Rational Quadratic Zeros

In this lesson, you will extend the code from **Integer Quadratic Zeros**. If you didn't complete the activity, complete that activity first or obtain the base code from your teacher.

In this lesson, you will create a game that lets you practice finding x-intercepts for equations in the form $y = ax^2 + bx + c$. These solutions will have one rational and one integer solution.

In the challenge, you will apply what you have learned to create a third game. This game will let you practice finding x-intercepts for equations in the form $y = ax^2 + bx + c$ where both x-intercepts could be rational numbers.

Objectives:

Programming Objectives:

- Use the input function and a variable to collect and store data from a user
- Use the randint() function to generate random integers.
- Use a while loop to repeat code
- Use if..elif..else statements to make decisions.

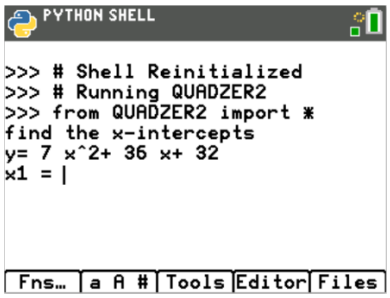
Math Objectives:

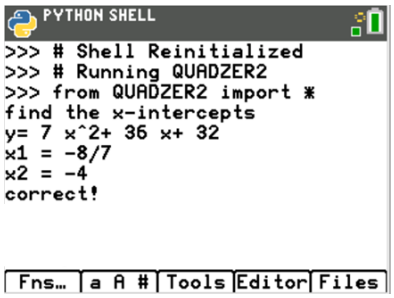
- Explore how x-intercepts are related to factored quadratic equations
- Explore how to factor equation in standard form
- Factor quadratic equations with rational solutions

Math Course Connections: Algebra 1 or Algebra 2

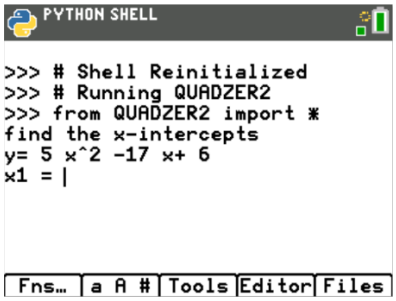
In this lesson, you will create a game that lets you practice finding x-intercepts for equations in the form $y = ax^2 + bx + c$. These solutions will have one rational and one integer solution.

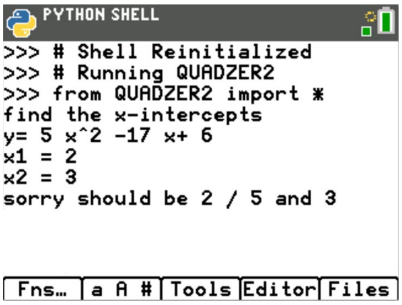
Example 1:





Example 2:



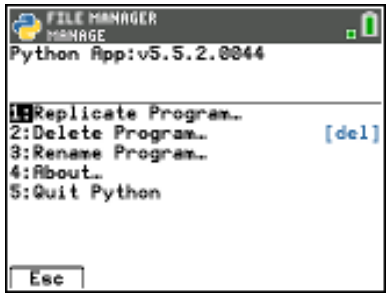


1. Open up the python File Manager.
   [prgm] Python App

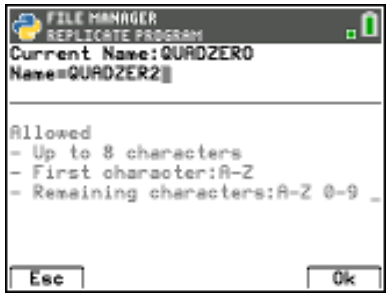
   Scroll through your list of projects until the arrow is to the left of QUADZERO.

   Select [Manage]

   Choose: 1 Replicate Program



   Name the new program QUADZER2.



2. The factored equations in this problem will be of the type:
   $y = (m*x – x1)(x – x2)$

   In the first project, the line
   x2 = randint(-10,10)
   creates and stores random integer value from -10 to 10 in the variable x2

   Similarily, we will let m be an integer value from two to seven.

   Add a line of code after the x2 = randint(-10,10) to generate and store the value of m.

3. How does the addition of the cofficient m change the values of b and c in the code?
   Use distribution to solve and rewrite the equation in standard form.

   $y = (m*x – x1)(x – x2)$

b = _____

c = _____

Modify the values for b and c in the code if necessary.

4. Does your code match the code to the right?

```
EDITOR: QUADZER2
PROGRAM LINE 0011
# Random Simulation
from random import *

for i in range(5):
  x1=randint(-10,10)
  x2=randint(-10,10)
  m=randint(2,7)

  b=(-x1)+(-x2*m)
  c=x1*x2
_
Fns… | a A # | Tools | Run | Files
```

5. When distributing m in step 3, your final equation started with mx^2 instead of x^2.
How can you modify the print statements to show mx^2 instead of x^2?
Be careful. You want the value of m to display not the letter m.

```
EDITOR: QUADZERO
PROGRAM LINE 0021
print("find the x-intercepts")

if b>=0 and c>=0:
    print("y=x^2+",b,"x+",c)
elif b>=0:
    print("y=x^2+",b,"x",c)
elif c>=0:
    print("y=x^2",b,"x+",c)
else:
    print("y=x^2",b,"x",c)
_
Fns… | a A # | Tools | Run | Files
```

Original

```
EDITOR: QUADZERO
PROGRAM LINE 0021
print("find the x-intercepts")

if b>=0 and c>=0:
    pr
eli
    pr
eli
    pr
els
    pr
_
Fns… | a A # | Tools | Run | Files
```

Modified

6. *How does the user input change?*

Let's look at a sample problem:

$4x^2 + 25x - 21 = 0$

$(4x - 3)(x + 7) = 0$

$4x - 3 = 0$ $\quad x + 7 = 0$

$x = 3/4$ $\quad x = -7$

```
EDITOR: QUADZER2
PROGRAM LINE 0018
    print("y=",m,"x^2+",b,"x",c)

elif c>=0:
    print("y=",m,"x^2",b,"x+",c)
_
else:
    print("y=",m,"x^2",b,"x",c)

z1=float(eval(input("x1 = ")))

z2=float(eval(input("x2 = ")))
Fns… | a A # | Tools | Run | Files
```

Not all of the answers will be fractions, but some will be fractions.
The original code:

z1 = int(input("x1 = "))

will not allow the user to enter the division sign.

To preform a calculation then store as a float, use the eval() function.

Modify the two input lines to:

z1 = float(eval(input("x1 = ")))

z2 = float(eval(input("x2 = ")))

Fns > Type > Float

Fns > I/O > eval()

7. You have one more modification to make. The original project had the line:

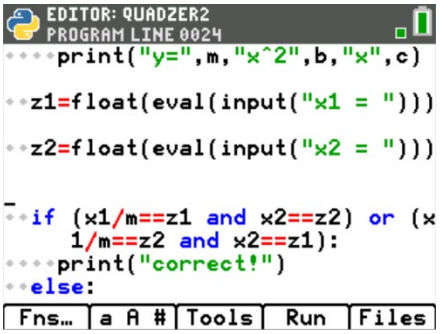
if (x1 == z1 and x2== z2) or (x1 == z2 and z1== x2):

Modify the if statement so it includes the new coefficient m.

Execute your program. Verify your if statement works.

8. Did you change the code to:

if (x1/m==z1 and x2==z2) or (x1/m==z2 and x2==z1):



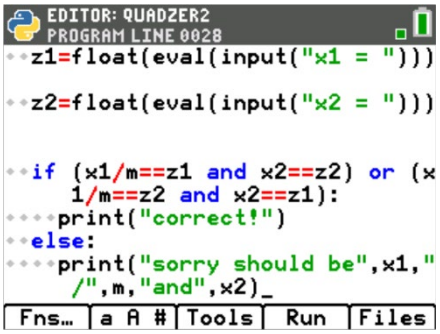
9. Lastly, modify your print statement if the user input is incorrect.

Original:

print("Sorry sould be",x1,"and",x2)

Change To:

print("Sorry sould be",x1,"/",m,"and",x2)



Challenge:

Create a **QUADZER3** program that generates equations with two fractional x-intercepts.

For example, $6x^2 - 11x - 35 = 0$ factors to $(3x + 5)(2x - 7) = 0$.

The x-intercepts would be x = -5/3 and x = 7/2.