

1. **(3 points)** Calculate the following radicals, or state that they cannot be calculated:

- $\sqrt{-81}$.

This quantity is not a real number, since the square of any real number is non-negative; there is thus no calculable n such that $n^2 = 81$.

- $\sqrt[4]{1}$.

This is 1, since $1^4 = 1$ and $1 \geq 0$.

- $\sqrt[3]{-8}$.

This is -2 , since $(-2)^3 = -8$.

2. **(2 points)** A rectangular garden is 10 feet wide and 30 feet long.

- What is its perimeter?

The perimeter is built from two sides of length 10 and two sides of length 30, so it is $2 \cdot 10 + 2 \cdot 30 = 80$ feet.

- What is its area?

The area is given by the product of the length and width, so it is $10 \cdot 30 = 300$ square feet.

3. **(3 points)** Factor the polynomial $x^2 - 9x + 14$.

14 can be split into two factors in 4 different ways: (1)(14), (2)(7), $(-1)(-14)$, and $(-2)(-7)$. There are thus four potential factorizations which would have the terms x^2 and 14, shown below:

$$(x + 1)(x + 14) = x^2 + 14x + x + 14 = x^2 + 15x + 14 \quad (x + 2)(x + 7) = x^2 + 7x + 2x + 14 = x^2 + 9x + 14$$

Since the third multiplication yields the polynomial originally under consideration, we know the correct factorization is $(x - 2)(x - 7)$.

4. **(3 points)** Simplify the rational expression $\frac{7}{2x-4} - \frac{1}{x}$.

We start by multiplying each fraction by an appropriate representation of 1 in order to get them to have the same denominator, and then we merge the two fractions into a single fraction with a shared denominator.

$$\begin{aligned} \frac{7}{2x-4} - \frac{1}{x} &= \frac{7}{2x-4} \cdot \frac{x}{x} - \frac{1}{x} \cdot \frac{2x-4}{2x-4} \\ &= \frac{7x}{(2x-4)x} - \frac{2x-4}{(2x-4)x} \\ &= \frac{7x - (2x-4)}{(2x-4)x} \\ &= \frac{5x+4}{(2x-4)x} \end{aligned}$$

5. **(4 points)** Solve the equation $9y - 3(y - 1) = 6 + y$.

We expand the left side fully, and then migrate all the occurrences of y to the left side, and unwrap the addition and multiplications performed on them:

$$9y - 3(y - 1) = 6 + y$$

$$9y - 3y + 3 = 6 + y$$

$$6y + 3 = 6 + y$$

$$-y \quad -y$$

$$5y + 3 = 6$$

$$-3 \quad -3$$

$$5y = 3$$

$$y = \frac{3}{5}$$