

## Rational Functions

Write one page (single-spaced if hand-written, double-spaced if typed) about the following function, then sketch its graph.

$$f(x) = \frac{2x^3 + 2x^2 - 12x}{x^3 + 6x^2 + 9x}$$

## Projectile Motion

A bottle rocket is launched from the ground into the air at an angle of 78 degrees with an initial velocity of 90 feet per second. Graph the path the rocket will take on the  $xy$ -plane with height on the  $y$ -axis and distance (*not time*) from the launch point on the  $x$ -axis. Find and label the vertex and  $x$ -intercepts and describe what they mean in the context of the problem.

## Inequalities

Create systems of inequalities whose intersections make the following shapes on the  $xy$ -plane: a diamond, a heart, a house, and the filled in letter "D."

### Polynomials

Find all roots (including complex roots) and their multiplicities of the following function, then sketch its graph.

$$f(x) = -x^7 - 2x^6 - 3x^5 - 6x^4 + 4x^3 + 8x^2$$

### Quadratics

Derive the quadratic formula by completing the square. Include a one or two sentence explanation for each step.

### Complex Numbers

Let  $T$  be the set of all points in the complex plane that are inside the triangle with vertices at  $0$ ,  $4$ , and  $4i$ . Let  $f(x) = \frac{x}{2i}$ . Draw  $f(T)$  and show how you found at least five points.