Simple Algebra

Part 3 · Algebra in Action

Now we'll see algebra in pictures:

$$y = x + 2$$

an equation with TWO mystery numbers!

1. Welcome to Part 3!

In Parts 1 and 2, every problem had ONE mystery number. In Part 3, we'll meet equations with TWO mystery numbers — and we'll learn to draw them as pictures!

📌 What's New in Part 3

Equations with TWO variables (like y = x + 2)

Input/output tables

The coordinate plane (graph paper!)

Plotting points and drawing lines

Function machines

Inequalities (greater than, less than)

2. Two Variables Working Together

Look at this equation:

$$y = x + 2$$

This is different! There's no single answer. Instead, x and y work TOGETHER:

- If **x = 1**, then **y = 1 + 2 = 3**
- If **x = 5**, then **y = 5 + 2 = 7**
- If **x = 10**, then **y = 10 + 2 = 12**

> 📌 **The Idea**
>
> **When x changes, y changes too — by following the rule.**
>
> x is the INPUT (whatever you pick).
> y is the OUTPUT (what the rule gives back).

3. Making a Table

To see the pattern clearly, make a table. Pick some x values, then calculate y.

For the rule y = x + 2:

x (input)	y = x + 2	y (output)
0	0 + 2	2
1	1 + 2	3
2	2 + 2	4
3	3 + 2	5
4	4 + 2	6

See the pattern? Every time x goes up by 1, y also goes up by 1.

📌 **You Try**

Make a table for y = 2x. Fill in the y values for x = 0, 1, 2, 3, 4.

Answers: $x = 0 \rightarrow y = 0$, $x = 1 \rightarrow y = 2$, $x = 2 \rightarrow y = 4$, $x = 3 \rightarrow y = 6$, $x = 4 \rightarrow y = 8$.

4. The Coordinate Plane

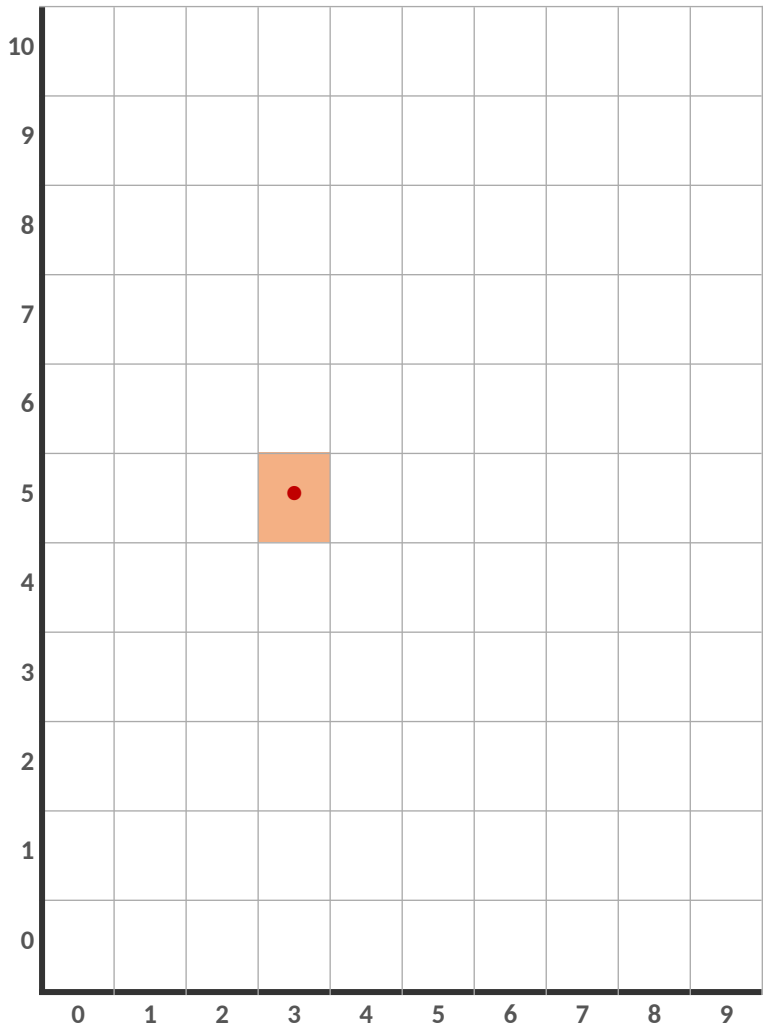
The coordinate plane is a special grid for drawing math. It has two lines (called AXES) that meet at zero:

- The **x-axis** goes LEFT and RIGHT.
- The **y-axis** goes UP and DOWN.

To plot a point, you give two numbers in parentheses: (x, y). The first number is how far RIGHT. The second is how far UP.

> 📌 **Example: the point (3, 5)**
>
> **(3, 5) means: start at zero, go 3 units RIGHT, then 5 units UP.**
>
> Picture an X marks the spot — (3, 5) is your X.

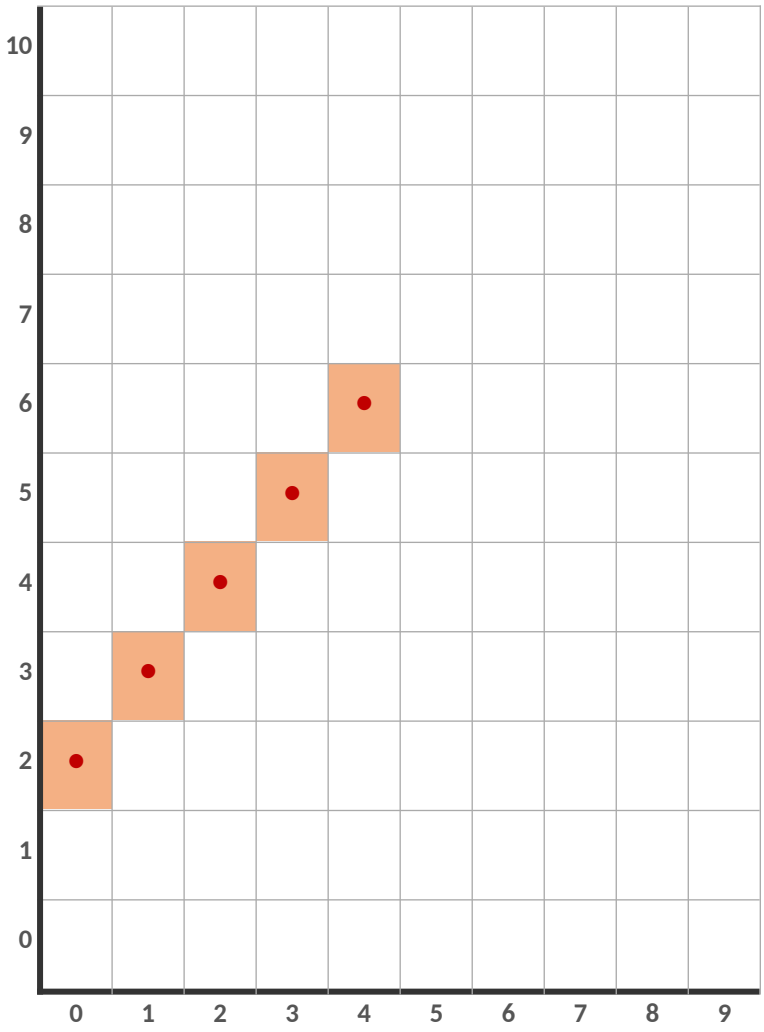
A coordinate plane with the point (3, 5) plotted:



5. Plotting an Equation

Remember our table for y = x + 2? Let's turn each row into a POINT and plot them all on the coordinate plane.

From the table, we get these points: (0, 2), (1, 3), (2, 4), (3, 5), (4, 6).



📌 **Notice This!**

All the points line up in a straight line!

If you connect them with a ruler, you'd get a LINE. That's why y = x + 2 is called a LINEAR equation — it makes a line when you graph it.

6. Patterns Are Like Machines

Think of a rule like y = x + 2 as a MACHINE. You put a number in. The machine does something to it. A different number comes out.

This is called a FUNCTION. A function is a rule (or machine) that turns each input into exactly one output.

📌 **The Cool Part**

Every equation with two variables (like y = x + 2 or y = 3x) is a function. You can think of it as a machine, OR as a table, OR as a graph — they're three views of the SAME thing.

7. Greater Than, Less Than (Inequalities)

Sometimes you don't need numbers to be EQUAL — you just need one to be bigger or smaller than the other. That's where INEQUALITIES come in.

Symbol	Means	Example
=	is equal to	x = 5 → x is exactly 5
>	is greater than	x > 5 → x is more than 5 (like 6, 7, 100)
<	is less than	x < 5 → x is less than 5 (like 4, 0, −10)
≥	is greater than or equal to	x ≥ 5 → x is 5 OR bigger
≤	is less than or equal to	x ≤ 5 → x is 5 OR smaller

📌 **Memory Trick**

The wide-open end of > and < always points toward the BIGGER number.

5 > 3 *(5 is bigger, so the wide side faces 5)*

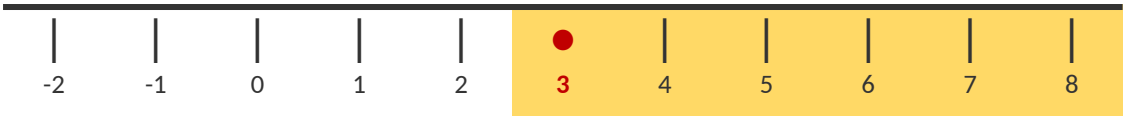
3 < 5 *(5 is bigger, so the wide side faces 5)*

8. Inequalities on a Number Line

An inequality like x > 3 doesn't have just one answer — it has LOTS of answers! Every number bigger than 3 works. We can show this on a number line.

x > 3 (x is strictly greater than 3 — but NOT 3 itself)

x ≥ 3 (x is 3 OR bigger — including 3 itself)



x < 5 (x is less than 5 — but NOT 5 itself)

📌 Open Circle vs Filled Circle

- ○ **Open circle (○)** means "NOT included". Used for > and <.
- ● **Filled circle (●)** means "included." Used for ≥ and ≤.

9. Solving Inequalities

Good news: solving an inequality works almost exactly like solving an equation! You use the same inverse operations and the Golden Rule.

$$x + 4 > 9$$

Subtract 4 from both sides — just like a regular equation:

$$x + 4 > 9$$

$$\downarrow$$

$$x + 4 - 4 > 9 - 4$$

$$\downarrow$$

$$x > 5$$

So x is any number greater than 5. Let's picture it:

> 📌 **One Tiny Warning (for later!)**
>
> There's a special rule: if you multiply or divide BOTH sides by a NEGATIVE number, you have to FLIP the inequality sign.
>
> You won't run into this often as a 5th grader, but keep it in the back of your mind.

10. Algebra in the Real World

Look at how often algebra (with two variables) shows up in real life:

💵 Allowance over time

If you save $5 per week, then after w weeks you have y = 5w dollars. Make a table! After 4 weeks: y = $20.

🚗 Distance and time

If a car drives 60 mph, then after t hours it has gone d = 60t miles. After 2 hours: d = 120 miles.

📞 Phone bill

$15 a month plus $0.05 per text. Total cost: c = 15 + 0.05t. If you send 100 texts: c = $20.

🥕 Cooking

If 1 cup of rice feeds 2 people, then to feed p people you need r = p/2 cups of rice. For 8 people: r = 4 cups.

11. Try It Yourself!

Try this!

Question 1: Make a table for the rule **$y = 3x$**

If x = 0, y = ____ If x = 1, y = ____ If x = 2, y = ____ If x = 4, y = ____

Try this!

Question 2: Plot the point (4, 7). Describe how you'd get there from zero.

My description: _____

Try this!

Question 3: Function machine! If the rule is **output = input × 5**:

Input 3 → output ____ Input 7 → output ____ Input 10 → output ____

Try this!

Question 4: Write the inequality symbol that goes in the blank:

7 ____ 10 15 ____ 9 8 ____ 8 (3 choices)

Try this!

Question 5: Solve the inequality: **$x - 3 \geq 5$**

x ____ ____

Answers

1) y = 0, 3, 6, 12 2) Go 4 right, then 7 up 3) 15, 35, 50 4) 7 < 10, 15 > 9, 8 = 8 5) x ≥ 8

Congratulations — that's the whole guide!

You now know more algebra than most 5th graders. Keep practicing — and have fun finding patterns!