1. (5 points) Solve the inequality below and sketch the solution on the real number line

$$|9 - 2x| - 2 < -1.$$

Solution: We first must isolate the absolute value expression on one side of the inequality by adding 2 to both sides of the inequality. This gives $|9 - 2x| < 1$. To solve this, we need to write the double inequality

$$-1 < 9 - 2x < 1$$

and find its solution. We do this by first subtracting 9 from each part of the inequality, which yields the new double inequality

$$-10 < -2x < -8.$$

We now want to divide by -2, which is legal, so long as we *switch the inequality signs*! Thus, we now have

$$5 > x > 4,$$

which says that the solution is $(4, 5)$. You sketch this on the real number line by putting parentheses at the points 4 and 5 and shading the region between them.

2. (5 points) Use algebraic tests to check for symmetry with respect to the x-axis, the y-axis, and the origin in the equation

$$y = \frac{x}{x^2 + 1}.$$

Solution:

1. For x-axis symmetry, you substitute $-y$ for y and see if an equivalent equation results. Substituting $-y$ for y yields
$$-y = \frac{x}{x^2 + 1},$$
which is not equivalent to the given equation, so it does not have x-axis symmetry.

2. For y-axis symmetry, you substitute $-x$ for x and see if an equivalent equation results. Substituting $-x$ for x yields
$$y = \frac{-x}{(-x)^2 + 1} = \frac{-x}{x^2 + 1},$$
which his also not equivalent to the given equation.

3. For symmetry with respect to the origin, you substitute $-x$ for x and $-y$ for y and look for an equivalent equation. This results in the equation
$$-y = \frac{-x}{(-x)^2 + 1} = \frac{-x}{x^2 + 1}.$$

Multiplying both sides of this by -1 gives

$$y = \frac{x}{x^2 + 1},$$

which is the equation with which we started. Thus, we have equivalent equations, so the equation is symmetric with respect to the origin.