTION 2)

Question 2:

Write a function that accepts the following 3 inputs for a quadratic function in standard quadratic form:

- a = the coefficient of the quadratic term
- b = the coefficient of the linear term
- c = the constant term

$$\text{standard quadratic form: } f(x) = ax^2 + bx + c$$

Your function should return the following information:

a. A statement that gives the value of the descriminant for the given quadratic function.

b. A statement that describes the number and nature of real roots of the given quadratic function (see the possible ouputs below):

- This quadratic equation has two unique real roots, both of which are rational.
- This quadratic equation has two unique real roots, both of which are irrational.
- This quadratic equation has one unique real root with a multiplicity of two, and this root is rational.
- This quadratic equation has zero real roots, and two complex roots.

c. A statement that indicates whether the graph of the given quadratic function opens up or down with a statement that explains why.

d. The y-intercept of the given quadratic function.

e. The vertex of the given quadratic function.

f. A statement that indicates Whether the given quadratic function has a maximum or a minimum and the value of that maximum or minimum.

g. A statement that provides the equation for the axis of symmetry for the quadratic function.

h. Bonus: A statement that gives the first derivative and second derivative of the function.

Present your output in an aesthetic and professional manner!!

Test Cases:

Test Case #1: $f(x) = 2x^2 - 7x - 4$

Test Case #2: $f(x) = 2x^2 + 2x + 3$

Test Case #3: $f(x) = 9x^2 + 6x + 1$

Test Case #4: $f(x) = 3x^2 + 2x + 3$

In [19]:

```
def find_y_value(x):
    return (a * (x**2)) + (b*x) + c


def is_square(i):
    i = int(i)
    return i == math.isqrt(i)**2

def find_deriv(a,b,c):
    if(b < 0):
        return f"{a*2}x{b}"
    elif(b>0):
        return f"{a*2}x+{b}"

def to_string(a,b,c):
    discriminant = (b**2) - (4*a*c)
    xvertex = round((-b/(2*a)),2)
    print(f"The discriminant of the equation is {discriminant}.")
    if(discriminant > 0 and is_square(discriminant)):
        print("This quadratic equation has two unique real roots, both of whi
    elif(discriminant < 0):
        print("This quadratic equation has  zero real roots, and two complex
    elif(discriminant == 0):
        print("This quadratic equation has one unique real root with a multip

    if(a > 0):
        print("This graph opens upwards because the coefficient of the quadra
    elif(a < 0):
        print("This graph opens downwards because the coefficient of the quad

    print(f"The y-intercept of the quadratic is at {round(find_y_value(xverte

    print(f"The coordinates for the vertex is ({xvertex},{round(find_y_value(

    if(a > 0):
        print(f"There will be a minimum at the ({xvertex},{round(find_y_value
    elif(a < 0):
        print(f"There will be a maximum at the ({xvertex},{round(find_y_value

    print(f"The equation for the axis of symmetry is x = {xvertex}.")

    print(f"The derivative of the function is {find_deriv(a,b,c)}.")

    print(f"The second derivative of the function is {a*2}.")

for i in range(4):
    a = int(input("Enter the coefficient of the quadratic term: "))
    b = int(input("Enter the coefficient of the linear term: "))
    c = int(input("Enter the constant term: "))
    print("\n------------------\n")
    to_string(a,b,c)
    print("\n------------------\n")
```

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Enter the coefficient of the quadratic term: 2
Enter the coefficient of the linear term: -7
Enter the constant term: -4
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The discriminant of the equation is 81.
This quadratic equation has two unique real roots, both of which are rati
onal.
This graph opens upwards because the coefficient of the quadratic term is
positive.
The y-intercept of the quadratic is at -10.12.
The coordinates for the vertex is (1.75,-10.12).
There will be a minimum at the (1.75,-10.12).
The equation for the axis of symmetry is x = 1.75.
The derivative of the function is 4x-7.
The second derivative of the function is 4.

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Enter the coefficient of the quadratic term: 2
Enter the coefficient of the linear term: 2
Enter the constant term: 3

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The discriminant of the equation is -20.
This quadratic equation has  zero real roots, and two complex roots.
This graph opens upwards because the coefficient of the quadratic term is
positive.
The y-intercept of the quadratic is at 2.5.
The coordinates for the vertex is (-0.5,2.5).
There will be a minimum at the (-0.5,2.5).
The equation for the axis of symmetry is x = -0.5.
The derivative of the function is 4x+2.
The second derivative of the function is 4.

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Enter the coefficient of the quadratic term: 9
Enter the coefficient of the linear term: 6
Enter the constant term: 1

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The discriminant of the equation is 0.
This quadratic equation has one unique real root with a multiplicity of t
wo, and this root is rational.
This graph opens upwards because the coefficient of the quadratic term is
positive.
The y-intercept of the quadratic is at 0.0.
The coordinates for the vertex is (-0.33,0.0).
There will be a minimum at the (-0.33,0.0).
The equation for the axis of symmetry is x = -0.33.
The derivative of the function is 18x+6.
The second derivative of the function is 18.

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Enter the coefficient of the quadratic term: 3
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Enter the coefficient of the linear term: 2
Enter the constant term: 3

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The discriminant of the equation is -32.
This quadratic equation has  zero real roots, and two complex roots.
This graph opens upwards because the coefficient of the quadratic term is
positive.
The y-intercept of the quadratic is at 2.67.
The coordinates for the vertex is (-0.33,2.67).
There will be a minimum at the (-0.33,2.67).
The equation for the axis of symmetry is x = -0.33.
The derivative of the function is 6x+2.
The second derivative of the function is 6.

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In [ ]: