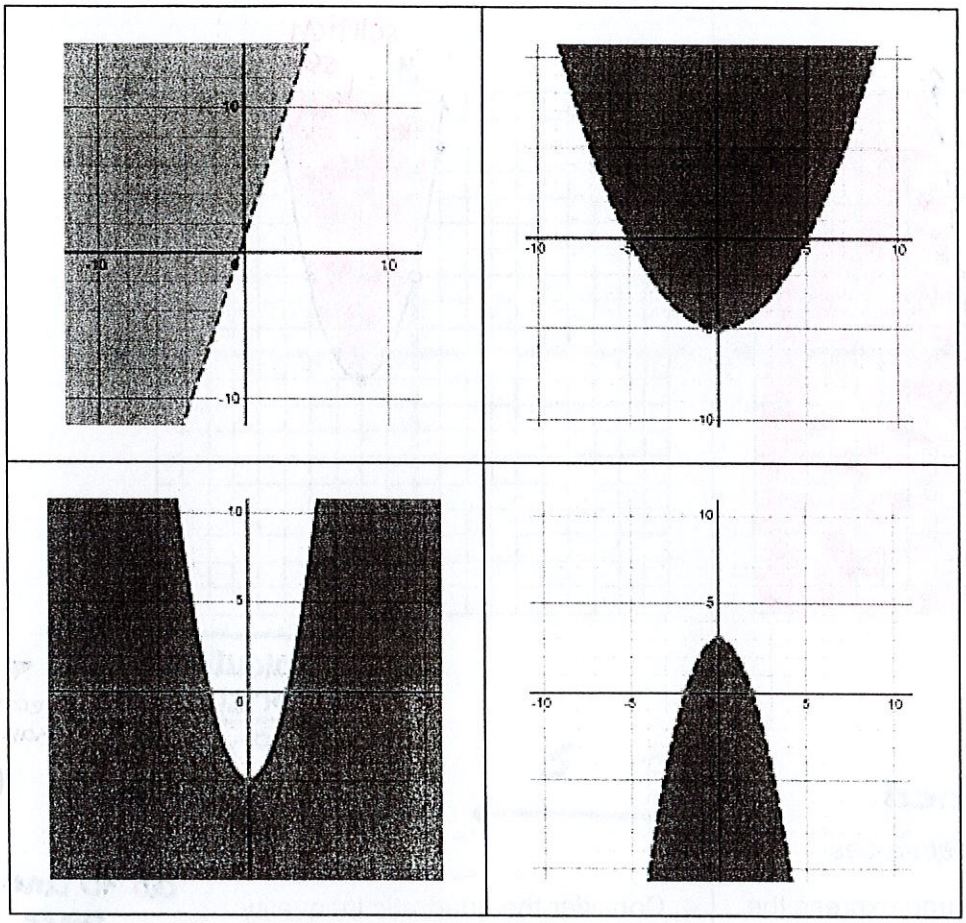
Name: _____ Date: _____ Period: _____

4.7 Quadratic Inequalities

Engage: Which One Doesn't Belong?



Which one do you think doesn't belong? Why?
(Remember, there are no wrong answers as long as you explain your reasoning.)

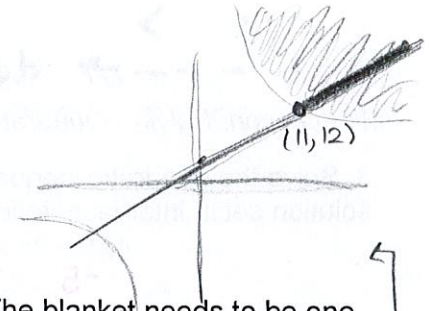
Answers will vary.

Explore: Quilting Quadratics

Lila is making a large blanket that needs to cover **at least 132 square feet**. The blanket needs to be one foot longer than it is wide. What do the dimensions (length and width) of her blanket need to be? Prove your answer in more than one way (i.e.: graphs, number lines, equations/inequalities).

Work may vary. Examples BELOW

width ≥ 11 length ≥ 12



graph of $\begin{cases} y \geq \frac{132}{x} \\ y = x+1 \end{cases}$

dark line are the solutions

Student 1

$\begin{cases} xy \geq 132 \\ y = x+1 \end{cases}$ created a system

$x(x+1) \geq 132$

$x^2 + x \geq 132$

$x^2 + x - 132 \geq 0$

$(x+12)(x-11) \geq 0$

$x = 11 \rightarrow x \geq 11$

$y = 12 \rightarrow y \geq 12$

Student 2

$132 = lw$

$w = x$

$l = x+1$

$132 = x(x+1)$

$132 = x^2 + x$

$0 = x^2 + x - 132$

$0 = (x+12)(x+11)$

$x = -12$ $x = 11$

$w = 11$

$l = 12$

Student 3

Use table for $y = 132/x$

x	y
1	132
2	66
3	44
4	33
6	22
11	12

differs by 1

Student 4

used table for $y = x(x+1)$

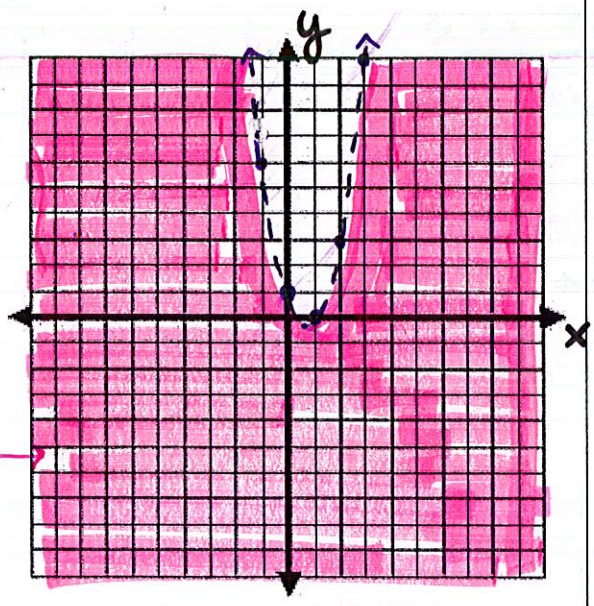
x	y
⋮	⋮
10	110
11	132
12	156

has the area we want

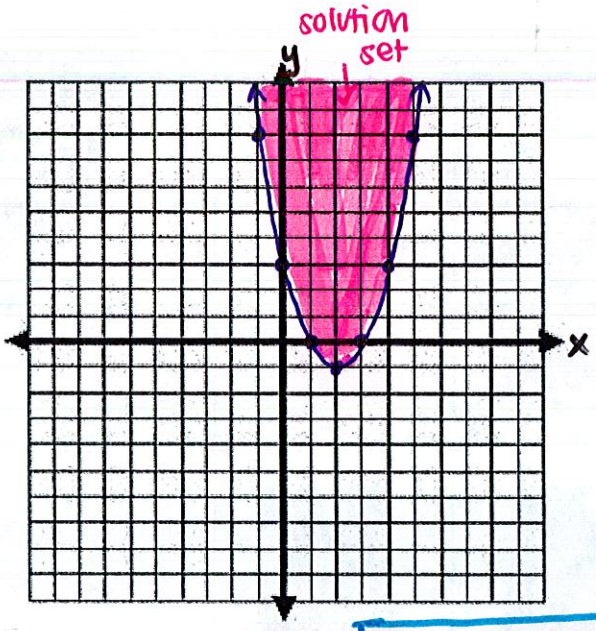
① Graph the Quadratic (watch line type) ② Use calc or test point to shade solution set

Mini-Lesson: Graphing Two-Variable Quadratic Inequalities

1. Given the quadratic inequality, $y < 2x^2 - 3x + 1$, sketch the graph of the inequality on the coordinate plane and identify the solution set.



2. Identify the key features of the graph of the inequality $y \geq x^2 - 4x + 3$. How do the features relate to the solutions of the inequality?



< > ← - - - → dashed

≤ ≥ ←——→ solid

Calculator steps for shading (greater than / less than)
Press Y=
◀ to ■\
Press enter
Go to Line: Press ▶ for go to OK press enter

Mini-Lesson: Solving Quadratic Inequalities

3. Solve the quadratic inequality and express the solution set in interval notation.

$$4x^2 - 9x > 5$$
$$-5 \quad -5$$

$4x^2 - 9x - 5 > 0$

$4x^2 - 9x - 5 = 0$

Solve algebraically

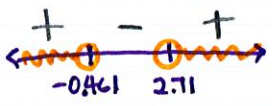
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

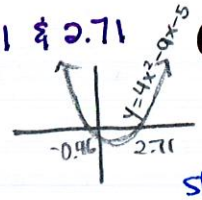
N: -20, O: 0, -9

$$x = \frac{9 \pm \sqrt{(-9)^2 - 4(4)(-5)}}{2(4)}$$

$$x = \frac{9 \pm \sqrt{161}}{8}$$

$x \approx -0.461$ & 2.71





Solution set:

set notation: $\{x \mid x < -0.461, x > 2.71\}$ # line/table

interval notation: $x \in (-\infty, -0.461) \cup (2.71, \infty)$

① Make sure quadratic is in standard form & zero is on the other side of the inequality

② Solve $ax^2 + bx + c = 0$ algebraically or graphically

③ Make of the parabola and/or a number line for your solutions.

④ Determine the solution set by looking for:

	>	≥	<	≤
sketch	ABOVE THE x-axis		BELOW THE x-axis	
	POSITIVE OUTPUTS		NEGATIVE OUTPUTS	

4. Consider the quadratic inequality: $2x^2 + 3x - 4 \leq 0$. Determine the intervals for which the inequality is true and false, and express the solution set in interval notation.

$2x^2 + 3x - 4 \leq 0$

$2x^2 + 3x - 4 = 0$

Solve graphically

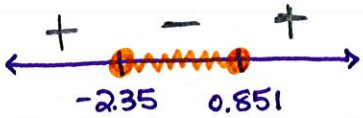
$Y_1 = 2x^2 + 3x - 4$

$Y_2 = 0$

N: -8, O: 0, 3

Press graph and trace 5:intersect Enter 3x

$x \approx -2.35$ & 0.851



Solution set:

set notation $\{x \mid -2.35 \leq x \leq 0.851\}$

interval notation: $x \in [-2.35, 0.851]$

TRUE for $[-2.35, 0.851]$

FALSE for $(-\infty, -2.35) \cup (0.851, \infty)$

Apply: Production Engineering {PRACTICE}

A manufacturer wants to produce a batch of rectangular metal sheets with a fixed perimeter of 40 meters. The manufacturer wants to maximize the area of the metal sheets while using the least amount of material.

However, due to the manufacturing process, the manufacturer has some constraints on the dimensions of the metal sheets. The length must be at least 2 meters longer than the width, and the width must be at least 3 meters. Additionally, the manufacturer has limited resources and can only use a maximum of 50 square meters of metal for each sheet.

Formulate and solve a quadratic inequality to find the dimensions of the metal sheets that will maximize the area while satisfying all the given constraints.

constraints

$2x + 2y = 40$

$xy \leq 50$

$\begin{cases} x \geq y+2 \\ y \geq 3 \end{cases} \rightarrow x \geq 5$

variables

x: length

y: width

Givens

perimeter = 40

area ≤ 50

If $2x + 2y = 40$

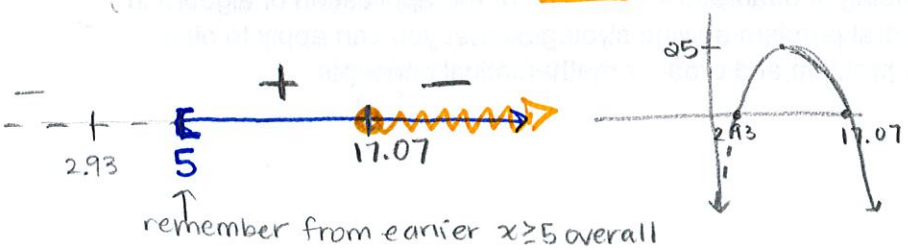
then $2y = 40 - 2x$

$y = 20 - x$

and $x(20-x) \leq 50$

$20x - x^2 \leq 50$

$-x^2 + 20x - 50 \leq 0$



remember from earlier $x \geq 5$ overall

$x \geq 17.07$

length	width	Perimeter	Area
18	2	40	36
17.5	2.5	40	43.75
17.1	2.9	40	49.59

The closest we can measure the length of the sheet to 17.07 would maximize the area.

Reflect: Inequality Escapades {OPTIONAL}

Write your responses to the questions in the space below it.

1. Personal Reflection: When you first encountered the problem, how did you feel? Were you confident or uncertain about how to proceed? Did you have any prior knowledge or strategies that you thought might be useful?

answers will vary

2. Problem-Solving Process: Outline the steps you took to solve the problem. Did you correctly interpret the given information and formulate the necessary equations or inequalities? Did you use appropriate mathematical techniques to solve the problem? Explain your reasoning and the choices you made throughout the process.

answers will vary.

3. Challenges Faced: Identify any difficulties or challenges you encountered while solving the problem. Did you struggle with any particular step or concept? Did you make any mistakes or encounter obstacles? How did you overcome these challenges? Provide specific examples.

answers will vary.

4. Alternative Approaches: Think about alternative approaches or strategies you could have used to solve the problem. Did you consider different problem-solving techniques or perspectives? How might these alternative approaches have influenced your solution or the efficiency of your process?

answers will vary.

5. Lessons Learned: Reflect on what you learned from this problem-solving experience. Did you gain any new insights or deepen your understanding of quadratic inequalities or the application of algebra in real-world contexts? Did you learn any general problem-solving strategies that you can apply to other situations? Make connections between the problem and broader mathematical concepts.

answers will vary

6. Future Application: Think about how you can apply the problem-solving skills and strategies you used in this activity to other real-world scenarios. Can you identify any other situations where quadratic inequalities might be useful? How might you approach similar problems in the future?

answers will vary