FIBO / MATH / ALGEBRA · UNIT 7 · LINEAR FUNCTIONS

The Equation of a Line: Three Forms, One Line — Lecture

A line can introduce itself three ways — slope-intercept, point-slope, and standard form. They all name the same line; the trick is knowing which costume to wear.

BY THE END OF THIS LESSON, YOU WILL BE ABLE TO

- ✓ Write a line's equation in slope-intercept form from its slope and y-intercept
- ✓ Use point-slope form when you know a point and the slope
- ✓ Convert fluently between slope-intercept, point-slope, and standard form

⏱ About 25 min · Needs: slope, solving equations · Unit 7 · Linear Functions

Name: _____ **Date:** _____

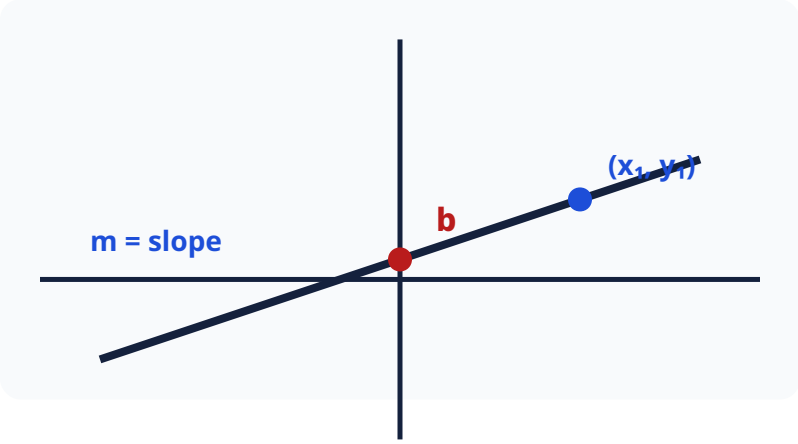
Printable companion to the interactive lesson at fibotutors.com — full color. Worked examples and application solutions are shown in full; Try-It answers live in the separate Answer Key.

CONCEPTS

The Big Picture

Meet the line **y = 2x + 1**. Now meet it again — **y − 3 = 2(x − 1)** — and once more — **2x − y = −1**. Same line, three costumes. Each form spotlights something different:

- **Slope-intercept** y = **m**x + **b** — shows the **slope** and the **y-intercept** at a glance. Best for graphing.
- **Point-slope** $y - y_1 = \mathbf{m}(x - x_1)$ — built from one point and the **slope**. Best when you know a point.
- **Standard** Ax + By = C — integers only, great for finding both intercepts fast.



y = mx + b | **$y - y_1 = m(x - x_1)$** | **Ax + By = C**

One line, three costumes — slope-intercept, point-slope, and standard form all name the same line.

$y = mx + b$

m = slope · b = y-intercept

$y - y_1 = m(x - x_1)$

plug in a point (x_1, y_1) and the slope **m**

Ax + By = C

A, B, C are integers — handy for finding intercepts

Slope-intercept shows **m** and **b**; point-slope starts from a point; standard form keeps everything integer.

Converting is just algebra. To turn y = **−2**x + **6** into standard form, move the x-term left (it changes sign):

Step 1 $y = -2x + 6$

Step 2 Add 2x to both sides: $2x + y = 6$ ✓ (A = 2, B = 1, C = 6)

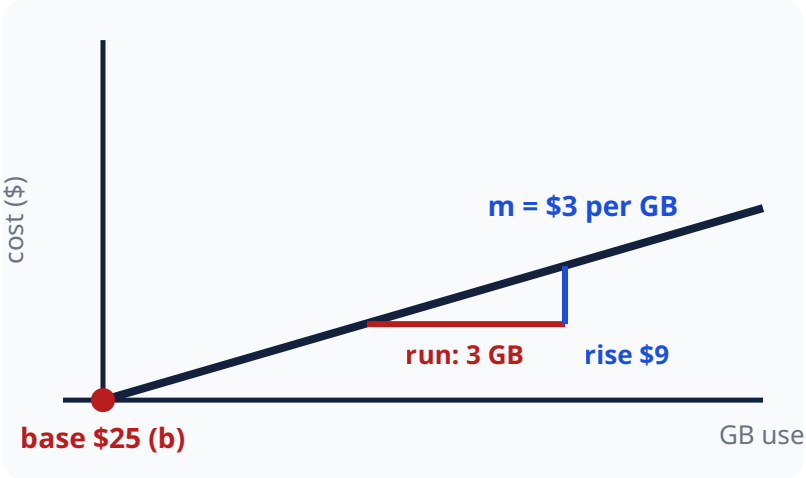
REAL LIFE FIRST

Math in the Wild

REAL LIFE FIRST

📷 Picture this: a smartphone showing a monthly bill breakdown

Every phone bill is secretly **y = mx + b**: a fixed base fee (**b** — you pay it even at 0 GB) plus a per-GB rate (**m** — each gigabyte adds the same amount).



A $25 base fee plus $3 per GB — the intercept **b** is where you start, the slope **m** is the rate.

Where you already meet line equations: taxi meters (flag drop + per-mile), gym memberships (signup + monthly), and streaming bundles (base + add-ons).

WORKED EXAMPLES

See Every Step

Example 1 — Slope-intercept from m and b

Write the equation of the line with slope **3** and y-intercept **−2**.

Step 1 We know **m** and **b** — reach for y = **m**x + **b**.

Step 2 Drop them in: y = (**3**)x + (**−2**).

y = 3x − 2

➜ slope-intercept is instant when you know **m** and **b**.

✏️ Workspace — rework this example

✏️ Try It 1 — your turn

Write the equation with slope **5** and y-intercept **−7**.

(Answer in the separate Answer Key — try it on your own first!)

✏️ Workspace — solve the Try-It here

Example 2 — Point-slope, then convert

Write the equation of the line through (1, 4) with slope **−2**, then convert to slope-intercept form.

Step 1 We know a point and **m** — use $y - y_1 = m(x - x_1)$: $y - 4 = -2(x - 1)$.

Step 2 Distribute: $y - 4 = -2x + 2$.

Step 3 Add 4: $y = -2x + 6$.

$y - 4 = -2(x - 1) \rightarrow y = -2x + 6$

➜ point-slope is the bridge: start there, simplify into whichever form you need.

✏️ **Workspace — rework this example**

✏️ Try It 2 — your turn

Line through (2, −1) with slope **4**: write point-slope form, then simplify to y = **m**x + **b**.

(Answer in the separate Answer Key — try it on your own first!)

✏️ **Workspace — solve the Try-It here**

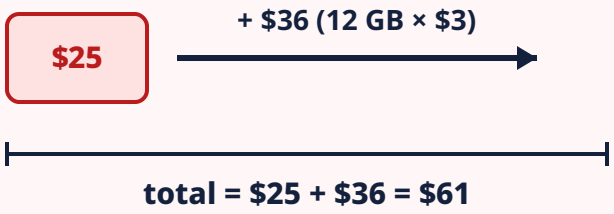
USE IT FOR REAL

Application Problems

USE IT FOR REAL

App 1 — The phone plan

A plan costs **$25/month** plus **$3 per GB**. Write the cost equation and find the bill for 12 GB.



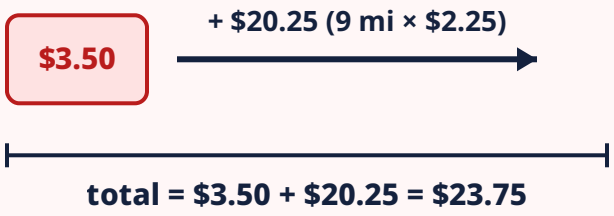
Base fee + usage charge — the classic y = **m**x + **b** receipt.

Solution. Cost = (rate)(GB) + base: y = **3**x + **25**.
At x = 12: y = 3(12) + 25 = 36 + 25 = **$61**.

✏️ Workspace — solve it your way first, then compare

App 2 — The taxi ride

A taxi charges a **$3.50** flag drop plus **$2.25 per mile**. Write the fare equation and find the fare for 9 miles.



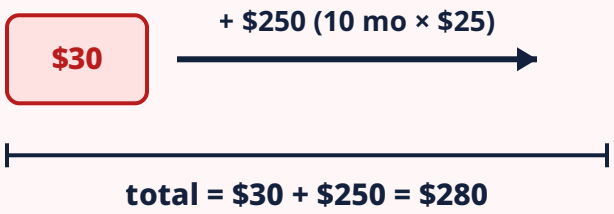
The meter starts at $3.50 (that's **b**) and climbs $2.25 a mile (that's **m**).

Solution. Fare = **2.25**x + **3.50**.
At x = 9: y = 2.25(9) + 3.50 = 20.25 + 3.50 = **$23.75**.

✏️ **Workspace — solve it your way first, then compare**

App 3 — The gym membership

A gym charges a **$30** signup fee plus **$25 per month**. Write the total-cost equation and find the cost after 10 months.



Signup today, pay monthly — the receipt adds up exactly like **m**x + **b**.

Solution. Total = **25**x + **30**.
At x = 10: y = 25(10) + 30 = 250 + 30 = **$280**.

✏️ **Workspace — solve it your way first, then compare**

KEEP FOREVER

Key Points — Cheat Sheet

- $y = \mathbf{m}x + \mathbf{b}$ — **slope** × x plus **y-intercept**; best for graphing
- $y - y_1 = \mathbf{m}(x - x_1)$ — one point + slope; substitute *signed* values
- $Ax + By = C$ — integers, $A \geq 0$; set x = 0 for the y-intercept, y = 0 for the x-intercept
- Convert slope-intercept → standard: move the x-term left (it flips sign)
- **b** is a number; (0, **b**) is the point
- Real world: total = (rate)(amount) + (starting fee) — phone, taxi, gym