Exploring Complex Roots

Time required
00 minutes

Activity Overview

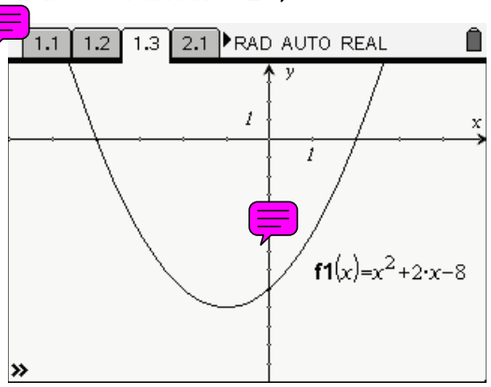
In this activity, you will explore the relationship between the complex roots of a quadratic equation and the related parabola's graph. Open the file *CollegeAlg_ComplexRoots.tns* on your TI-Nspire handheld device to work through the activity.

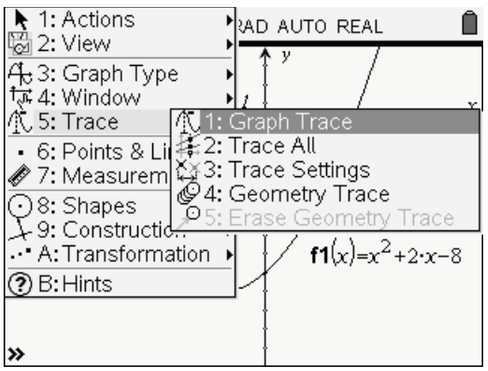
Materials

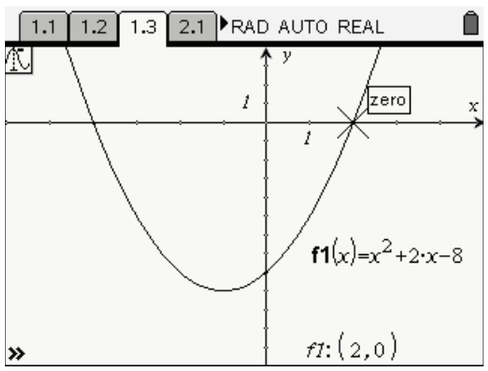
- *Technology*: TI-Nspire CAS handheld or TI-Nspire CAS computer software
- *Documents*: Complex_Roots.tns, Complex_Roots_Student.doc

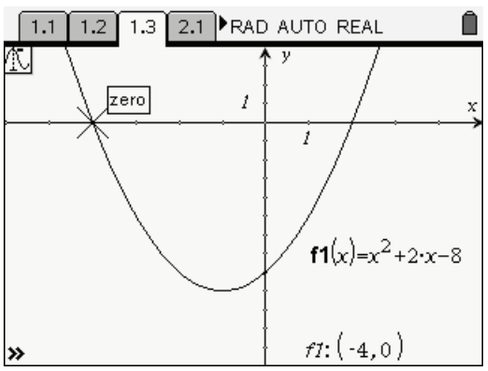
~~Exploring Complex Roots~~ Student Solutions

1. a. $x = -4$ *and* $x = 2$

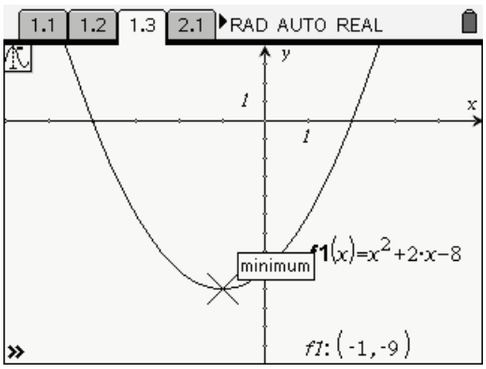






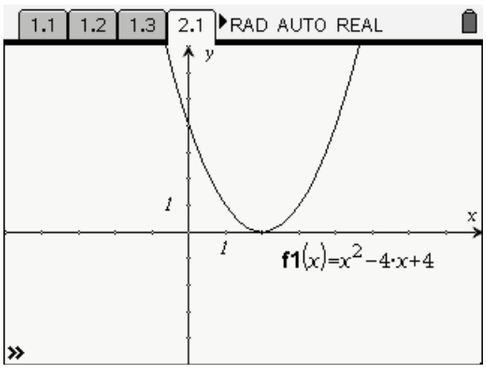


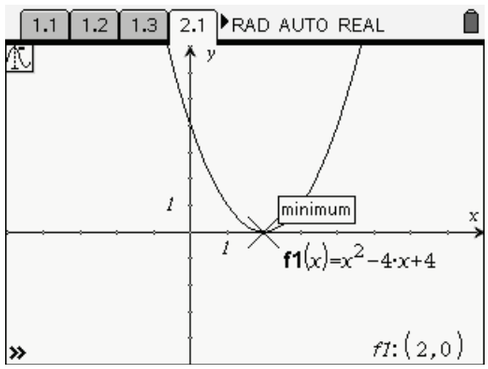
b. *Axis of symmetry: $x = -1$; Vertex: $(-1, 9)$*



c. *The line segment joining the real zeros is perpendicular to the axis of symmetry. The real zeros are equidistant from the axis of symmetry and the vertex.*

2. a. *One real zero: $x = 2$*



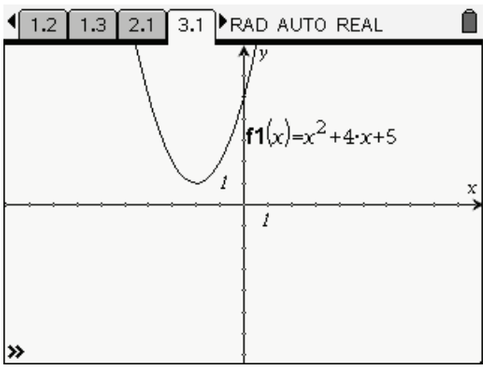


b. *Axis of symmetry: $x = 2$; Vertex: (2, 0)*

c. *The real zero lies on the axis of symmetry and passes through the vertex*

Finding Complex Solutions with Imaginary Parts

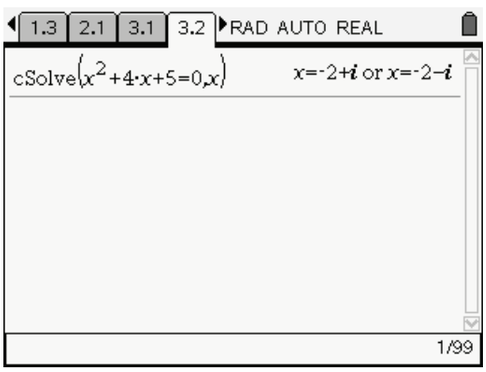
3. a. *Axis of symmetry: $x = -2$; Vertex: (−2, 1)*



b. *No real solutions (never intersects x-axis)*

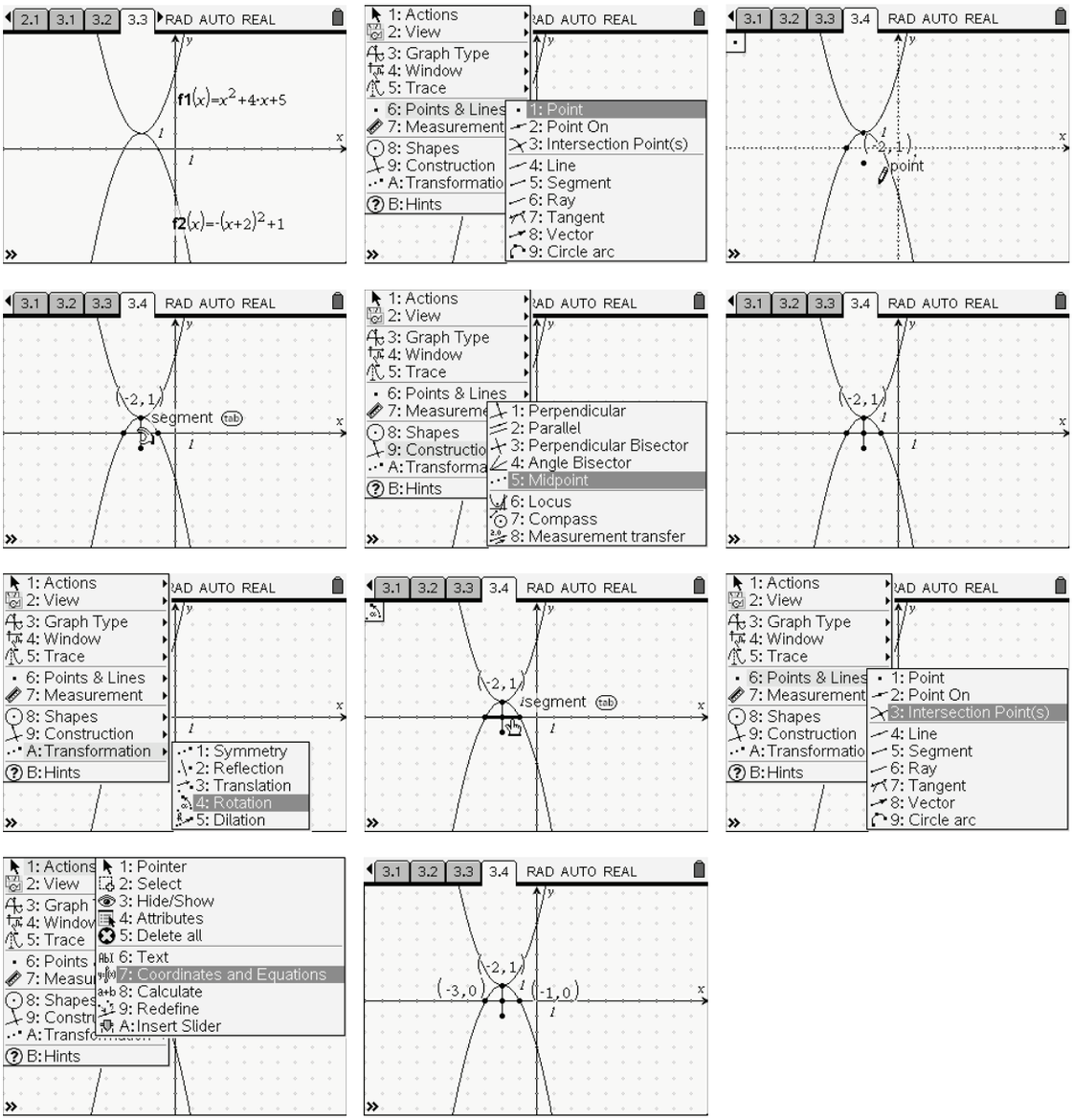
c. *Real zeros exist if the parabola intersects the x-axis. Complex zeros exist if the parabola does not intersect the x-axis.*

d.



Visualizing Complex Roots

4. a. *So here we simply need to change the* [illegible] *in front of the* $a(x - h)^2$ *part of the expression.*



b. *At the x-intercepts of the reflected parabola*

c. *(−3, 0) and (−1, 0)*

d. *They coincide.*

e. *If the parabola does not intersect the x-axis, reflect it vertically over its vertex. Find the x-intercepts of this reflection. Rotate these intercepts 90° about their midpoint. The coordinates of these rotated points, written as complex numbers of the form a + bi and a − bi using their x-coordinate as a and their y-coordinate as b, will be the desired roots.*

Notes