Lecture Notes · Unit 7 · Lecture 3 AP CED 7.3

Slope fields

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INTRO: NO FUNCTION, JUST DY/DX

Slope Fields AP Calculus 7.3

7.2: at (0, 1), $\frac{dy}{dx} = x + y = 0 + 1 = 1$

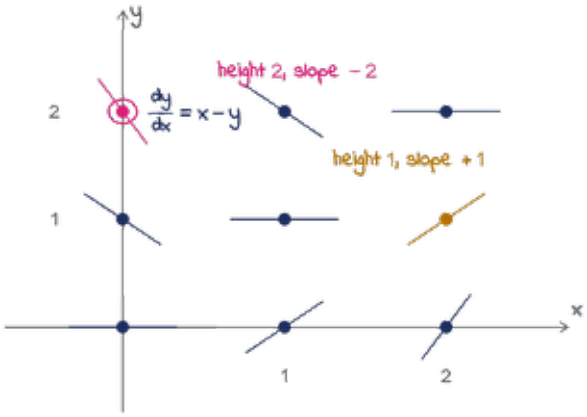
Just $\frac{dy}{dx}$, no function

→ what can it show?

$\frac{dy}{dx} = x - y$

Let's get that 5

A SLOPE AT EACH POINT



$\frac{dy}{dx} = x - y$ at (2, 1) → 2 − 1 = 1

Through (2, 1) → slope 1

y = height = solution's value

on (2, 1), slope 1

y = 0 → 0, 1, 2

0 flat, + up, − down, 2 steeper

y = 1 → −1, 0, 1

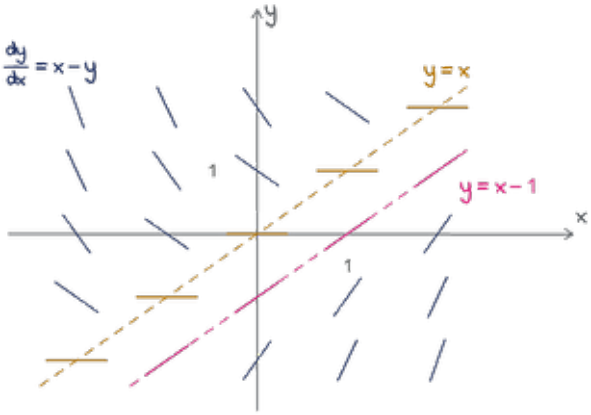
y = 2 → −2, −1, 0

−2 = slope, not height → on (0, 2)

Segment at every point → slope field

READING A SLOPE FIELD FAST

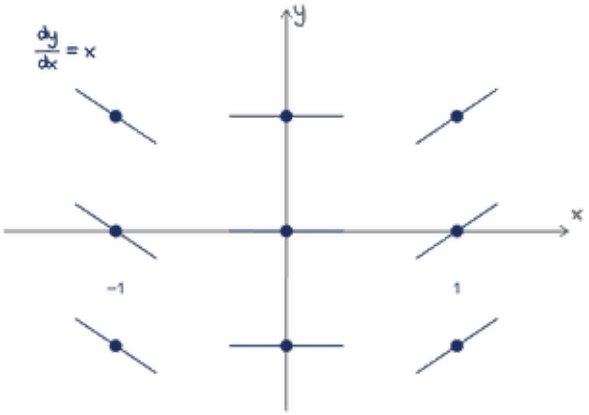
Reading it fast



x − y = 0; x − (x − 1) = 1

Same value → same slope

ONLY X? ONLY Y?



$\frac{dy}{dx} = x$ → −1, 0, 1 → each column same

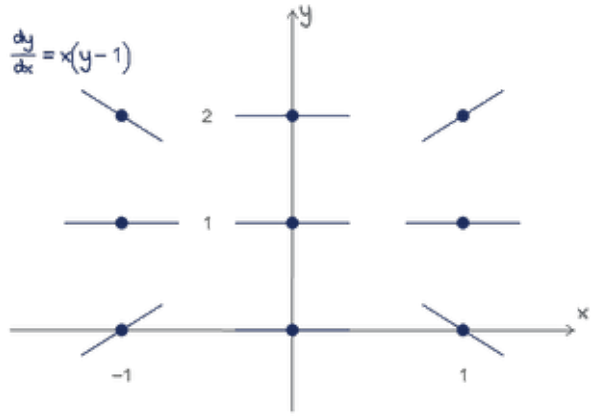
only x → columns same; only y → rows same

AP: sketch or match → no solving

PROBLEM 1 OF 2

Nine points

Consider the differential equation $\frac{dy}{dx} = x(y-1)$. Sketch the slope field at the nine points $x = -1, 0, 1$ and $y = 0, 1, 2$.



Solution (a) Row by row: plug in y first

(a)

Plan: row by row

y first → one y per row

$y = 1 \to x \cdot 0 = 0 \to$ all flat

$y = 0 \to x(0-1) = -x \to 1,\ 0,\ -1$

$y = 2 \to x \to -1,\ 0,\ 1$

Workbook → rows first

Careful → the sign

✗ Common mistake

$x(0-1) = x$ ✗

$\to x = \pm 1$ tilt flipped

✓ Do this

$x(0-1) = -x \to 1,\ 0,\ -1$

PROBLEM 2 OF 2

Which equation?

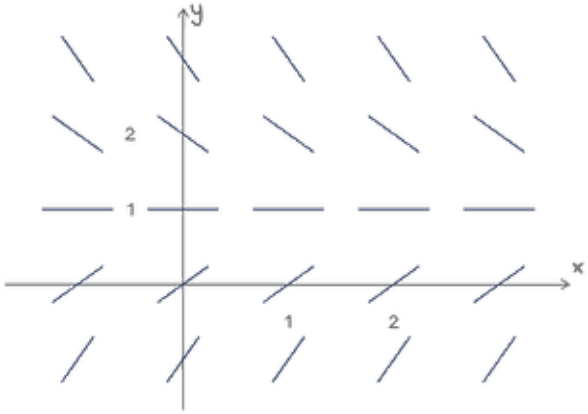
Which differential equation has this slope field?

(A) $\frac{dy}{dx} = y - 1$

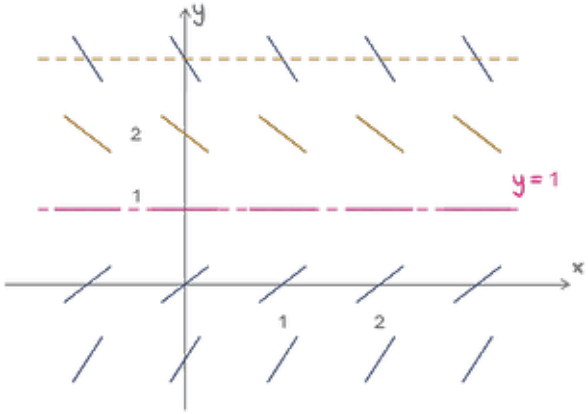
(B) $\frac{dy}{dx} = 1 - y$

(C) $\frac{dy}{dx} = 1 - x$

(D) $\frac{dy}{dx} = x - 1$



Solution Rows or columns → flat row → one sign



Plan: rows? → flat row → a sign

Rows alike → not x → not (C), (D)

$y = 1 \to$ flat → (A), (B) = 0

$y = 2 \to$ down → (B) −1 ✓, (A) +1 ✗

So (B) → $\frac{dy}{dx} = 1 - y$

Rows, flat row, one sign

WRAP-UP

what can it show?

A segment at each point: slope, not height

only x → each column the same; only y → each row the same

Match: rows, flat row, one sign

workbook · Next → 7.4: follow the segments

Next: the workbook for this topic (link in the video description). Stuck? Ask in the comments.