

Differential Equations: Calculus AB

Lesson Plan 4: Slope fields (cont.).

Overview

After learning about Slope fields, and their relation to other aspects of the differential equation, we will get our feet wet with plenty of examples.

Learning Objectives

- Practice the various aspects of Slope Fields.

Prior Knowledge needed

The students should have learned in the previous lesson slope-fields and solution-curves, and the relation therein.

Special Materials

- Work sheet: See below (one page, double sided).
- Transparencies + Sharpies for students to draw their group work.

Instruction and activity

1. **Warm-up problem (from AP), and by that review of what we did yesterday.**
2. **Group work w/presentations:**

The idea is to let the student solve, and see, quite a few slope-field equations, while not getting bored. Various options:

- a. Speed dating mode.
- b. Small groups, and then switch.

→ At any rate, at the end (last session), need to draw on Transparencies so we can all share.

The students will solve the following question, for each:

- a. Draw slope field.
- b. Draw solution curves (if needed and possible, solve equation first).
- c. Draw a particular solution using the initial conditions.

The 4 questions will be on the sheet handed out. See at the bottom.

3. Presentation of the solution and discussions.
4. **Wrap-up** : Two options.
 - a. We mentioned a few concepts. Write down what the connection between those is:
 - i. Differential equation

- ii. Solution curves
- iii. Slope curve
- iv. Particular solution

OR

b. Which was the hardest one for you to solve (question and item) ? Why? Which was the easiest?

5. **Homework:** Start work on homework!

====End==== (Well, the worksheet is below)

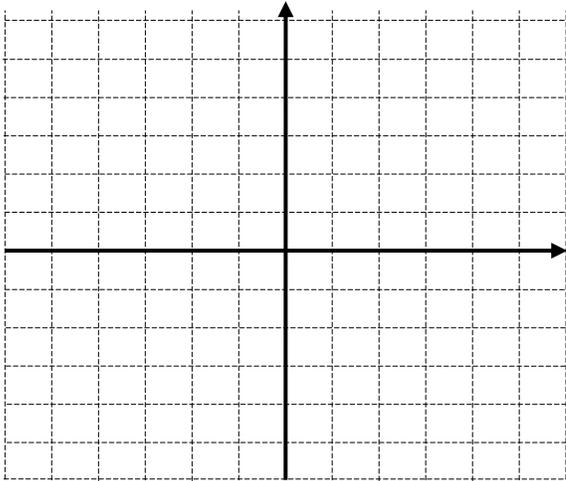
Student Name: _____

Date: _____

Slope Field worksheet

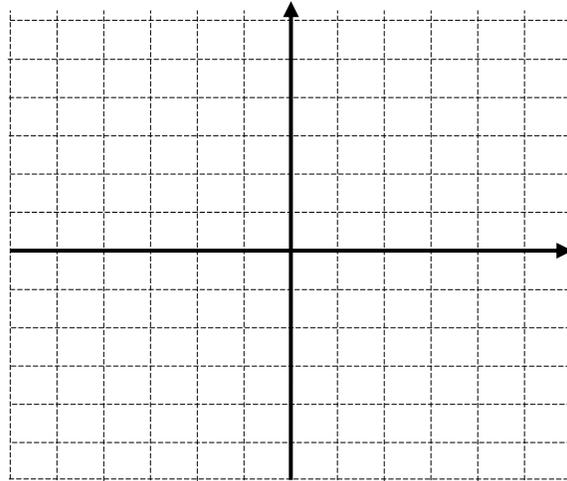
NOTE: NOT every tick on the grid should be taken as '1', and slope fields should NOT be drawn on each point. Use your own judgment for how to do it.

① $\frac{dy}{dx} = \cos(x)$; $y(0)=1$



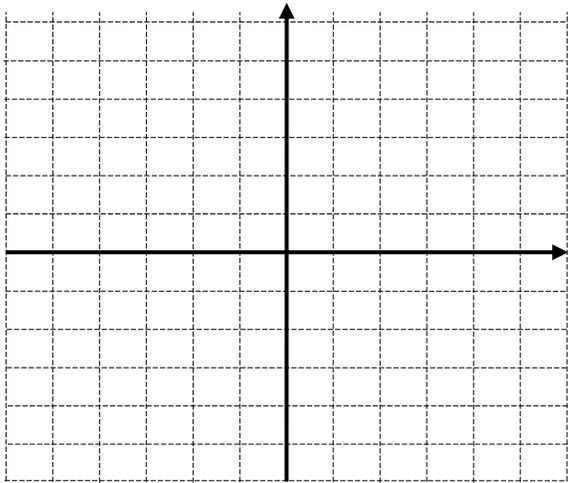
- * Draw slope field.
- * Draw solution curves (solve equation first).
- * Draw a particular solution using the initial conditions.

② $\frac{dy}{dx} = 3x^2 - 4$; $y(0)=-1$



- * Draw slope field.
- * Draw solution curves (solve equation first).
- * Draw a particular solution using the initial conditions.

③ $\frac{dy}{dx} = x + y$; $y(0)=1$



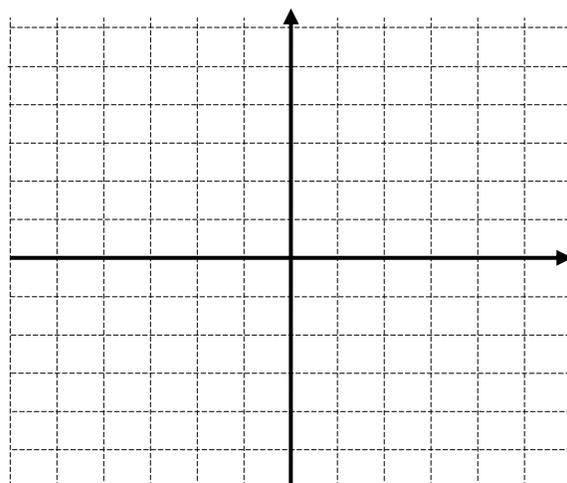
* Draw slope field.

* Draw solution curves.

→ Check the possible solution: $y = ke^x - 1 - x$.
What's special about this solution?!?

* Draw a particular solution using the initial conditions.

④ $\frac{dy}{dx} = \frac{2x}{y}$; $y(1) = 1$



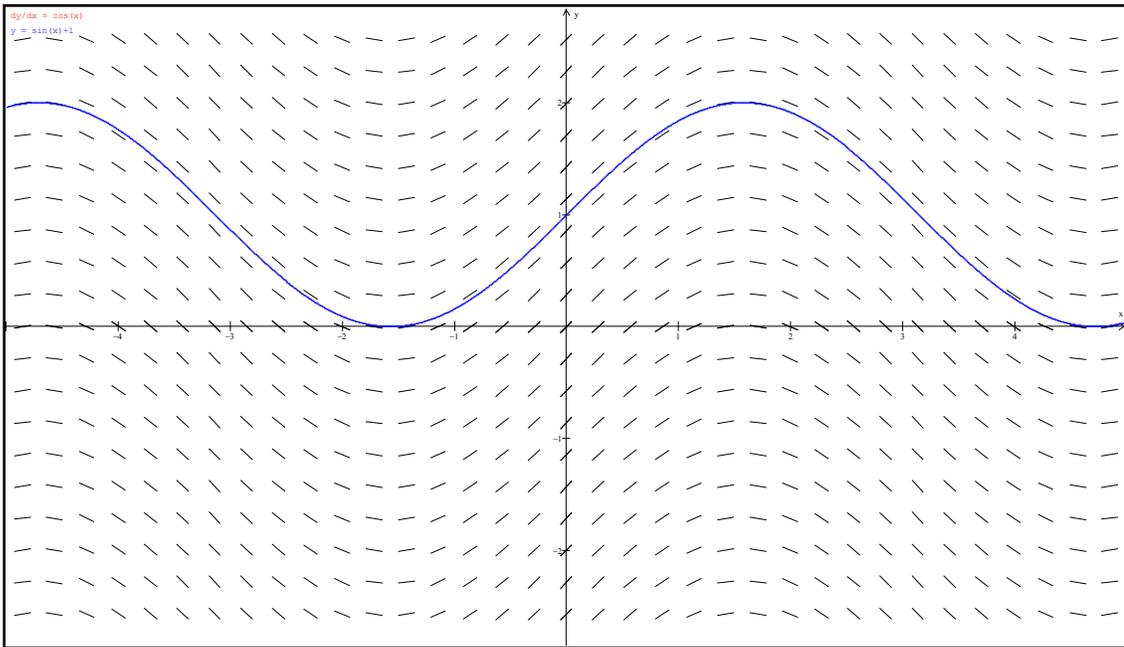
* Draw slope field.

* Draw solution curves (solve equation first).

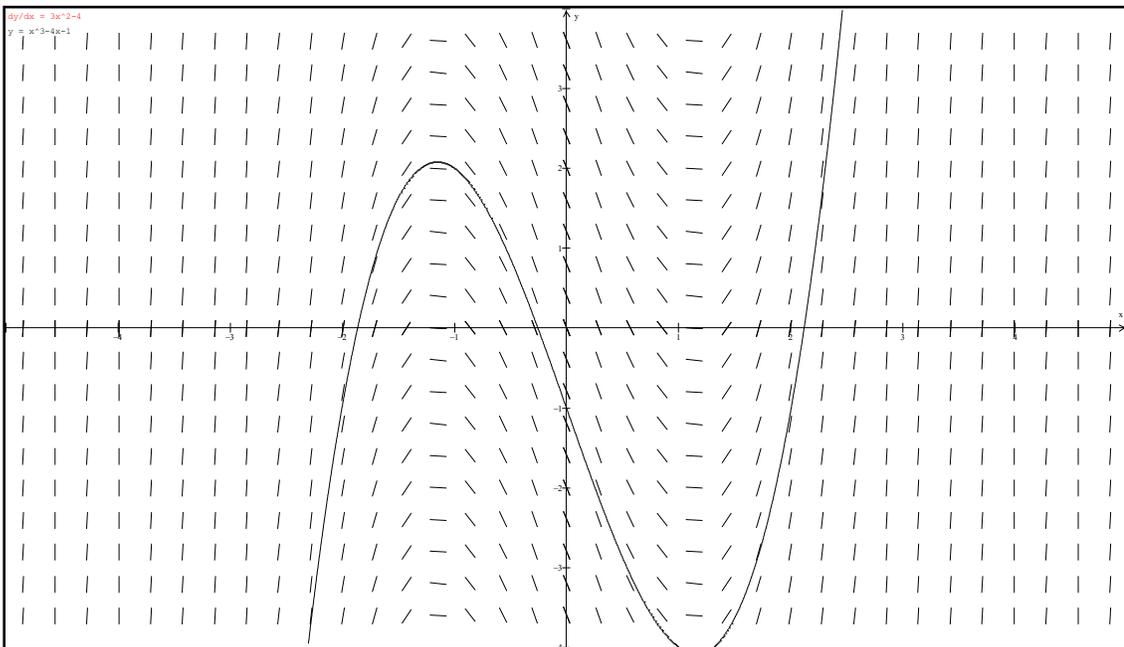
* Draw a particular solution using the initial conditions.

Solutions.

① $\frac{dy}{dx} = \cos(x)$; $y(0)=1$

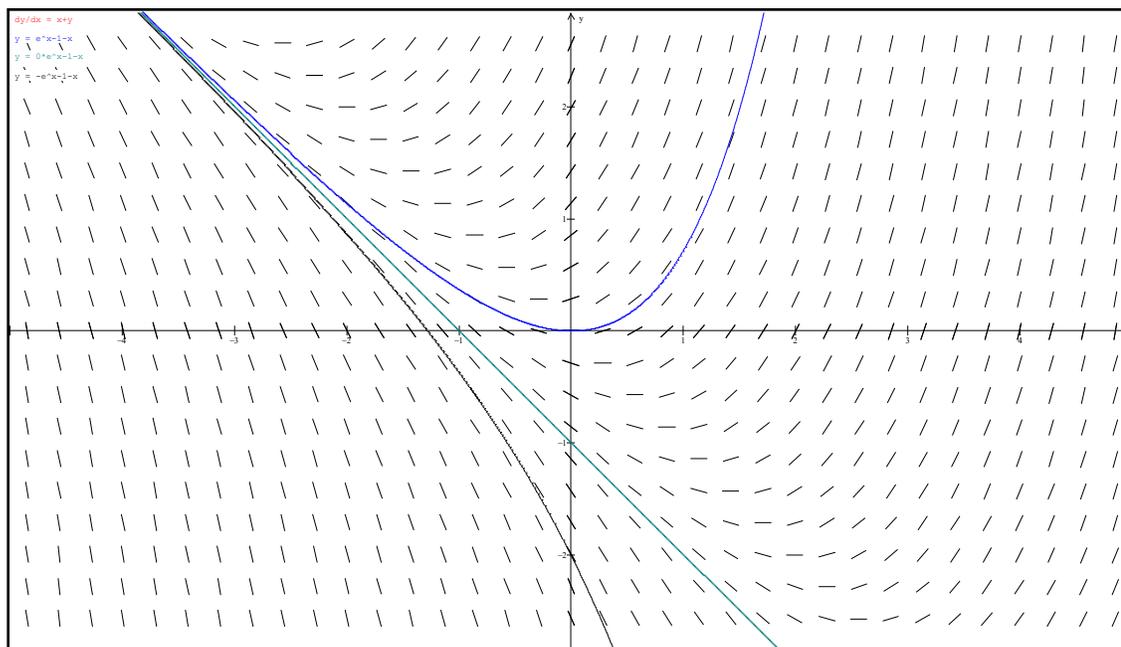


② $\frac{dy}{dx} = 3x^2 - 4$; $y(0)=-1$

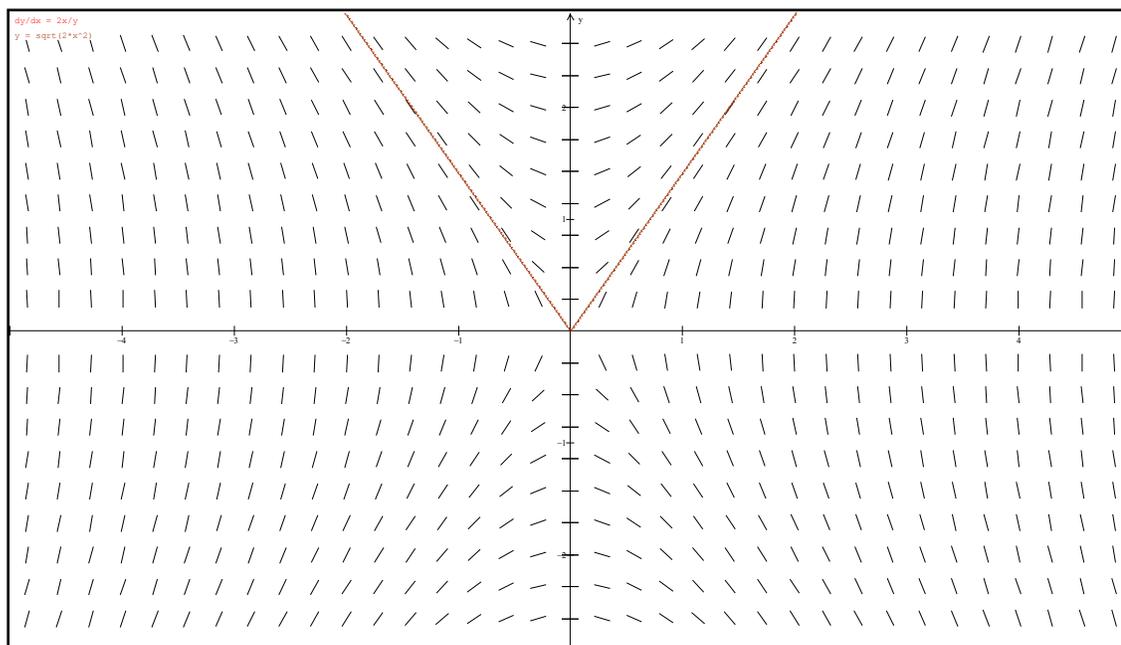


③ $\frac{dy}{dx} = x + y$; $y(0)=1$

⇒ General solution: $y = ke^x - 1 - x$



④ $\frac{dy}{dx} = \frac{2x}{y}$; $y(1) = 1$



==END==