Search for parabola vertex

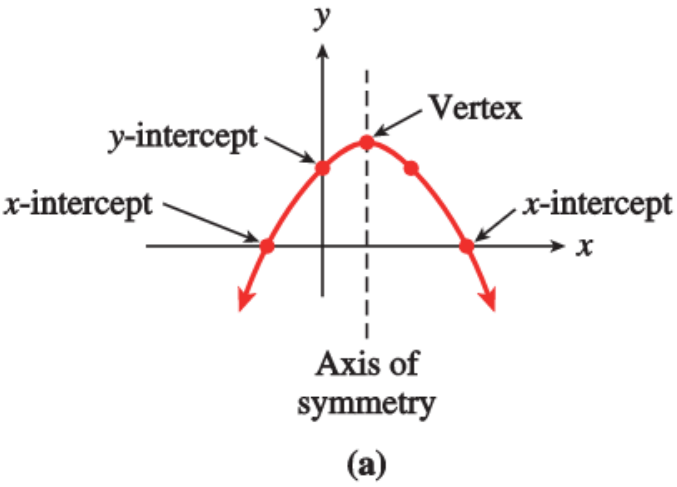
Time Limit: 10.0s **Memory Limit:** 250M

Search for the vertex of a parabola:

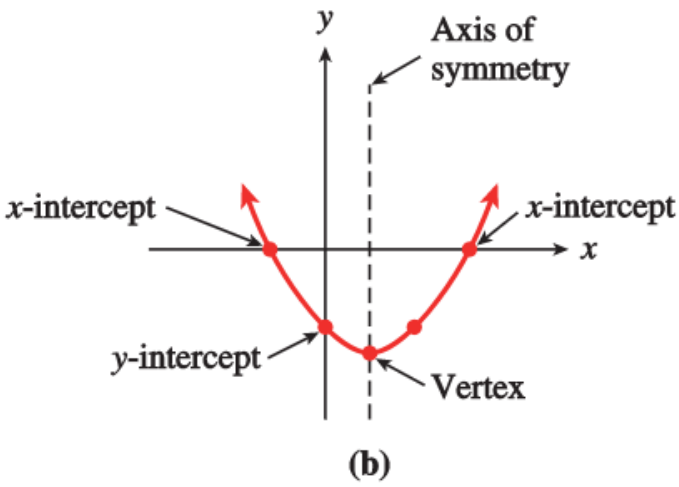
1. In this problem you are to search, one incremental step at a time, for the x-coordinate of the vertex of the parabola given by the quadratic formula:

   $y(x) = ax^2 + bx + c$

2. The vertex of a parabola is either a highest point (if the parabola opens downward, as in Figure (a) below) or a lowest point (if the parabola opens upward, as in Figure (b) below). This high or low point is called the vertex of the parabola and has coordinates (h, k).



(a)



(b)

Coding your program. You must find the vertex by using a stepping method, as suggested here, and not by simply using the formula for the vertex.

To find the vertex you are required to search on the x-axis for a maximum or minimum value of y(x) by incrementing x by a step size of the input, which is typically 0.0001. For example, if you start at 0 and step = 0.0001, the x values that you would use are: 0, 0.0001, 0.0002, 0.0003, 0.0004, and so on. For your solution assume that the x-coordinate of the vertex is within the range [-25, 25], that is, for the vertex (h, k) we assume that $-25 \leq h \leq +25$. Also, it is manditory that you round the coordinates of the vertex by using the round function with 4 digits. The following is our recommended way of implementing your solution to this problem:

1. Input the coefficients (a,b,c) of the parabola and a step size of your choice, and cast them as floats.
2. Define a function, using **def**, that returns y(x), for an arbitrary x-cordinate x, for the parabola with the given coordinates.
3. Within the above function, cast all parameters as floats.
4. For computational efficiency, we will assume that the x-coordinate of the vertex is within the range [-25, 25]. That is, for the vertex (h, k) we assume that $-25 \leq h \leq +25$.

5. Given that the maximum or minimum value of the parabola is within the previously mentioned range, define the following starting values for your search:

   min = quadratic(a, b, c, -26)

   max = quadratic(a, b, c, -26)

6. Use the following for loop to search for the minimum or maximum value of the parabola: ***for i in range (-25, 26):***

7. Within the above for loop, create a new float variable j that increments the i value by the step size of your input (you may want to use a while statement for incrementing j). Note that this stepping adds the step value to j until the next i value is reached.
8. Test the value of the quadratic for each j to see if it is a new maximum or minimum: *test = quadratic(a, b, c, j)*
9. If $a \geq 0$ then the parabola opens upward and we test for a minimum. If we find a new minimum, we set *min* to the test value.
10. If $a < 0$ then the parabola opens downwards and we test for a maximum. If we find a new maximum, we set *max* to the test value.

11. Round the coordinates of the vertex by using the round function with 4 digits as illustrated here:

    h1 = round(h,4)

    k1 = round(k,4)

Sample Input #1:

```
2
-20
52
0.0001
```

Sample Output #1:

```
5.0 2.0
```

Sample Input #2:

```
3
-15
25.75
0.2
```

Sample Output #2:

```
2.4 7.03
```

Sample Input #3:

```
6
-100
503
0.3
```

Sample Output #3:

```
8.3 86.34
```