**1.** Compute the discriminant of the quadratic polynomial in the following equation and use that information to determine how many **real number** solutions the equation has (you do not need to actually solve the equation).

$$2x^2 + 4x + 2 = 0$$

**Discriminant:** _____

**Number of real solutions:** _____

**2.** I have a TV whose width is one inch less than twice its height. The area of the screen is 465 square inches. What are the dimensions of the TV?

**Width:** _____ **Height:** _____

**3.** Write the reciprocal of the complex number $3 + 5i$ in **standard form** ($a + bi$ for real numbers $a$ and $b$).

$\frac{1}{3+5i} =$ _____

**4.** Find **all** solutions (real or complex) to the following quadratic equation, and write your solution(s) in **set notation**.

$$x^2 - 4x + 13 = 0$$

**Solution:** _____

# Solutions

**1.** Remember that the discriminant is the quantity $b^2 - 4ac$, where in this case $a = 2$, $b = 4$, $c = 2$.

$$\begin{aligned} b^2 - 4ac &= 4^2 - 4(2)(2) \\ &= 16 - 16 \\ &= 0 \end{aligned}$$

Since the discriminant is zero, we know that the polynomial has only one real solution.

**2.** Let $w$ be the width of the TV, and $h$ be the height. Then the information from the story problem gives us that $w = 2h - 1$. Since the area of a rectangle is given by $A = hw$, we obtain the equation

$$465 = h(2h - 1) = 2h^2 - h$$

We can subtract 465 to get this in standard form:

$$0 = 2h^2 - h - 465$$

Now we just plug everything into the quadratic formula to get

$$\begin{aligned} h &= \frac{1 \pm \sqrt{(-1)^2 - 4(2)(-465)}}{2(2)} \\ &= \frac{1 \pm \sqrt{3721}}{4} \\ &= \frac{1 \pm 61}{4} \end{aligned}$$

Obviously one of these two solutions is negative, and we don't want that one. So we take the positive one:

$$h = \frac{1 + 61}{4} = \frac{62}{4} = 15.5$$

We said earlier on that $w = 2h - 1$, so $w = 2(15.5) - 1 = 30$.

**Width:** 30" **Height:** 15.5"

**3.**

$$\begin{aligned} \frac{1}{3 + 5i} &= \left(\frac{1}{3 + 5i}\right)\left(\frac{3 - 5i}{3 - 5i}\right) \\ &= \frac{3 - 5i}{3(3) + 15i - 15i - 5i(5i)} \\ &= \frac{3 - 5i}{9 - 25i^2} \\ &= \frac{3 - 5i}{9 + 25} \\ &= \frac{3 - 5i}{34} \end{aligned}$$

**4.** Just use the quadratic formula:

$$\begin{aligned} x &= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(13)}}{2(1)} \\ &= \frac{4 \pm \sqrt{16 - 52}}{2} \\ &= \frac{4 \pm \sqrt{-36}}{2} \\ &= \frac{4 \pm 6i}{2} \\ &= 2 \pm 3i \end{aligned}$$

**Solution Set:** $\{2 - 3i, 2 + 3i\}$