Problem 1 – Exploring Values of *b* and *c*

On the page 1.3, change the values of *b* and *c* by clicking the left or right arrows next to the value. The quadratic formula is shown on the right side of the graph. Observe the number under the square root and the value of the zero(s) as you change *b* and *c*.

1. When does the function have 2 zeros? 1 zero? No real zeros?

2. How does the number of zeros relate to the number under the square root?

3. When does the function have zero(s) that are rational? Irrational? Not real? (Relate the type of zero to the number under the square root."

4. Give a function that has the following type of root(s). Avoid using 0 for *b* and *c*.

   - 2 real, rational roots:

   - 2 real, irrational roots:

   - 1 real, double root (rational):

   - No real roots:

Problem 2 – The Quadratic Formula

The quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ for $f(x) = ax^2 + bx + c$, can be used to determine all roots. It is particularly useful when trying to find irrational and imaginary roots.

5. Use the quadratic formula to find the exact values of the zeros of $f(x) = x^2 + 3x - 1$. What are the values of *a*, *b*, and *c*?

6. By hand, use the quadratic formula to find the imaginary zeros of $f(x) = x^2 - 2x + 2$. Show your work. Remember that $\sqrt{-1} = i$.

    Confirm your answer on page 2.5. You will need to calculate the – and + of the quadratic formula separately.

Problem 3 –Exploring the Value of *a*

A slider for the value of *a* has been added to the original graph from Problem 1. Use the arrows next to the value to change ***a***.

7. In Problem 1, *a* was set equal to 1. Do your conclusions from Problem 1 still hold if $a \neq 1$?

Problem 4 – Exploring Other Rational Numbers

The sliders for *a*, *b*, and *c* have been changed to allow numbers other than integers. Use the arrows next to the values to change ***a***, ***b***, and ***c***. Investigate the effect on the graph.

8. Do your conclusions from Problem 1 still hold if *a*, *b*, and *c* are not integers?

9. Why do some decimals under the square root, like 12.25, make the zeros rational, but other decimals make the zeros irrational?