GENERAL

saxon algebra 2 warm up 22

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Understanding Saxon Algebra 2 Warm Up 22: A Step by Step Guide

Every Algebra /2 student knows that the Saxon series is a staple of middle school and high school math curricula. The books are celebrated for their incremental, “build upon what you’ve learned” approach, which keeps concepts fresh and helps students master the fundamentals before moving on to more advanced topics. One of the most frequently cited practice problems is **Saxon Algebra /2 Warm Up 22**Whether you’re a student, a teacher, or a parent looking to help your child, this article will walk you through the problem in detail, explain the underlying concepts, and offer strategies for mastering similar exercises.

What Is Warm Up 22?

Warm Up 22 appears in the Saxon Algebra 2 workbook (the 2018/2019 edition) as part of the “Warm Ups” section that precedes each chapter. The problem asks students to solve a system of equations that involves both a linear equation and a quadratic equation. The goal is to reinforce skills in manipulating algebraic expressions, solving quadratic equations by factoring, and interpreting the results in a real world context.

Below is the exact wording of the problem:

Warm Up 22A rectangular garden has a length that is 4 m longer than its width. The area of the garden is 84 m². Find the length and the width of the garden.

While the wording may seem simple, the problem encapsulates several core Algebra 2 concepts: setting up a system of equations, translating word problems into algebraic form, solving a quadratic equation, and validating the solution.

Breaking Down the Problem

To solve Warm Up 22 effectively, we need to follow a systematic approach. Let’s outline the steps before diving into the algebra.

1. Identify the variables and assign symbols.
2. Translate the verbal description into algebraic equations.
3. Reduce the system to a single quadratic equation.
4. Solve the quadratic equation.
5. Verify the solution in the original context.

Step 1: Identify Variables

We need two variables: one for the width and one for the length. A common convention is to let *w* represent the width and *l* represent the length.

Step 2: Translate the Description

The problem states:

- The length is 4 /m longer than the width.
- The area equals 84 /m².

Translating these into equations:

1. Length–width relationship: l = w + 4
2. Area condition: l × w = 84

Step 3: Reduce to a Quadratic Equation

Substitute the expression for l from the first equation into the second:

(w + 4) × w = 84

Expanding gives:

$w^2 + 4w = 84$

Move all terms to one side to set the equation to zero:

$w^2 + 4w - 84 = 0$

Step 4: Solve the Quadratic Equation

We now have a standard quadratic form $aw^2 + bw + c = 0$ with a = 1, b = 4, c = -84. There are three common methods for solving quadratics: factoring, completing the square, and the quadratic formula. In this case, factoring is straightforward.

We need two numbers that multiply to -84 and add to 4. Those numbers are 12 and -7 because 12 × -7 = -84 and 12 + (-7) = 5—oops, that adds to 5, not 4. Let's check again.

Actually, the correct pair is 12 and -7? Wait, 12 + (-7) = 5. That's wrong. Let's try 14 and -6: 14 × -6 = -84 and 14 + (-6) = 8. Still not 4. How about 21 and -4? 21 × -4 = -84 and 21 + (-4) = 17. No. Let's systematically search.

We need factors of 84: ±1, ±2, ±3, ±4, ±6, ±7, ±12, ±14, ±21, ±28, ±42, ±84. We need one positive and one negative factor that sums to 4.

Try 12 and -7 again: sums to 5. 14 and -6: sum 8. 21 and -4: sum 17. 28 and -3: sum 25. 42 and -2: sum 40. 84 and -1: sum 83. None of these give 4.

It seems factoring might not yield integer solutions. Let's double check the algebra: Did we set up the equation correctly? The area is 84, length = width + 4. So w × (w + 4) = 84. Expand: $w^2 + 4w = 84$. Subtract 84: $w^2 + 4w - 84 = 0$. That's correct. Maybe the factors are not integers. In that case, we can use the quadratic formula:

w = [-b ± sqrt(b^2 - 4ac)] / (2a)

Plugging in a = 1, b = 4, c = -84:

w = [-4 ± sqrt(4^2 - 4(1)(-84))] / (2(1))

w = [-4 ± sqrt(16 + 336)] / 2

w = [-4 ± sqrt(352)] / 2

w = [-4 ± sqrt(16 × 22)] / 2

w = [-4 ± 4" 22] / 2

w = -2 ± 2" 22

We discard the negative root because width must be positive. So:

w = -2 + 2" 22

Numerically, " 22 "H 4.690, so w "H -2 + 9.380 "H 7.380 /m.

Now find the length:

l = w + 4 "H 7.380 + 4 "H 11.380 /m

We can verify by multiplying:

7.380 × 11.380 "H 84.0 /m²

Thus the width is approximately **7.38 /m** and the length is approximately **11.38 /m**

Step 5: Verify the Solution

Verification is a crucial habit in Algebra 2. Plug the values back into the original equations to ensure they satisfy both the length–width relationship and the area condition. As shown, the numbers check out, confirming the solution's validity.

Why Warm Up 22 Is a Cornerstone Problem

Although the solution involves a non integer result, Warm Up 22 serves several educational purposes:

- Real World Context: The problem translates a tangible scenario—measuring a garden—into algebraic language, helping students see the relevance of equations.
- System of Equations: It introduces a linear equation (the relationship between length and width) and a quadratic equation (the area condition) within a single problem.
- Quadratic Techniques: Students practice the quadratic formula, a tool they'll use repeatedly in Algebra /2 and beyond.
- Critical Thinking: The solution is not a neat integer pair, encouraging students to interpret approximate answers and understand the importance of rounding and significant figures.

Common Mistakes and How to Avoid Them

When tackling Warm Up 22, students often fall into a few pitfalls. Below are common errors and tips for prevention.

1. Misidentifying Variables

Assigning the wrong variable to the width or length can lead to an incorrect system. Always double check the problem's wording before assigning symbols.

2. Incorrect Equation Setup

For example, some students mistakenly write l = w - 4 instead of l = w + 4. Pay close attention to the phrase "4 m longer."

3. Forgetting to Move All Terms to One Side

After substituting, failing to set the equation to zero can make the quadratic formula misapplied.

4. Rounding Too Early

Using approximate decimal values before completing the algebra can introduce rounding errors. Perform algebraic manipulations symbolically, and round only at the end.

5. Ignoring the Negative Root

Quadratic equations often produce two solutions. In real world contexts, negative lengths or widths are physically meaningless, so discard them after verifying.

Extending Warm Up 22: Variations and Challenges

Once you master the base problem, you can explore variations that deepen understanding and provide additional practice.

Variation 1: Different Area

Change the area from 84 m² to 120 m² and solve again. This will produce a different quadratic, possibly with integer solutions.

Variation 2: Different Length–Width Relationship

Instead of “4 /m longer,” try “twice as long.” The system becomes l = 2w, leading to 2w × w = 84 !’ 2w² = 84 !’ w² = 42 !’ w = " 42 "H 6.48 /m and l "H 12.96 /m.

Variation 3: Perimeter Constraint

Add a second condition: the perimeter is 32 m. Now you have two equations: l + w = 16 (since perimeter = 2(l + w)) and l × w = 84. Solve the system using substitution or elimination.

Variation 4: Graphical Interpretation

Plot

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