

# 3.6 Curbside Rivalry

*A Solidify Understanding Task*

Carlos and Clarita have a brilliant idea for how they will earn money this summer. Since the community in which they live includes many high schools, a couple of universities, and even some professional sports teams, it seems that everyone has a favorite team they like to root for. In Carlos' and Clarita's neighborhood these rivalries take on special meaning, since many of the neighbors support different teams. They have observed that their neighbors often display handmade posters and other items to make their support of their favorite team known. The twins believe they can get people in the neighborhood to buy into their new project: painting team logos on curbs or driveways.

For a small fee, Carlos and Clarita will paint the logo of a team on a neighbor's curb, next to their house number. For a larger fee, the twins will paint a mascot on the driveway. Carlos and Clarita have designed stencils to make the painting easier and they have priced the cost of supplies. They have also surveyed neighbors to get a sense of how many people in the community might be interested in purchasing their service. Here is what they have decided, based on their research.

- *A curbside logo will require 48 in² of paint*
- *A driveway mascot will require 16 ft² of paint*
- *Surveys show the twins can sell 100 driveway mascots at a cost of $20, and they will sell 10 fewer mascots for each additional $5 they charge*

1. If a curbside logo is designed in the shape of a square, what will its dimensions be?

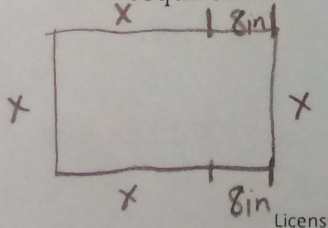
48in² | x | x

$x^2 = 48 \rightarrow \sqrt{x^2} = \sqrt{48} = x = \pm\sqrt{48} = \pm 6.93$ in

We only need the + answer since it's talking about length

A square logo will not fit nicely on a curb, so Carlos and Clarita are experimenting with different types of rectangles. They are using a software application that allows them to stretch or shrink their logo designs to fit different rectangular dimensions.

2. Carlos likes the look of the logo when the rectangle in which it fits is 8 inches longer than it is wide. What would the dimensions of the curbside logo need to be to fit in this type of rectangle? As part of your work, write a quadratic equation that represents these requirements.




$A = l \cdot w$

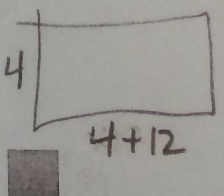
$A = (x)(x+8) = 48$

$-48 \quad -48$

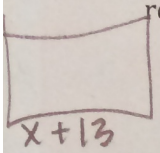
$A = x^2 + 8x - 48 = 0$

$A = (x+12)(x-4) = 0$

$x = -12, 4$



3. Clarita prefers the look of the logo when the rectangle in which it fits is 13 inches longer than it is wide. What would the dimensions of the curbside logo need to be to fit in this type of rectangle? As part of your work, write a quadratic equation that represents these requirements.




$A=(x)(x+13)=48$

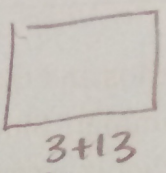
$x^2+13x=48$

$x^2+13x-48=0$

$x^2+13x-48=0$

$(x-3)(x+16)=0$

$x=3, -16$




Your quadratic equations on the previous two problems probably started out looking like this: $x(x+n)=48$ where $n$ represents the number of inches the rectangle is longer than it is wide. The expression on the left of the equation could be multiplied out to get and equation of the form $x^2+nx=48$. If we subtract 48 from both sides of this equation we get $x^2+nx-48=0$. In this form, the expression on the left looks more like the quadratic functions you have been working with in previous tasks, $y=x^2+nx-48$.

4. Consider Carlos' quadratic equation where $n=8$, so $x^2+8x-48=0$. How can we use our work with quadratic functions like $y=x^2+8x-48$ to help us solve the quadratic equation $x^2+8x-48=0$? Describe at least two different strategies you might use, and then carry them out. Your strategies should give you solutions to the equation as well as a solution to the question Carlos is trying to answer in #2.

Strategy 1 - factoring

done in #2

Strategy 2 - quadratic formula

$a=1\ b=8\ c=-48$

$x=\frac{-8\pm\sqrt{8^2-4(1)(-48)}}{2(1)}$

$x=4, -12$

5. Now consider Clarita's quadratic equation where $n=13$, so $x^2+13x-48=0$. Describe at least two different strategies you might use to solve this equation, and then carry them out. Your strategies should give you solutions to the equation as well as a solution to the question Clarita is trying to answer in #3.

Strategy 1 - factoring

done in #3

Strategy 2 - quadratic formula

$a=1\ b=13\ c=-48$

$x=\frac{-13\pm\sqrt{13^2-4(1)(-48)}}{2(1)}$

6. After much disagreement, Carlos and Clarita agree to design the curbside logo to fit in a rectangle that is 6 inches longer than it is wide. What would the dimensions of the curbside logo need to be to fit in this type of rectangle? As part of your work, write and solve a quadratic equation that represents these requirements.

$x^2+6x-48=0$

Strategy 1 - Quadratic form.

$a=1\ b=6\ c=-48$

$x=\frac{-6\pm\sqrt{6^2-4(1)(-48)}}{2(1)}$ $x\approx 4.55$

Strategy 2 - square root

vertex form: $(x-3)^2-57=0$

$(x-3)^2=57$

$\sqrt{(x-3)^2}=\pm\sqrt{57}$

$x-3=\pm\sqrt{57}$

$x=\pm\sqrt{57}+3$

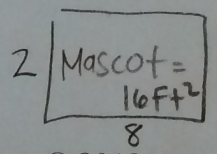
$x\approx 4.55$

7. What are the dimensions of a driveway mascot if it is designed to fit in a rectangle that is 6 feet longer than it is wide? (See the requirements for a driveway mascot given in the bulleted list above.) As part of your work, write and solve a quadratic equation that represents these requirements.

$x^2+6x-16=0$

$(x+8)(x-2)=0$

$x=-8, 2$



8. What are the dimensions of a driveway mascot if it is designed to fit in a rectangle that is 10 feet longer than it is wide? (See the requirements for a driveway mascot given in the bulleted list above.) As part of your work, write and solve a quadratic equation that represents these requirements.

$x^2+10x-16=0$

quad. form. → $a=1$ $b=10$ $c=-16$

$x=\frac{-10\pm\sqrt{10^2-4(1)(-16)}}{2(1)}$ $x\approx 1.403$

Carlos and Clarita are also examining the results of their neighborhood survey, trying to determine how much they should charge for a driveway mascot. Remember, this is what they have found from the survey: *They can sell 100 driveway mascots at a cost of $20, and they will sell 10 fewer mascots for each additional $5 they charge.*

x = price ← 9. Write an equation, make a table, and sketch a graph for the number of driveway mascots the twins can sell for each $5 increment, $x$, in the price of the mascot.

y = # sold

linear → $y=mx+b$ $m=\frac{\text{rise}}{\text{run}}=\frac{-10}{5}=-2$ $y=-2x+140$ → plug in # and see how far off you are

x = # sold ← 10. Write an equation, make a table, and sketch a graph (on the same set of axes) for the price of the driveway mascot for each $5 increment, $x$, in the price.

y = price

linear → $y=mx+b$ $m=\frac{\text{rise}}{\text{run}}=\frac{5}{-10}=-\frac{1}{2}$ $y=-\frac{1}{2}x+70$

x = price ← 11. Write an equation, make a table, and sketch a graph for the revenue the twins will collect for each $5 increment in the price of the mascot.

y = revenue

Written below

12. The twins estimate that the cost of supplies will be $250 and they would like to make $2000 in profit from selling driveway mascots. Therefore, they will need to collect $2250 in revenue. Write and solve a quadratic equation that represents collecting $2250 in revenue. Be sure to clearly show your strategy for solving this quadratic equation.

They have to charge $25 and sell 90 or they have to charge $45 and sell 50.

Table for #9-11

| price | # sold | revenue |
|---|---|---|
| 20 | 100 | 2000 |
| 25 | 90 | 2250 |
| 30 | 80 | 2400 |
| 35 | 70 | 2450 |
| 40 | 60 | 2400 |
| 45 | 50 | 2250 |
| 50 | 40 | 2000 |
| 55 | 30 | 1650 |
| 60 | 20 | 1200 |