Introduction to Linear Polynomials



1. Decoding Expressions
(Everyday objects)

2. Finding the Pattern
(Growth & Decay)

3. The Master Formula
$(y = ax + b)$

4. Graphing the Line
(Visualizing math)

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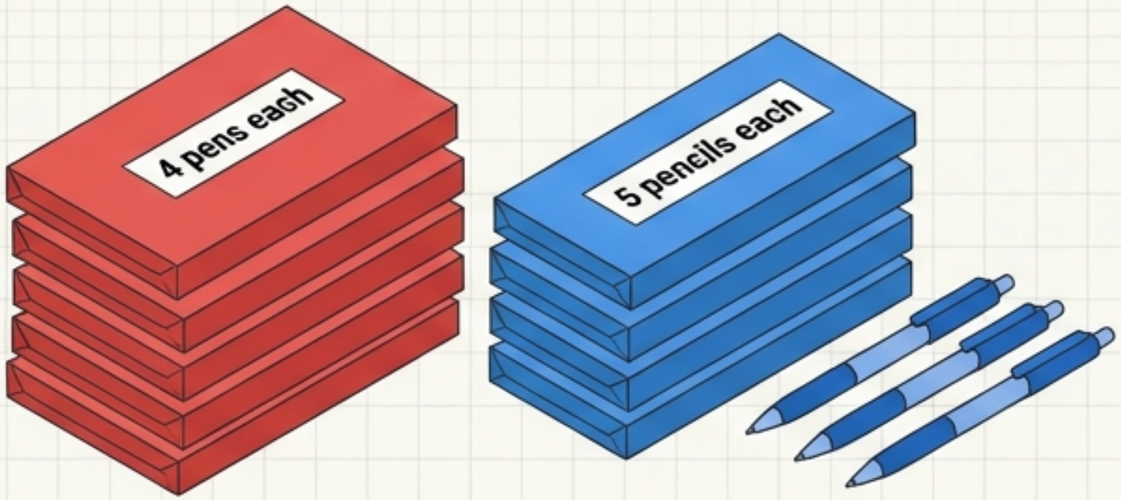
Translating the physical world into algebraic expressions

Raju's Purchase



Coefficient Coefficient Constant

$$4x + 5y + 3$$

Variable Variable

$$4x + 5y + 3$$

(Total pens and pencils)

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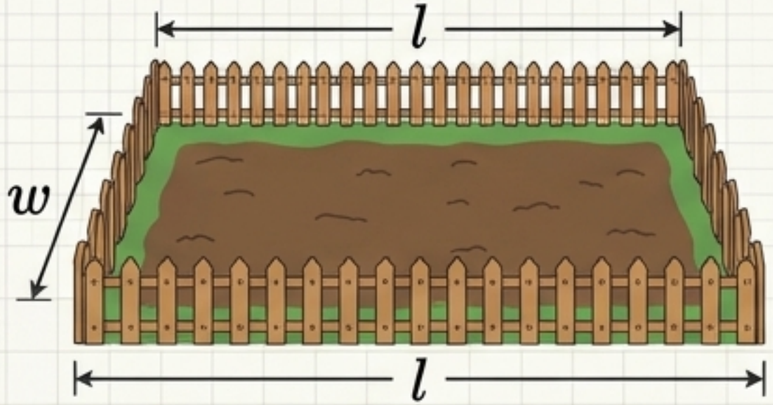
Comparing expressions: Fencing a garden vs. bending a wire

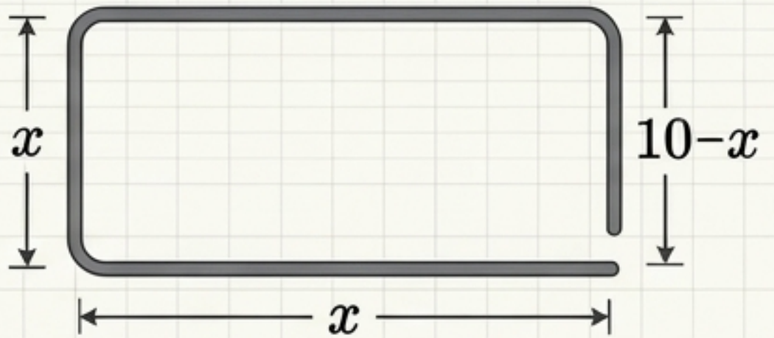
Garden Fence



$$200l + 160w + 50lw$$

- Number of Variables: 2 (l and w)
- Highest Power: 1

Wire Rectangle



$$10x - x^2$$

- Number of Variables: 1 (x)
- Highest Power: 2

Think and Reflect

Can you deconstruct these formulas? Identify the terms, variables, and coefficients in each expression above.

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Classifying univariate polynomials by their degree

“**Univariate**’ means one variable.
“**Degree**” is the highest power.



x^3

•	**Constant**	Degree 0	8
/	**Linear**	Degree 1	$3z + 7$
∪	**Quadratic**	Degree 2	$x^2 + 5x + 1$
~	**Cubic**	Degree 3	$5y^3 + y^2 + 2y - 1$

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The defining feature of a linear polynomial is a constant difference

Square Perimeter:

$4x$



Chess Club Fee:

$200 + 50m$



(Base fee + per match)

Matches (m):	1	2	3	4
Amount (₹):	250	300	350	400

+50 +50 +50

Think and Reflect

If a player paid ₹750, how many matches did they play?

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Equating a linear polynomial to a constant creates an equation

Problem: The sum of two numbers is 64. One is 10 more than the other. What are they?

Problem: The sum of two numbers is 64.

Step 1 (Model): Let the smaller number $= x$. Larger number $= x + 10$.

Step 2 (Equation): $x + (x + 10) = 64$

This is the linear polynomial → Step 3 (Simplify): $2x + 10 = 64$

Step 4 (Solve): $2x = 54 \longrightarrow x = 27$

Result: The numbers are 27 and 37.

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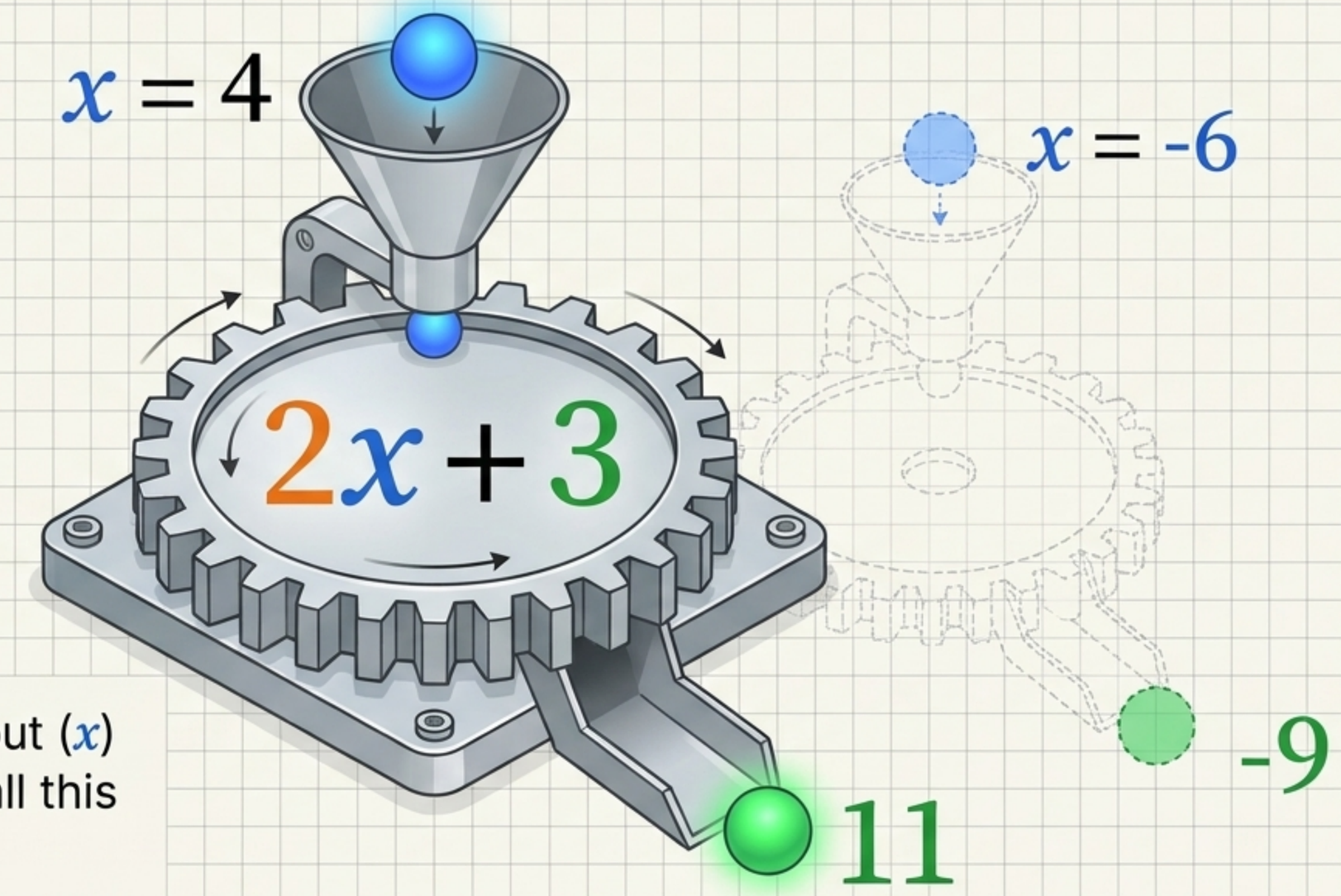
A polynomial operates as an input-output machine



When we process an input (x) through a set rule, we call this relationship a **function**.

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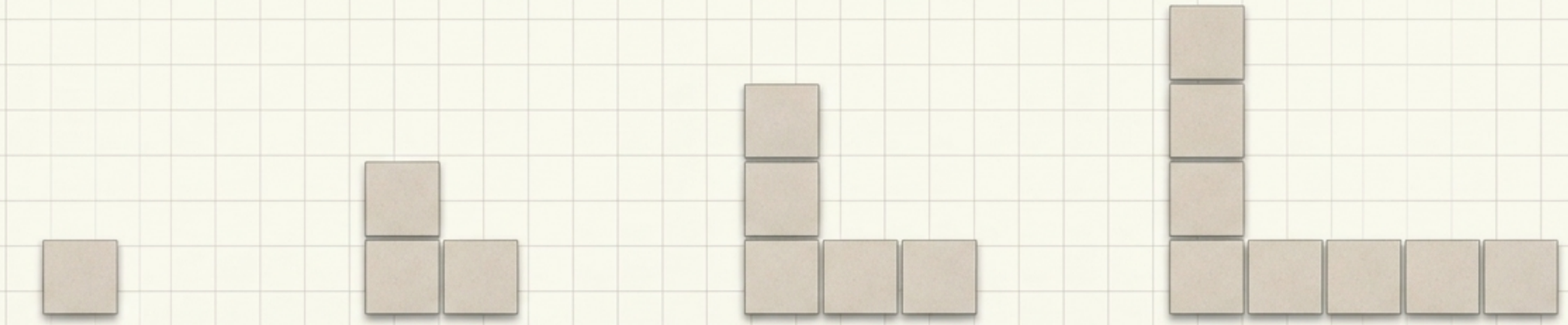
Linear rules map perfectly to physical growing patterns



Stage 1 Stage 2 Stage 3 Stage 4

Stage (n):	1	2	3	4
Tiles:	1	3	5	7

+2 +2 +2

The Rule: $2n - 1$

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Formalizing the definition of a linear pattern



Bela starts with ₹100, spends ₹5/day.

$$100 - 5n$$

Day	Amount
1	95
2	90
3	85



₹25 for first 2km, +₹15/km after.

$$15n - 5$$

Distance	Fare
3km	40
4km	55
5km	70

A **linear pattern** is a sequence of numbers where the difference between any two consecutive terms remains **completely constant**.

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Direction matters: Linear Growth versus Linear Decay

Linear Growth

Journey Cost

$$C(d) = 100 + 60d$$

distance (d)	cost (C)
1	160
2	220
3	280

Linear Decay

Water Tank Height

$$h(t) = 3 - 0.5t$$

months (t)	height (h)
1	2.5
2	2.0
3	1.5

Think and Reflect

What will be the exact height of the water in the tank at the end of 5 months?

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The Master Formula: Mapping any linear relationship

The **final output** or **total amount**.

The **Slope** or **Rate of Change** (how much it grows/decays per step).

$$y = ax + b$$

The **input variable** (time, distance, stages).

The **y-intercept** or **Starting Value** (the constant base amount at step zero).

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Translating a telecom bill into the master formula



The Problem: 10 GB costs ₹350. 20 GB costs ₹550.
Find the relationship y = ax + b.

Step 1: $350 = 10a + b$

Step 2: $550 = 20a + b$

Step 3 (Solve for a): The cost jumps ₹200 for 10 GB. So,
$10a = 200 \rightarrow a = 20$ (Cost per GB).

Step 4 (Solve for b): $b = 350 - 10(20) \rightarrow b = 150$ (Fixed monthly fee).

The Model: $y = 20x + 150$

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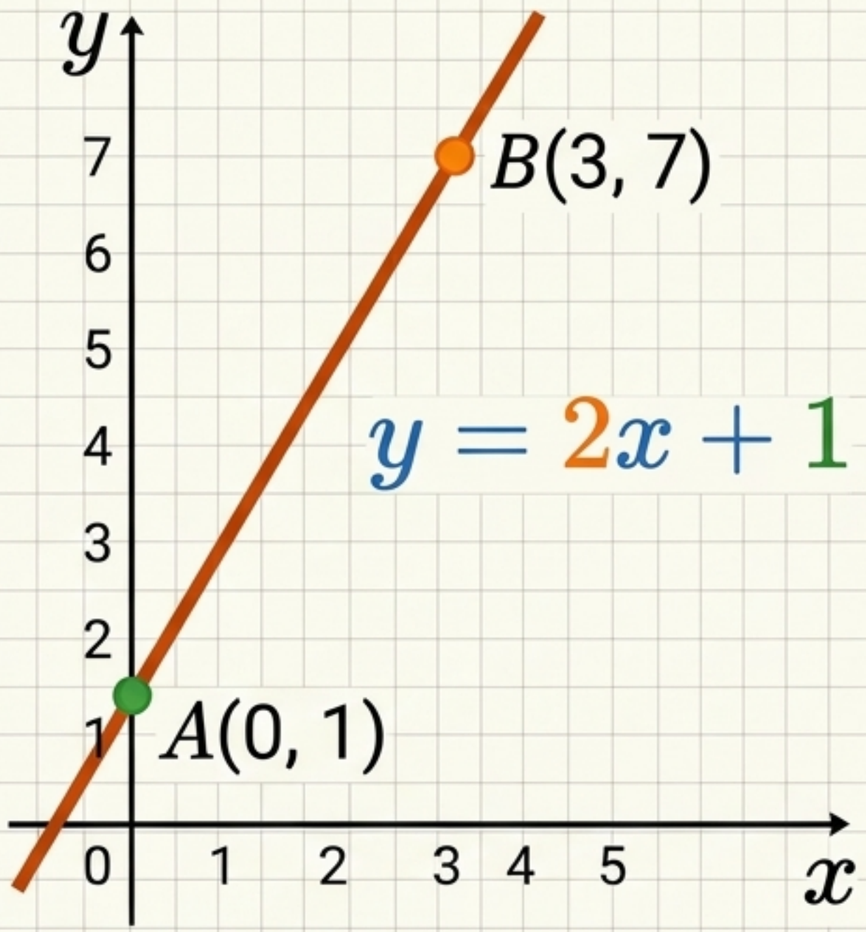
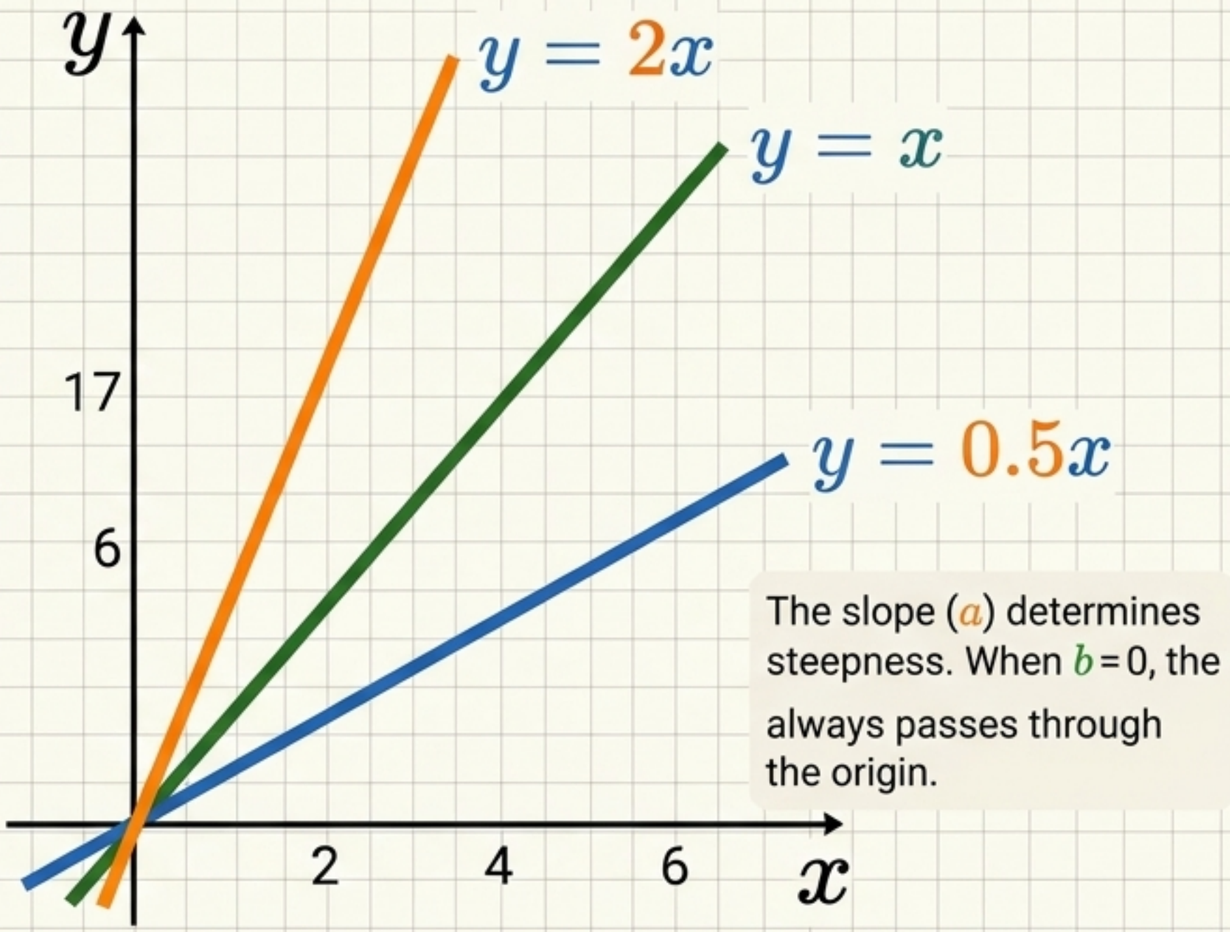
Visualizing the rule: Plotting lines and measuring slope (a)





The slope (a) determines steepness. When $b = 0$, the always passes through the origin.

Think and Reflect

Verify that the points (1,3) and (7,15) sit perfectly on the line $y = 2x + 1$.

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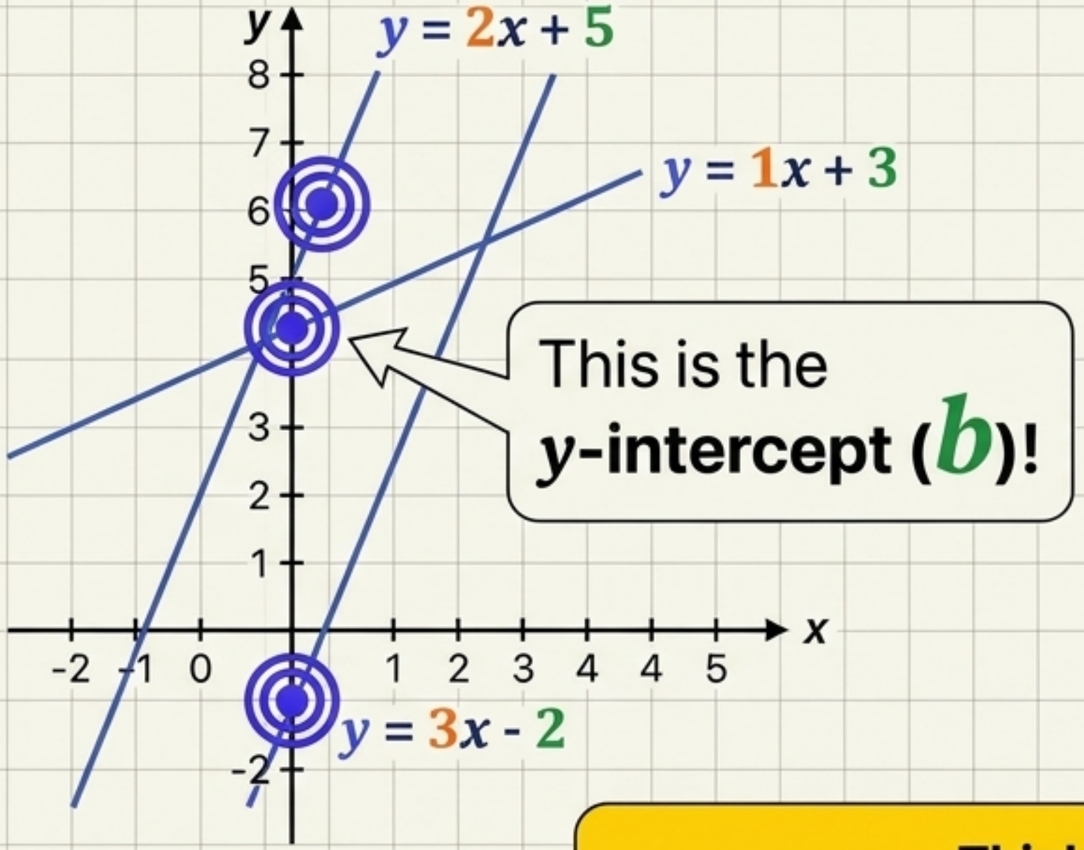
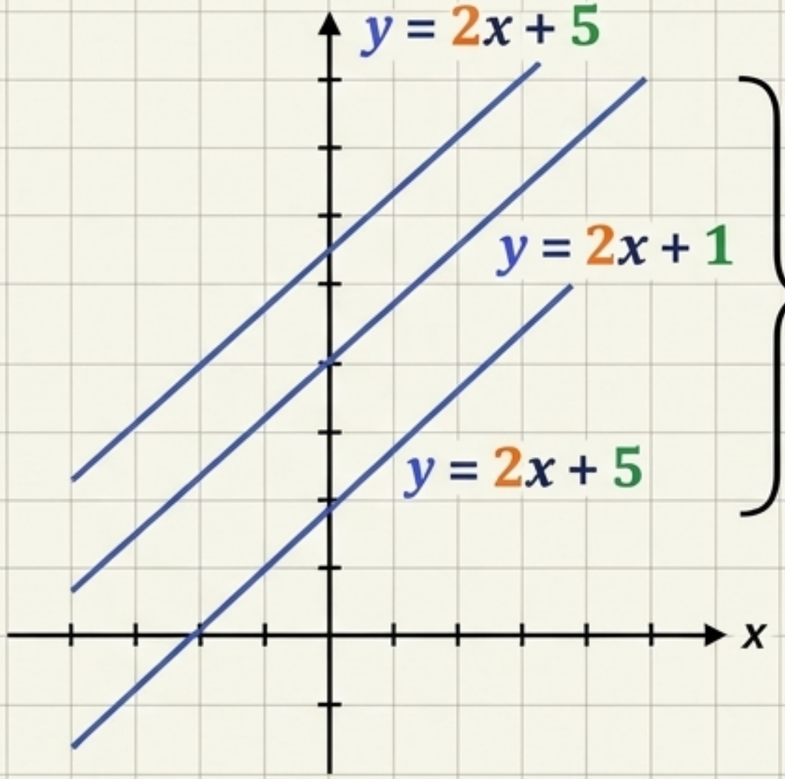
Shifting the line: The y-intercept (b) and parallel paths

The y-intercept



Parallel Lines



Same slope ($a = 2$) + Different intercepts (b) = Lines that never touch.

Think and Reflect

If a is fixed but b varies, how does the line move?

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The 7 Key Takeaways of Linear Polynomials



Polynomial & Degree:
The highest power of the variable dictates the type (Degree 1 = Linear).



Linear Polynomial:
Expressions like $2x + 3$ featuring a constant difference.



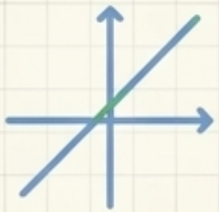
Linear Pattern: A sequence progressing by a completely constant amount.

$$y = ax + b$$

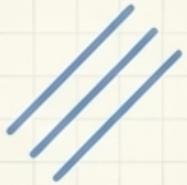
The Master Formula:
$y = ax + b$.



Growth & Decay:
Positive slopes grow; negative slopes decay.



Slope & Intercept:
a controls the steepness; b controls where the line hits the y-axis.



Parallel Lines:
Identical slopes (a) with different starting points (b) run perfectly parallel.

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