


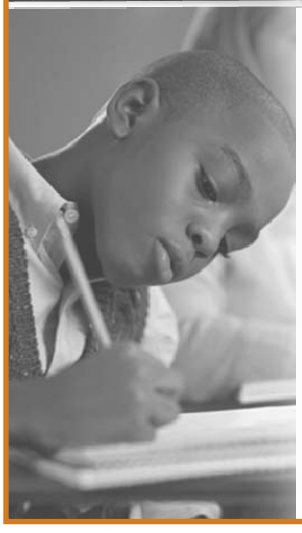

SUMMER ACADEMY

ATLANTA PUBLIC SCHOOLS

Grade 8 Math

Student Booklet

Name: _____

School: _____

Teacher: _____

130 Trinity Avenue, SW
Atlanta, GA 30303

ATLANTA PUBLIC SCHOOLS
Making A Difference

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ATLANTA PUBLIC SCHOOLS
Making A Difference

Secondary Student Mathematics Interest Inventory

Student Name (First and Last):_____

Teacher:_____ School: _____

Student ID: Write in and bubble the 6-digit district ID number

0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

Current Grade Level

6th ☐

7th ☐

8th ☐

9th ☐

Gender

Male ☐

Female ☐

Directions:

We are trying to understand what students think about the work they do for mathematics class. On the following pages are some examples of what students might think. Please give us your rating for each question.

Different students have different interests, so there are NO right or wrong answers. Your answers will **NOT** be used towards your grade. Please answer these questions honestly, and tell use what you **really** think.

Practice Questions

	Strongly **DISAGREE**		Neutral		Strongly **AGREE**
1. How good at science are you?	1	2	3	4	5
2. How good at reading are you?	1	2	3	4	5

Please bubble in the choice that best describes what you think. You can use a pen or pencil. If you make a mistake, either erase it or cross it out completely and bubble the correct choice.

How much do you agree or disagree with the following statements?

	Strongly **DISAGREE**		Neutral		Strongly **AGREE**
1. I enjoy studying math……	1	2	3	4	5
2. Math is very hard for me……	1	2	3	4	5
3. Doing math is easy for me……	1	2	3	4	5
4. I enjoy playing math games……	1	2	3	4	5
5. I do math problems on my own "just for fun."……..…	1	2	3	4	5
6. I enjoy doing math puzzles……	1	2	3	4	5
7. I look forward to learning new math……..	1	2	3	4	5
8. I hate math……...	1	2	3	4	5
9. Math comes easily to me……	1	2	3	4	5
10. I love math…….....	1	2	3	4	5
11. I can tell if my answers in math makes sense……..…	1	2	3	4	5
12. I can solve difficult math problems……...	1	2	3	4	5
13. Math is boring……..…	1	2	3	4	5
14. Math is confusing to me……	1	2	3	4	5
15. Math is fun…….....	1	2	3	4	5
16. I am really good at math……...	1	2	3	4	5
17. I understand math……..	1	2	3	4	5
18. Solving math problems is fun. ……	1	2	3	4	5

Please bubble in the choice that best describes what you think. You can use a pen or pencil. If you make a mistake, either erase it or cross it out completely and bubble the correct choice.

How much do you agree or disagree with the following statements?

	Strongly **DISAGREE**		Neutral		Strongly **AGREE**
22. When working on math, I want to stop and start working on Something else…….	1	2	3	4	5
23. I give up easily when working on math…….	1	2	3	4	5
24. I like to answer questions in math class…….	1	2	3	4	5
25. I feel excited when a new math topic is announced……..	1	2	3	4	5
26. I struggle with math……..	1	2	3	4	5
27. I work on math in my spare time……...	1	2	3	4	5

Stevens, T. & Olivarez, A. (2005). Development and Evaluation of the Mathematics Interest Inventory. *Measurement and Evaluation in Counseling and Development. 38*, 141-152.

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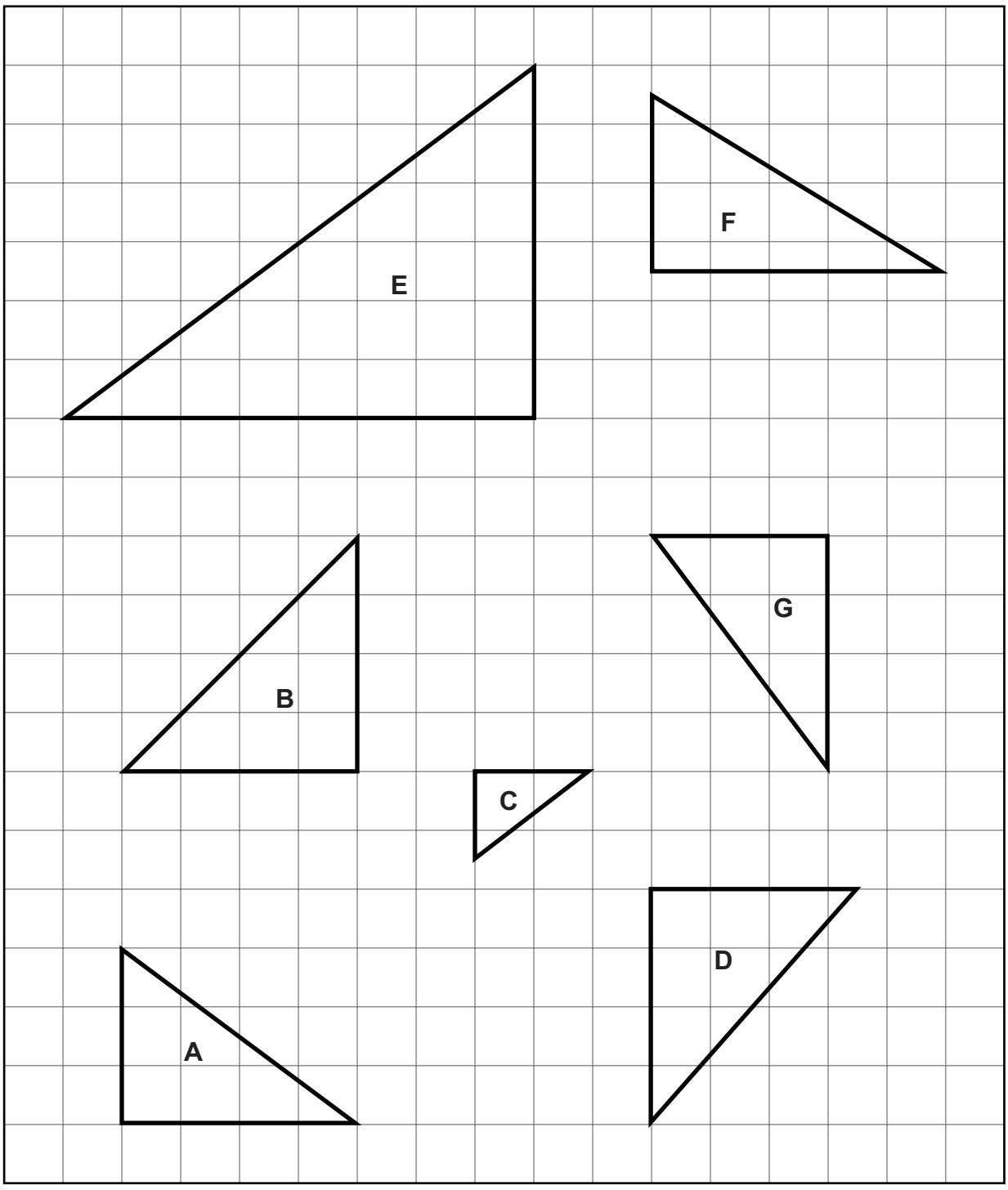
Triangles

This problem gives you the chance to:
- reason about similar figures and scale factor

Here are some right triangles.



1. Which of the triangles on the opposite page is congruent to triangle A? _____
Explain your reasoning.

_____

_____

_____

2. Which of the triangles on the opposite page are similar to triangle A? _____
Explain how you decided.

_____

_____

_____

_____

_____

3. If triangle A is enlarged by a scale factor of 3, what will be the area of the new triangle?
Show your work.

_____

8

CCGPS Frameworks Student Edition

Mathematics

Grade 8
Unit 1: Transformations, Congruence, and Similarity

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

Unit 1
TRANSFORMATIONS, CONGRUENCE, AND SIMILARITY

TABLE OF CONTENTS

STANDARDS ADDRESSED IN THIS UNIT

Mathematical standards are interwoven and should be addressed throughout the year in as many different units and activities as possible in order to emphasize the natural connections that exist among mathematical topics.

KEY STANDARDS

Understand congruence and similarity using physical models, transparencies, or geometry software.

MCC8.G.1 Verify experimentally the properties of rotations, reflections, and translations:

a. Lines are taken to lines, and line segments to line segments of the same length.

b. Angles are taken to angles of the same measure.

c. Parallel lines are taken to parallel lines.

MCC8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

MCC8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

MCC8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

MCC8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the three angles appear to form a line, and give an argument in terms of transversals why this is so.*

- Congruent figures have the same size and shape. If the scale factor of a dilation is equal to one, the image resulting from the dilation is congruent to the original figure.
- When parallel lines are cut by a transversal, corresponding, alternate interior and alternate exterior angles are congruent.

CONCEPTS/SKILLS TO MAINTAIN

It is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

- number sense
- computation with whole numbers and decimals, including application of order of operations
- addition and subtraction of common fractions with like denominators
- measuring length and finding perimeter and area of rectangles and squares
- characteristics of 2-D and 3-D shapes
- data usage and representations

SELECTED TERMS AND SYMBOLS

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The definitions below are for teacher reference only and are not to be memorized by the students. Students should explore these concepts using models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

The websites below are interactive and include a math glossary suitable for middle school students. **Note – Different sources use different definitions. Please preview any website for alignment to the definitions given in the frameworks.**

Visit http://intermath.coe.uga.edu or http://mathworld.wolfram.com to see additional definitions and specific examples of many terms and symbols used in grade 8 mathematics.

- **Alternate Exterior Angles:** Alternate exterior angles are pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on opposite sides of the transversal and are outside the other two lines. When the two other lines are parallel, the alternate exterior angles are equal.

- **Alternate Interior Angles:** Alternate interior angles are pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on opposite sides of the transversal and are in between the other two lines. When the two other lines are parallel, the alternate interior angles are equal.

- **Angle of Rotation:** The amount of rotation about a fixed point.

- **Congruent Figures:** Figures that have the same size and shape.

- **Corresponding Sides:** Sides that have the same relative positions in geometric figures.

- **Corresponding Angles:** Angles that have the same relative positions in geometric figures.

- **Dilation:** Transformation that changes the size of a figure, but not the shape.

- **Linear Pair:** Adjacent, supplementary angles. Excluding their common side, a linear pair forms a straight line.

- **Reflection:** A transformation that "flips" a figure over a line of reflection.

- **Reflection Line:** A line that is the perpendicular bisector of the segment with endpoints at a pre-image point and the image of that point after a reflection.

- **Rotation:** A transformation that turns a figure about a fixed point through a given angle and a given direction.

- **Same-Side Interior Angles:** Pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on the same side of the transversal and are between the other two lines. When the two other lines are parallel, same-side interior angles are supplementary.

- **Same-Side Exterior Angles:** Pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on the same side of the transversal and are outside the other two lines. When the two other lines are parallel, same-side exterior angles are supplementary.

- **Scale Factor:** The ratio of any two corresponding lengths of the sides of two similar figures.

- **Similar Figures:** Figures that have the same shape but not necessarily the same size.

- **Transformation:** The mapping, or movement, of all the points of a figure in a plane according to a common operation.

- **Translation:** A transformation that "slides" each point of a figure the same distance in the same direction.

- **Transversal:** A line that crosses two or more lines.

SE TASK: Dilations in the Coordinate Plane

Adapted from Stretching and Shrinking: Similarity, *Connected Mathematics*, Dale Seymour Publications

Plot the ordered pairs given in the table to make six different figures. Draw each figure on a separate sheet of graph paper. Connect the points with line segments as follows:

- For Set 1, connect the points in order. Connect the last point in the set to the first point in the set.
- For Set 2, connect the points in order. Connect the last point in the set to the first point in the set.
- For Set 3, connect the points in order. Do not connect the last point in the set to the first point in the set.
- For Set 4, make a dot at each point (do not connect the dots).

After drawing the six figures, compare Figure 1 to each of the other figures and answer the following questions.

1. Which figures are similar? Explain your thinking.

2. Describe any similarities and/or differences between Figure 1 and each of the other figures.
   - Describe how corresponding sides compare.
   - Describe how corresponding angles compare.

3. How do the coordinates of each figure compare to the coordinates of Figure 1? If possible, write general rules for making Figures 2-6.

4. Is having the same angle measurement enough to make two figures similar? Why or why not?

5. What would be the effect of multiplying each of the coordinates in Figure 1 by ½?

6. Translate, reflect, rotate (between 0 and 90°), and dilate Figure 1 so that it lies entirely in Quadrant III on the coordinate plane. You may perform the transformations in any order that you choose. Draw a picture of the new figure at each step and explain the procedures you followed to get the new figure. Use coordinates to describe the transformations and give the scale factor you used. Describe the similarities and differences between your new figures and Figure 1.

Figure 1	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6
Set 1	**Set 1**	**Set 1**	**Set 1**	**Set 1**	**Set 1**
(6, 4)	(12, 8)	(18, 4)	(18, 12)	(6, 12)	(8, 6)
(6, -4)	(12, -8)	(18, -4)	(18, -12)	(6, -12)	(8, -2)
(-6, -4)	(-12, -8)	(-18, -4)	(-18, -12)	(-6, -12)	(-4, -2)
(-6, 4)	(-12, 8)	(-18, 4)	(-18, 12)	(-6, 12)	(-4, 6)
Set 2	**Set 2**	**Set 2**	**Set 2**	**Set 2**	**Set 2**
(1, 1)	(2, 2)	(3, 1)	(3, 3)	(1, 3)	(3, 3)
(1, -1)	(2, -2)	(3, -1)	(3, -3)	(1, -3)	(3, 1)
(-1, -1)	(-2, -2)	(-3, -1)	(-3, -3)	(-1, -3)	(1, 1)
(-1, 1)	(-2, 2)	(-3, 1)	(-3, 3)	(-1, 3)	(1, 3)
Set 3	**Set 3**	**Set 3**	**Set 3**	**Set 3**	**Set 3**
(4, -2)	(8, -4)	(12, -2)	(12, -6)	(4, -6)	(6, 0)
(3, -3)	(6, -6)	(9, -3)	(9, -9)	(3, -9)	(5, -1)
(-3, -3)	(-6, -6)	(-9, -3)	(-9, -9)	(-3, -9)	(-1, -1)
(-4, -2)	(-8, -4)	(-12, -2)	(-12, -6)	(-4, -6)	(-2, 0)
Set 4	**Set 4**	**Set 4**	**Set 4**	**Set 4**	**Set 4**
(4, 2)	(8, 4)	(12, 2)	(12, 6)	(4, 6)	(6, 4)
(-4, 2)	(-8, 4)	(-12, 2)	(-12, 6)	(-4, 6)	(-2, 4)

SE TASK: Changing Shapes

Suppose you are going to be designing a logo for a club at your school. To prepare for this project, draw a non-rectangular shape in the coordinate plane so that portions of the shape are in each of the four quadrants. Explain what would happen to your shape if you transformed it using each of the given rules with the center of dilation at the origin.

a. $(4x, 4y)$

b. $(0.25x, 0.25y)$

c. $(2x, y)$

d. $(3x, 3y + 5)$

e. $(x + 5, y - 5)$

f. $(\frac{1}{2}x - 1, \frac{1}{2}y)$

g. Will any of the transformed figures be similar to the original figure? Explain.

h. If you make a new figure by adding 2 units to the length of each side of your shape, will the two figures be similar? Why or why not?

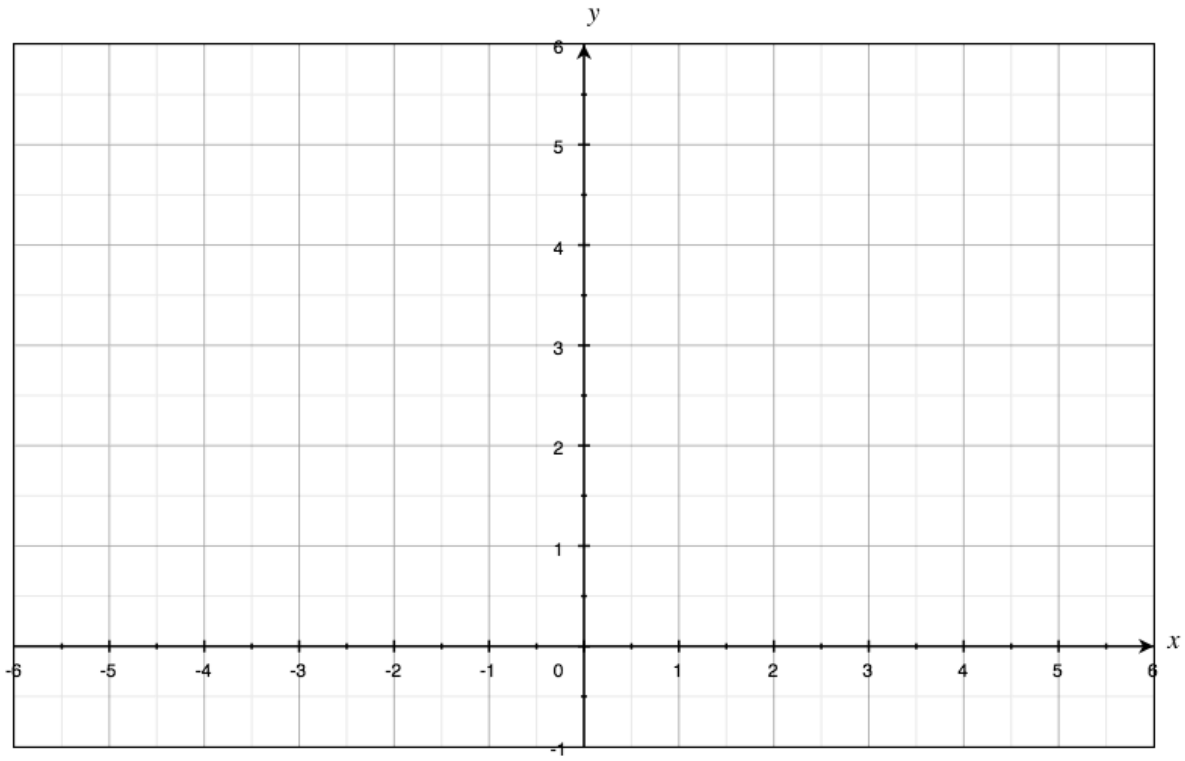
i. Write a general rule for transformations in the plane that produce similar figures.

SE TASK: Coordinating Reflections

Antonio and his friend Brittany were at a summer math camp that had a large *coordinate plane* drawn on the gym floor. Antonio challenged Brittany to try and mirror him as he traveled around the first quadrant.

Map Antonio's and Brittany's movements on this coordinate plane:

Antonio began at (2, 1) and walked to (3, 5); Brittany decided to begin at (-2, 1), then tried to mirror Antonio by walking to (-3, 5). Antonio jumped to (5,5) and side-stepped to (4,3); Brittany jumped to (-5, 5) then side-stepped to (-4,3). Antonio returned to (2, 1) and Brittany returned to (-2, 1).



1. Did Brittany mirror Antonio?

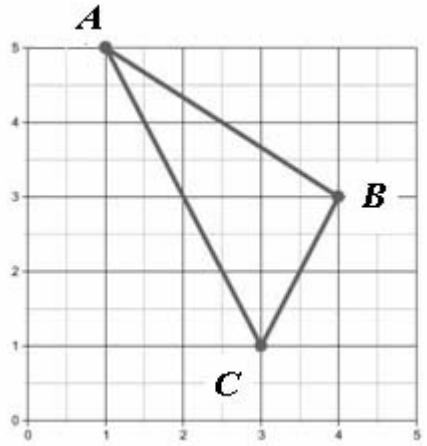
    - If you answered no, identify the incorrect coordinates Brittany used and find the correct coordinates. Explain your decision and identify the line of symmetry she should have used as a mirror. How did you know that this should have been the line of symmetry?

    - If you answered yes, identify the line of symmetry Brittany used as a mirror. How did you know it was the line of symmetry?

2. If Brittany had instead begun at (-2,1), walked to (-4,3), side-stepped to (-5,5), jumped to (-3,5) and then returned to (-2,1), could she claim that she created a mirror image of Antonio's path? Justify your answer.

Antonio and Brittany decided to change the game and use some lettered blocks to mark points they visited on the grid. Antonio placed blocks *A*, *B*, and *C* as indicated by the points below, then drew a chalk line between them.

3. Draw this figure on a separate sheet of graph paper. Label the coordinates Antonio used, and then construct the graph of where Brittany would place her blocks if she correctly reflected Antonio's figure across the *x*-axis.



4. Describe how you determined where to place Brittany's blocks.

5. Each block Brittany placed corresponds to one that Antonio placed. List each pair of coordinates that correspond.

6. What can you observe about the distances between each of Antonio's blocks and the corresponding block Brittany placed?

7. If Antonio walked 2 feet from his block *A* toward his block *C*, and Brittany mirrored his movement by walking 2 feet from the blocks corresponding to *A* and *C*, would Brittany and Antonio be the same distance from the reflection line? How can you be certain?

8. How would you define a reflection now that you have analyzed some of the properties of reflected images using the coordinate plane?

SE TASK: Coordinating Translations

Your task is to plot any creative polygon you want on the coordinate plane, and then create polygons congruent to the one you designed using the three translations described below.

1. For each vertex of your original polygon in the form (x, y), create its image at the coordinates ($x + 4$, y).

2. For each vertex of your original polygon in the form (x, y), create its image at the coordinates (x, $y - 3$).

3. For each vertex of your original polygon in the form (x, y), create its image at the coordinates ($x - 4$, $y + 1$).

The vertices of your original polygon combined with their images must be mapped to points in all four quadrants of the coordinate plane to receive full credit.

Differentiation

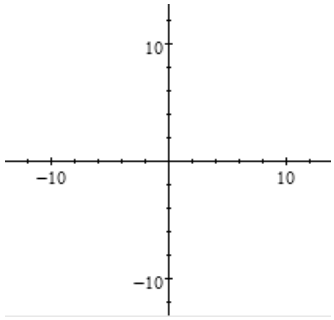
Provide a description of each of the following translations, where c can represent any number.

1. $(x + c, y)$

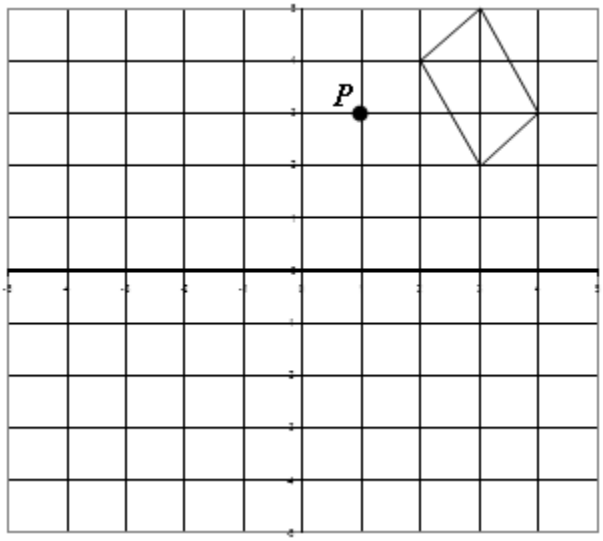
2. $(x, y - c)$

3. $(x - c, y)$

4. $(x, y + c)$



SE TASK: Coordinating Rotations



1. Label the coordinates of the polygon above.

2. Rotate the polygon 90^o (counterclockwise) about the origin and label the coordinates.

3. Rotate the polygon 90^o (clockwise) about the origin and label the coordinates.

4. Describe a rotation that would guarantee the point *P* (1, 3) would be inside the square formed by the vertices (5, 5), (-5, 5), (-5,-5), and (5,-5).

SE TASK: Playing with Dilations (Optional)

Go to the following website for this investigation:
http://www.mathsnet.net/dynamic/enlarge2.html

Click on "Show Values."

a. Change the scale by moving the red point on the segment in the top left corner. What do you observe when the scale is less than 1? Equal to 1? Greater than 1? As you are changing the scale, observe what is happening to the area of the red triangle and the ratio of the areas of the triangles. Describe what you observe. Why do you think this happens?

b. Move the point *X* to different locations outside, inside, and on the triangle. What changes in the values do you notice as you move *X*? Explain why you think this happens.

c. As you moved *X* in part b, other than the values, describe all the changes you noticed. Why do you think these changes occurred?

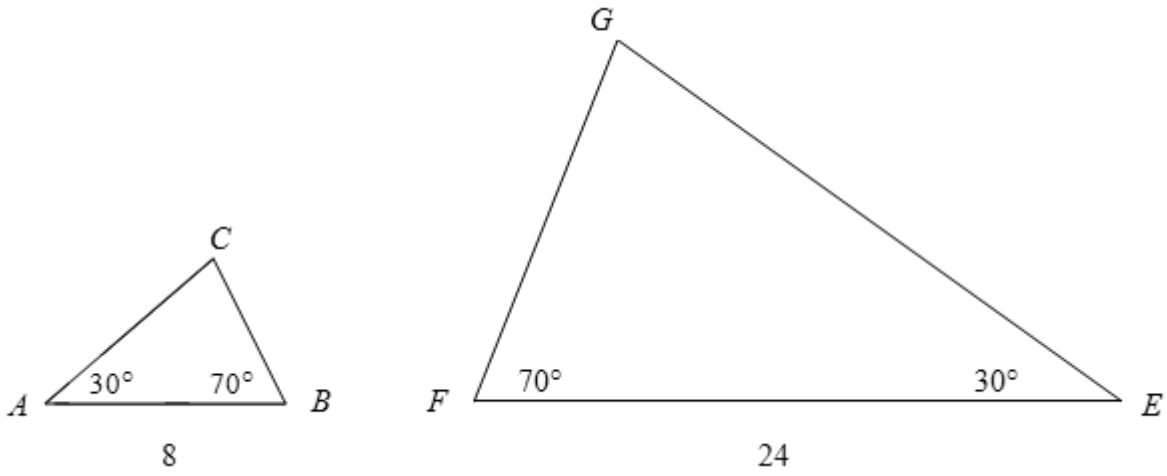
d. What are some real-world situations in which this might be used?

SE TASK: Similar Triangles

1. The sketch below shows two triangles, Δ*ABC* and Δ*EFG*. Δ*ABC* has an area of 12 square units, and its base (*AB*) is equal to 8 units. The base of Δ*EFG* is equal to 24 units.

a. How do you know that the triangles are similar?

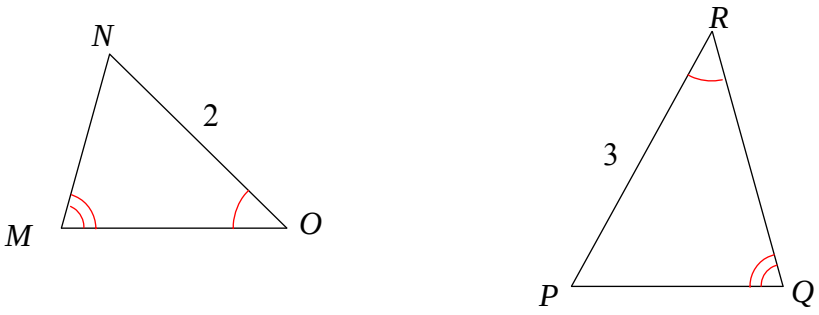
b. Name the pairs of corresponding sides and the pairs of corresponding angles. How are the corresponding sides related and how are the corresponding angles related? Why is this true?



2. The sketch below shows two triangles, Δ*MNO* and Δ*PQR*.

a. How do you know that the triangles are similar?

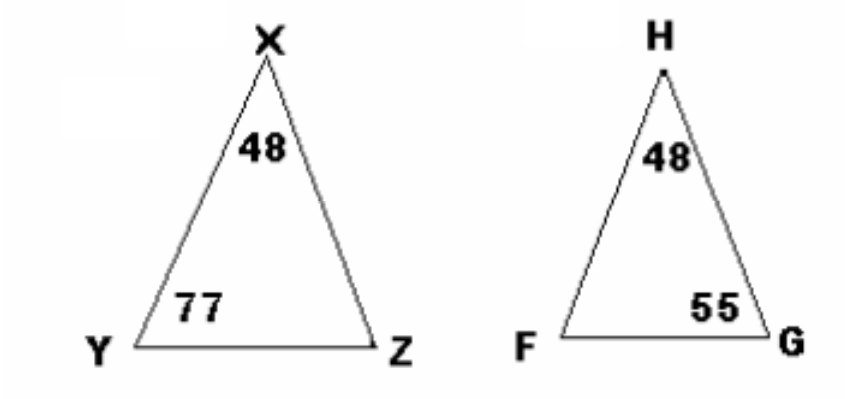
b. Name the pairs of corresponding sides and the pairs of corresponding angles. How are the corresponding sides related and how are the corresponding angles related? Why is this true?



3. The sketch below shows two triangles, Δ*XYZ* and Δ*HFG*.

a. How do you know that the triangles are similar?

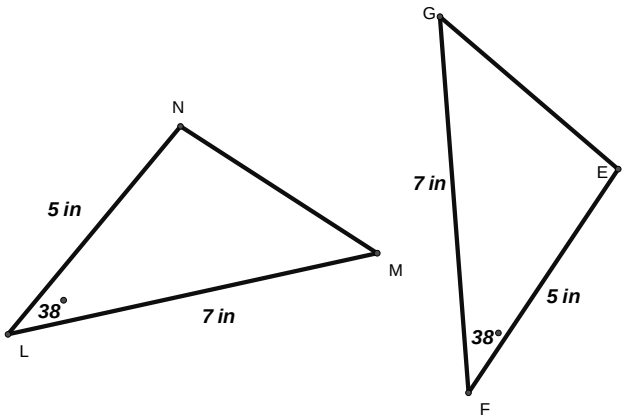
b. Name the pairs of corresponding sides and the pairs of corresponding angles. How are the corresponding sides related and how are the corresponding angles related? Why is this true?



4. The sketch below shows two triangles, Δ*LMN* and Δ*FEG*.

a. How do you know that the triangles are similar? Is there anything else you can say about the two triangles?

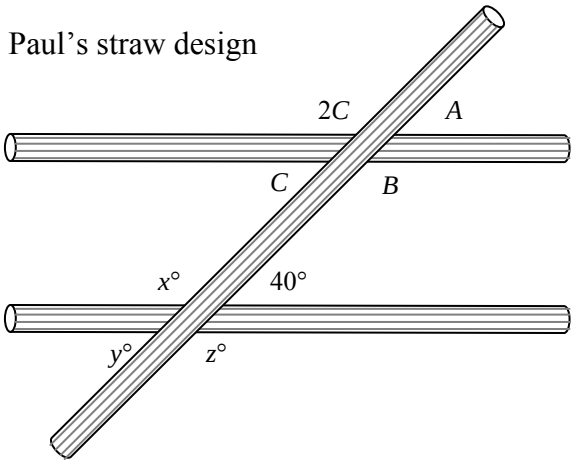
b. Name the pairs of corresponding sides and the pairs of corresponding angles. How are the corresponding sides related and how are the corresponding angles related? Why is this true?



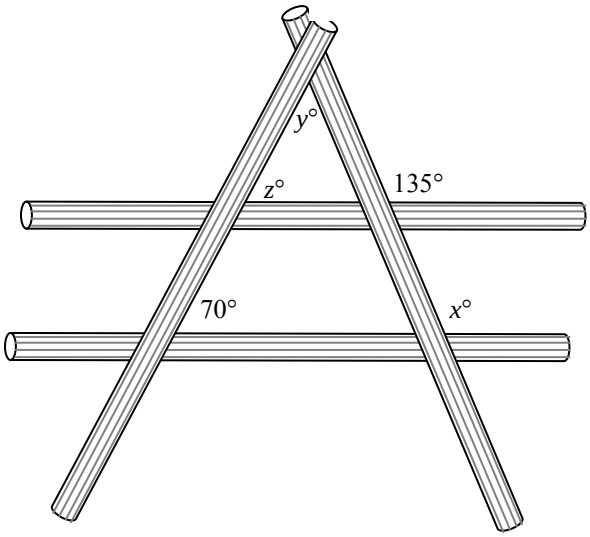
SE TASK: Lunch Lines

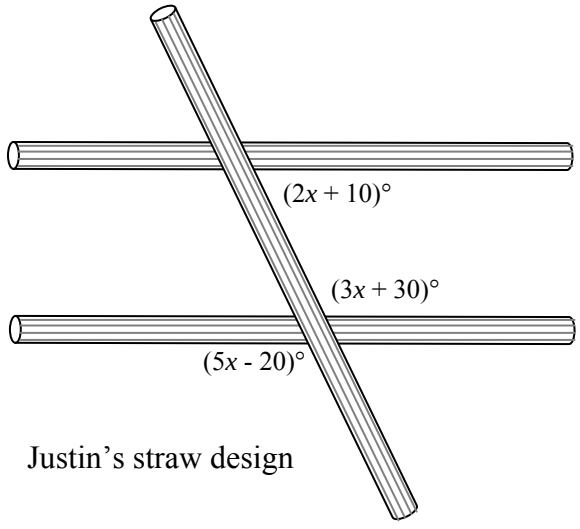
Paul, Jane, Justin, Sarah, and Opal were finished with lunch and began playing with drink straws. Each one was making a line design using either 3 or 4 straws. They had just come from math class where they had been studying special angles. Paul pulled his pencil out of his book bag and labeled some of the angles and lines. He then challenged himself and the others to find all the labeled angle measurements and to determine whether the lines that appear to be parallel really could be parallel.

Paul's straw design



Jane's straw design





Justin's straw design

- Find all of the labeled angle measurements.
- Determine whether the lines that appear to be parallel really could be parallel.
- Explain the reasoning for your results.

Aaron's Designs

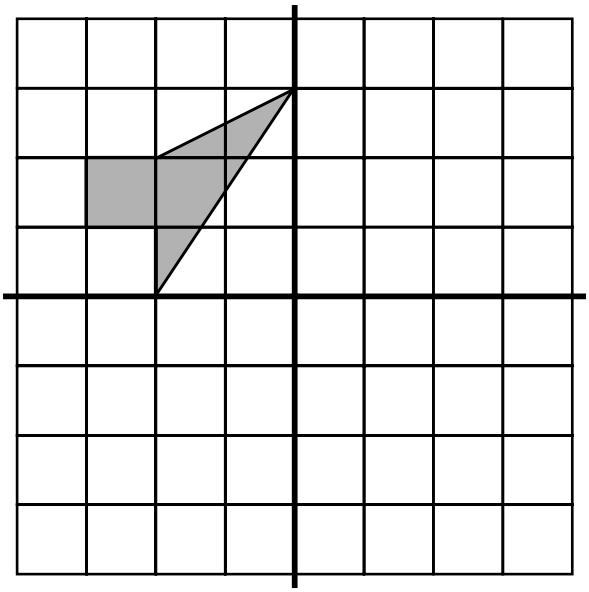
This problem gives you the chance to:
- draw reflections and rotations of a given figure on a grid
- describe transformations needed to make a given pattern

Aaron is drawing some designs for greetings cards.
He divides a grid into 4 quadrants and starts by drawing a shape in one quadrant.
He then reflects, rotates or translates the shape into the other three quadrants.

1. Finish Aaron's first design by reflecting the gray shape over the vertical line.

   Then reflect both of the shapes over the horizontal line.

   This will make a design in all four quadrants.

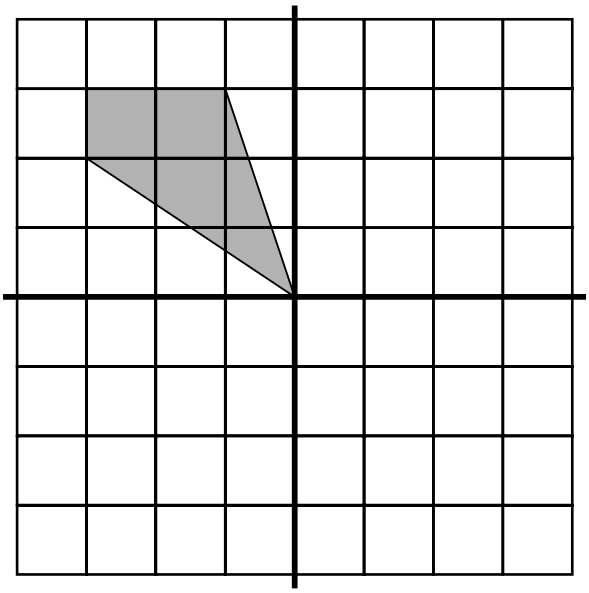


2. To finish drawing Aaron's second design, rotate the gray shape 1/4 of a turn in a clockwise direction about the origin. Then draw the second shape.

   Rotate the second shape 1/4 of a turn in a clockwise direction about the origin. Then draw the third shape.

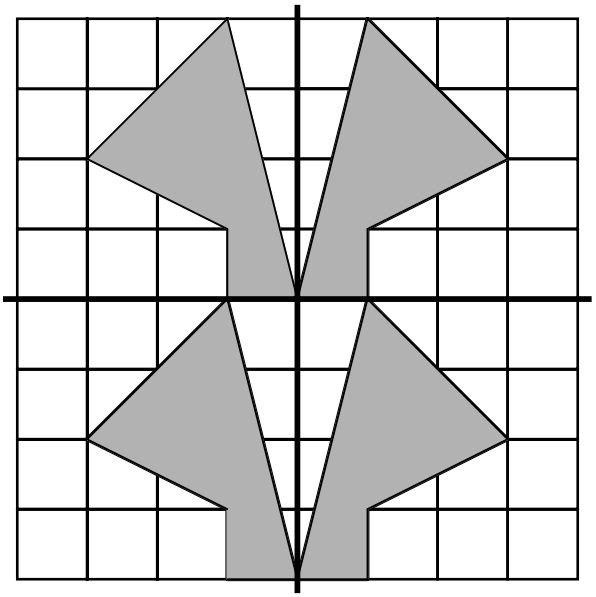
   Rotate the third shape 1/4 of a turn in a clockwise direction about the origin. Then draw the fourth shape.

   This will make a design in all four quadrants.



3. This is Aaron's third design.

   He started with one gray shape in the top left hand quadrant of the grid and transformed it to make the design.



Describe the transformations that Aaron may have used to draw this design.

_____

_____

_____

_____

_____

8

Photographs

This problem gives you the chance to:
• use proportion in a real life geometric context

A photographer wants to print a photograph and two smaller copies on the same rectangular sheet of paper. The photograph is 4 inches wide and 6 inches high.

Here are two ways he could do it. (Note: the diagrams are not drawn to actual size.)

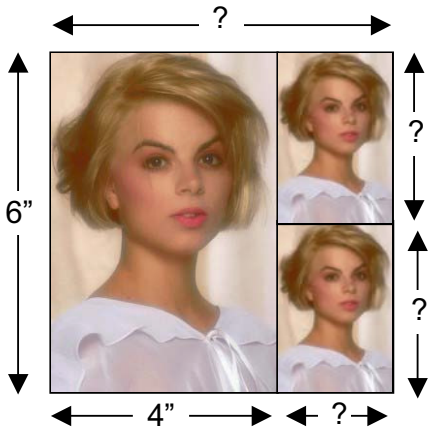


Diagram 1

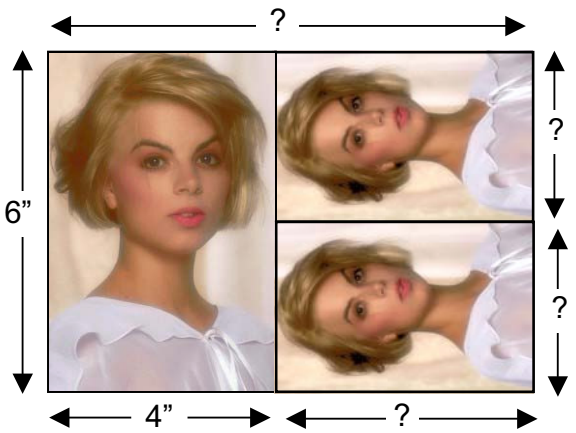


Diagram 2

1. Find the measurements of the small photographs for each arrangement.
   Show your calculations and explain how you figured it out.

   Diagram 1

Diagram 2

_____

_____

_____

_____

2. Find the size of the sheet of paper for each arrangement.

Diagram 1

The measurements of the sheet of paper are _____ wide and _____ high.

Diagram 2

The measurements of the sheet of paper are _____ wide and _____ high.

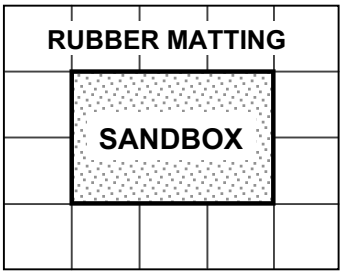
8

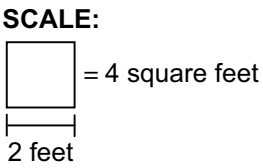
In the Playground

This problem gives you the chance to:
- work with areas

The playground committee decides to make a sandbox area for toddlers.
For safety reasons, the sandbox must be surrounded by a strip of rubber matting that is 2 feet wide.

Here is a scale drawing of the sandbox.



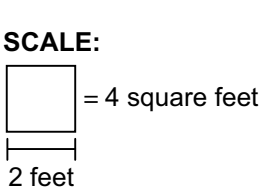


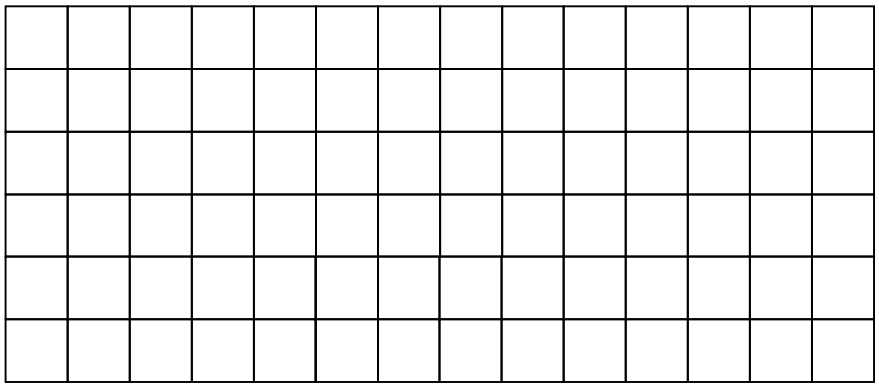
1. Find the area of the sandbox and the area of the rubber matting.

   Sandbox area: _____ square feet Rubber matting area: _____ square feet

More children are using the playground, so the committee decides to double the area of the sandbox.

2. Design a new rectangular sandbox that has double the area of the original sandbox.
   On the grid below, make a scale drawing of the new sandbox and the surrounding rubber matting.





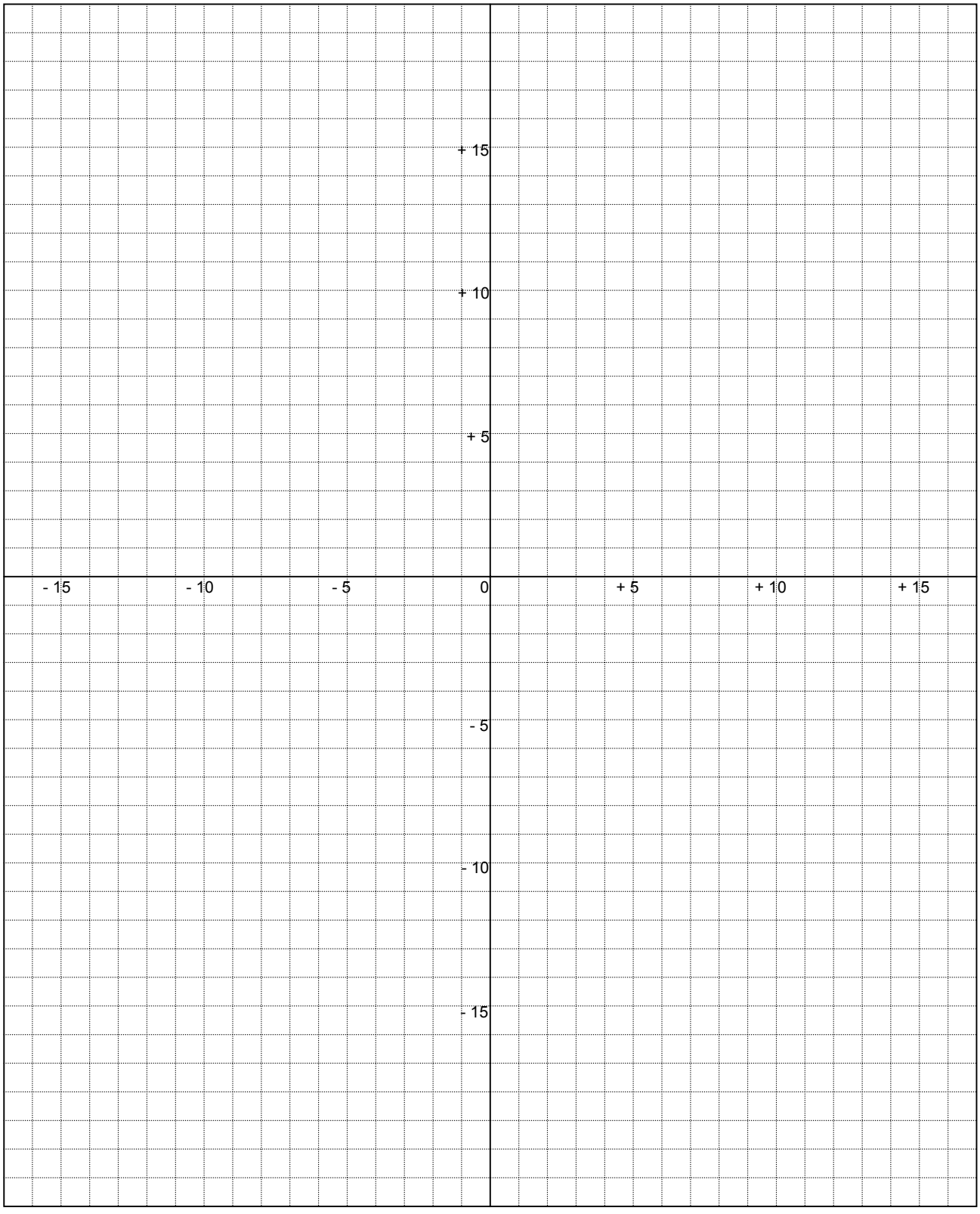
3. How many square feet of rubber matting will they need? _____square feet

4. What is the length and width of the new sandbox? length _____ feet

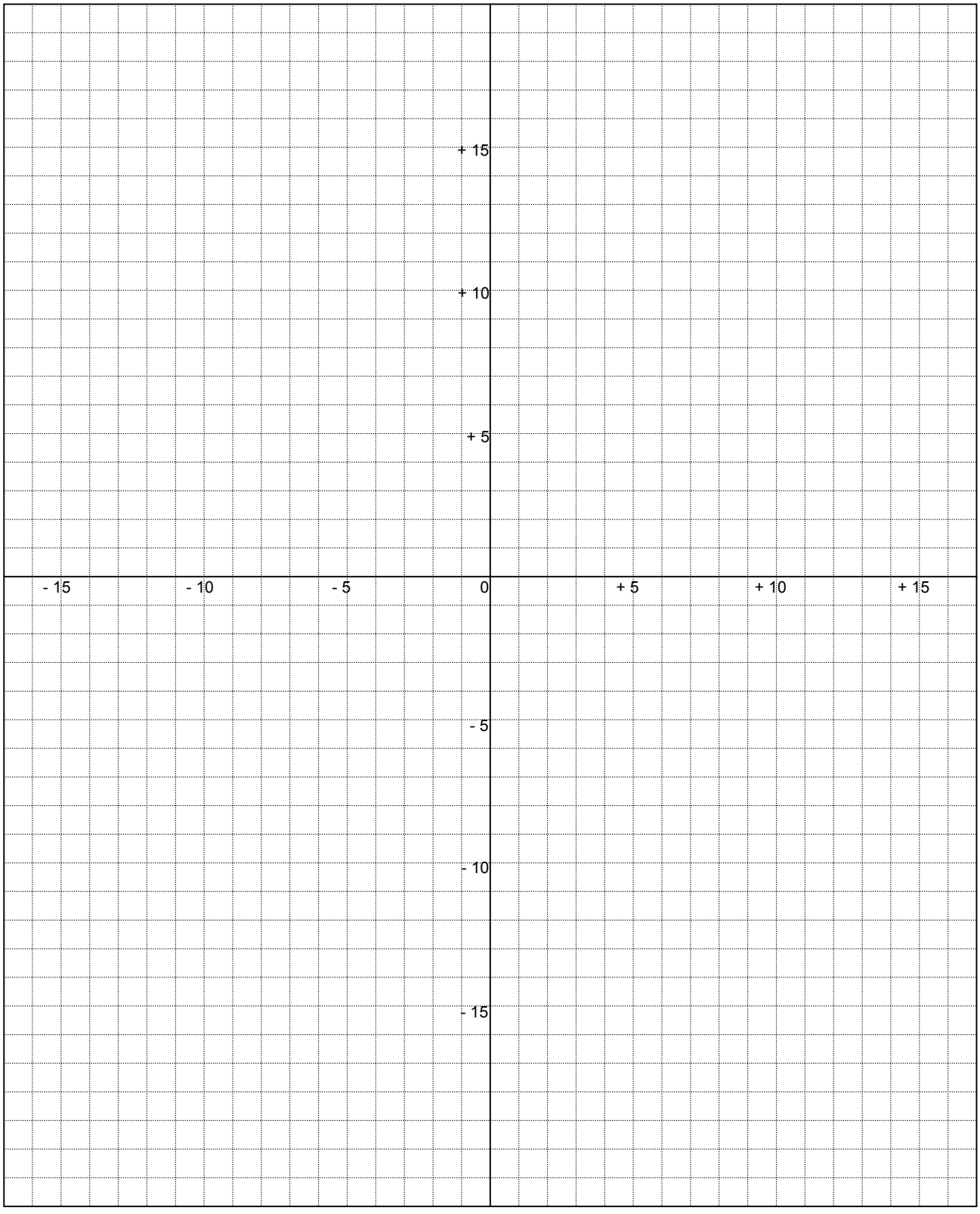
   width _____ feet

8

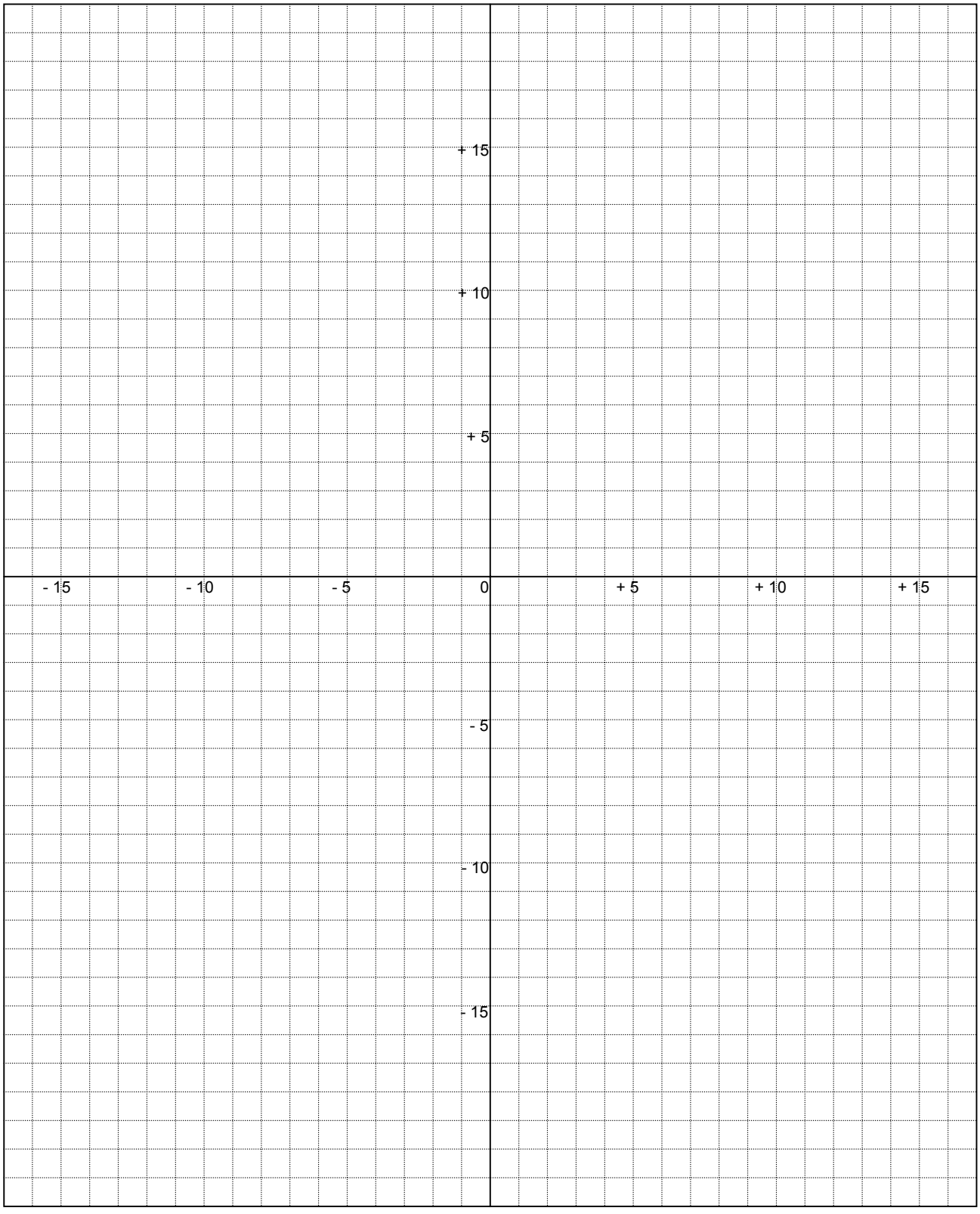
Co-ordinate Grid Paper



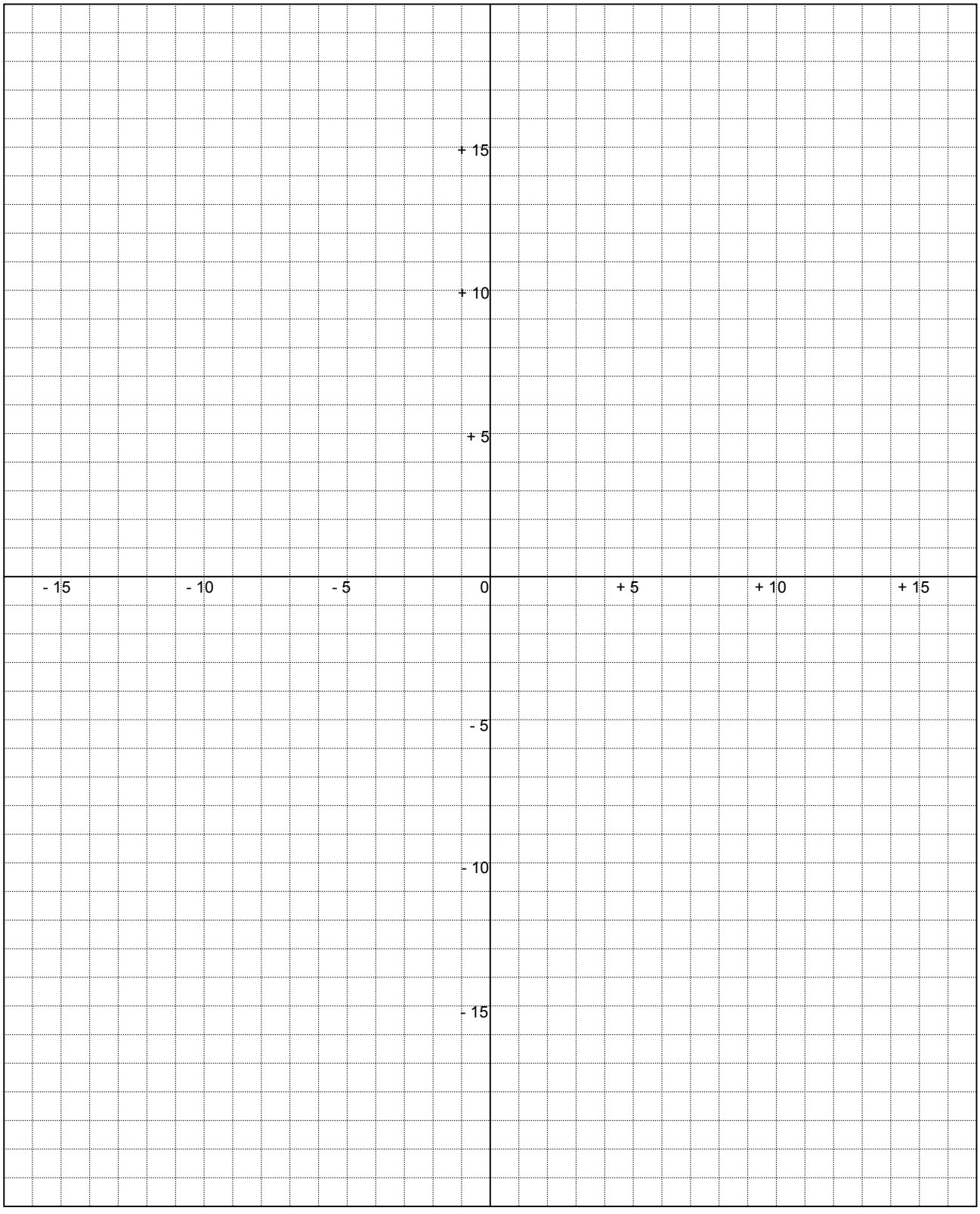
Co-ordinate Grid Paper



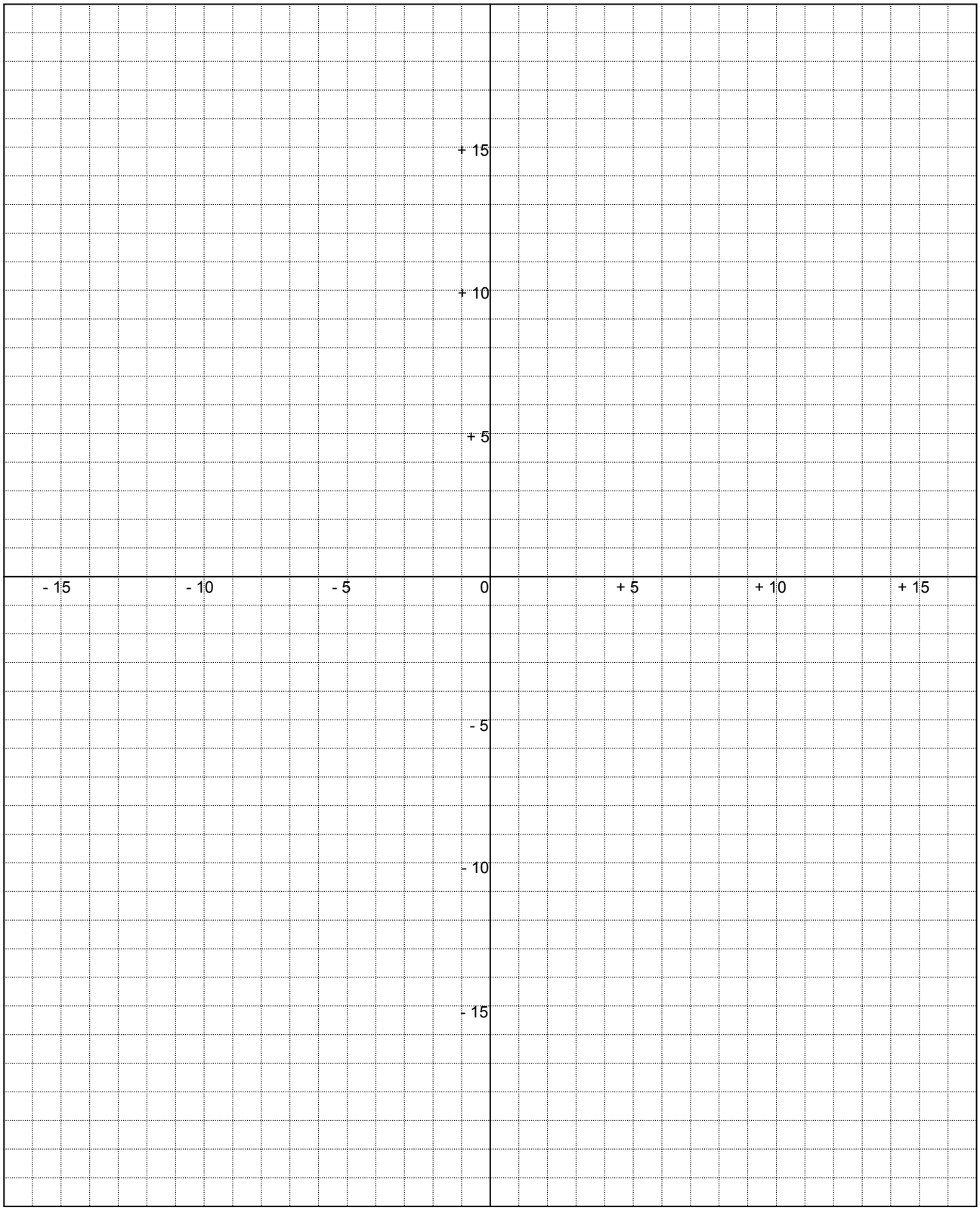
Co-ordinate Grid Paper



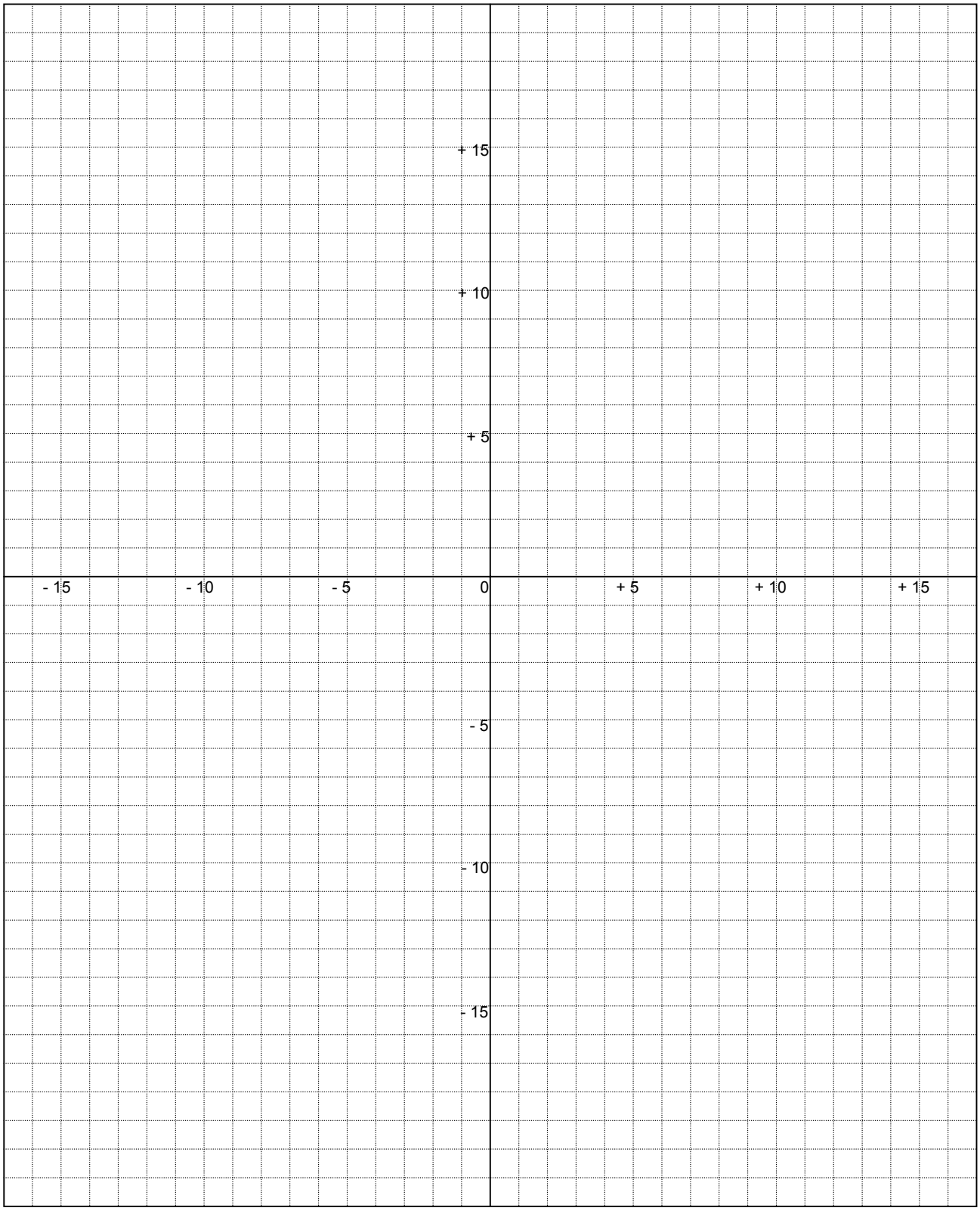
Co-ordinate Grid Paper



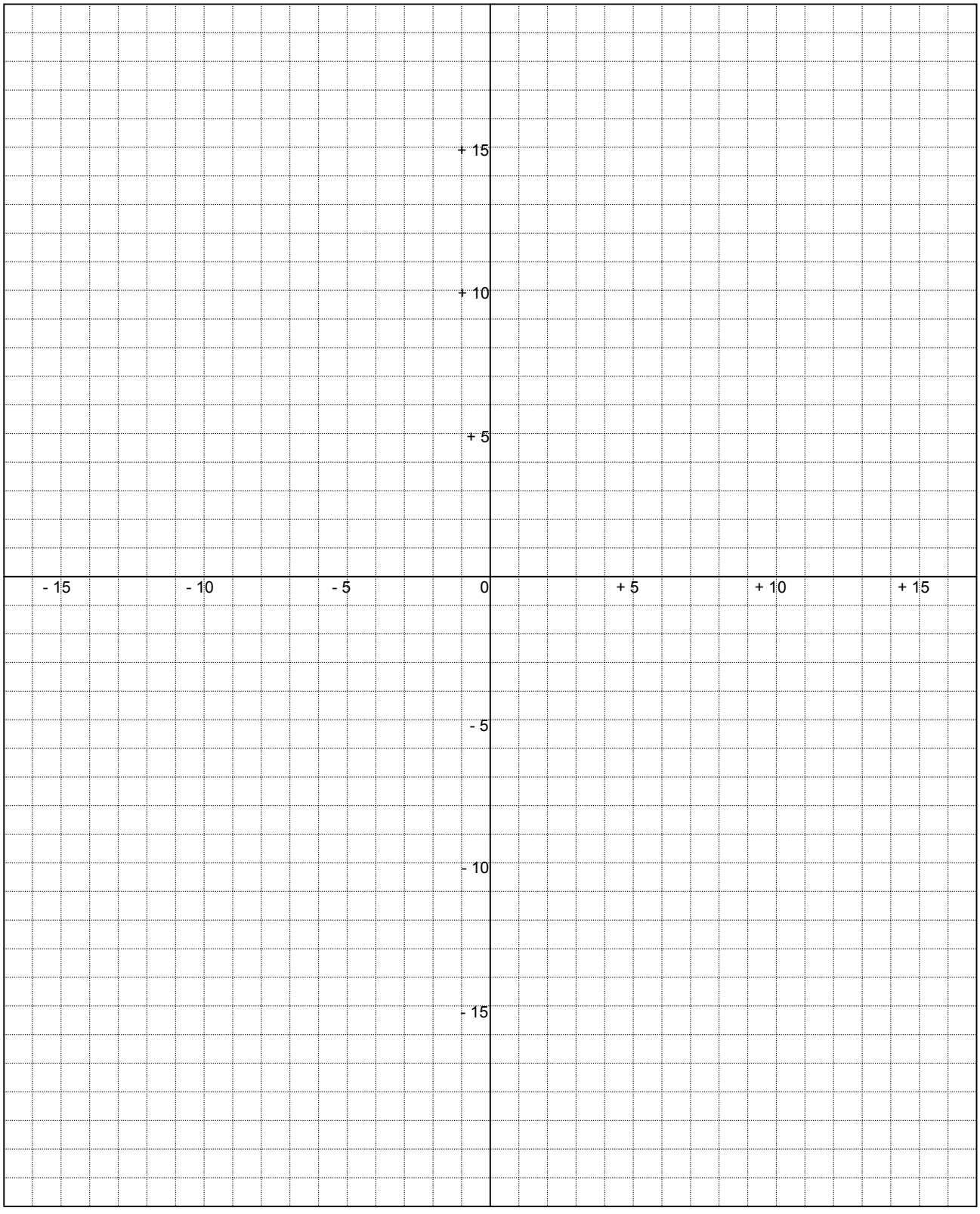
Co-ordinate Grid Paper



Co-ordinate Grid Paper



Co-ordinate Grid Paper



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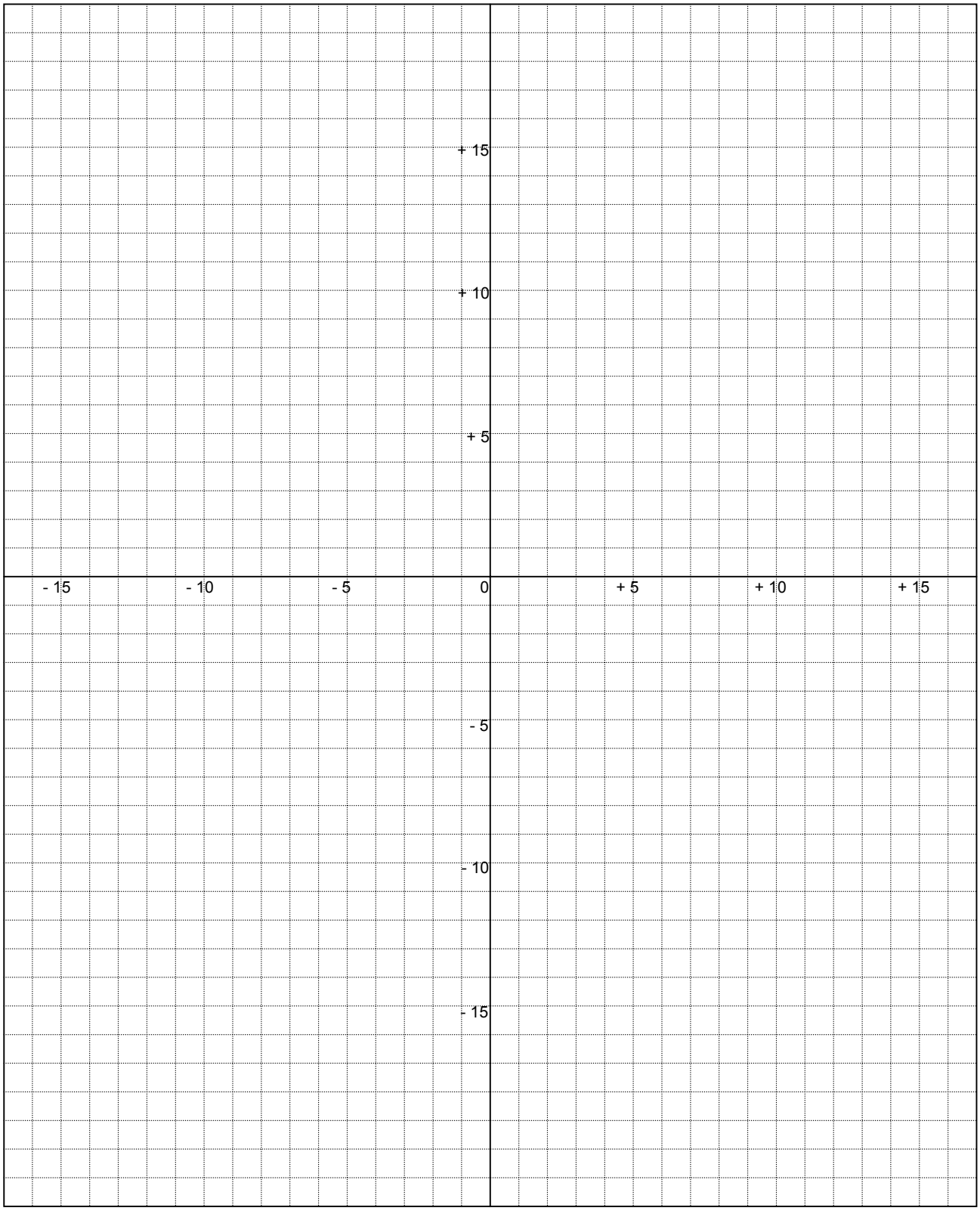
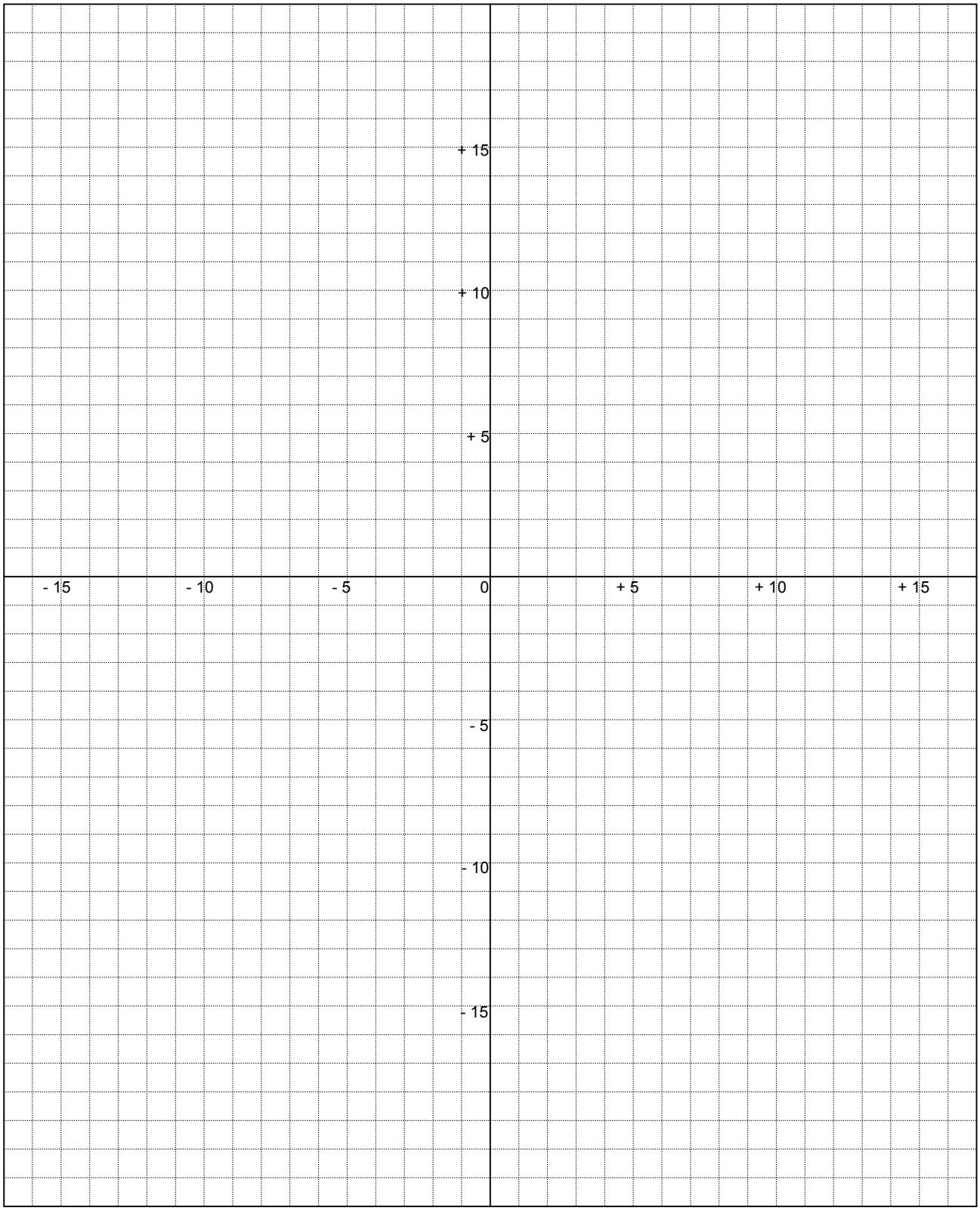
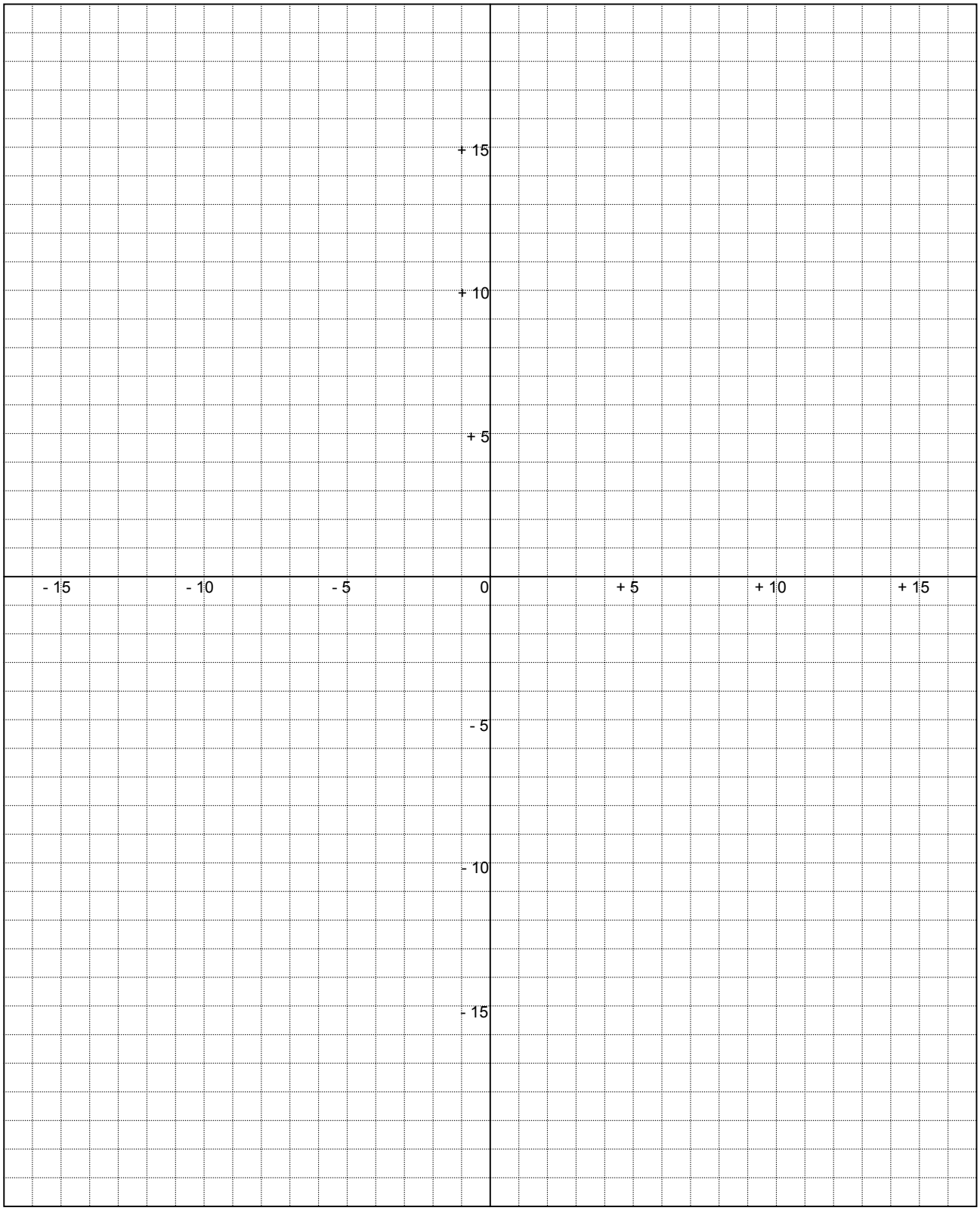


Co-ordinate Grid Paper



Co-ordinate Grid Paper



Co-ordinate Grid Paper