

Math 2280-1

Tuesday 26 Aug.

WBB 617 !!

§1.2-1.3

• Solve the murder mystery, example (2); there's space on page 4 of Monday's notes. Hopefully you worked this out overnight.

• Discuss (3) from Monday notes, the oscillator model (mass-spring) on page 2.

Then begin §1.2-1.3: A 1st order D.E. is an equation $F(x, y, \frac{dy}{dx}) = 0$.

e.g. $x y + (y')^2 = 0$

can usually use algebra to rewrite as

$$\frac{dy}{dx} = f(x, y)$$

If we also want to specify

$$y(x_0) = y_0$$

Then the DE together with the specified y-value ("initial value") is called an initial value problem:

$$\text{IVP} \begin{cases} \frac{dy}{dx} = f(x, y) \\ y(x_0) = y_0 \end{cases}$$

example 1 :

$$\text{IVP} \begin{cases} \frac{dy}{dx} = x-3 \\ y(1) = 2 \end{cases}$$

Notice: this DE is of the form $y' = f(x)$

(y' only depends on x , not also on $y(x)$)
(such DE's are focus of §1.2)

You can solve this IVP by antidifferentiation:

ans: $y = \frac{x^2}{2} - 3x + \frac{9}{2}$

example 2

$$\text{IVP} \begin{cases} \frac{dy}{dx} = y-x \\ y(0) = 0 \end{cases}$$

} magic (actually §1.5) (not §1.2)
 $y = x+1 + Ce^x$ solves DE

check:

solve IVP:

ans: $y = x+1 - e^x$

slope fields

for any D.E. of the form

$$(*) \quad \frac{dy}{dx} = f(x,y)$$

geometric interpretation of (*):

If $y(x)$ solves (*), the

slope of its graph $y=y(x)$ at $(x,y(x))$

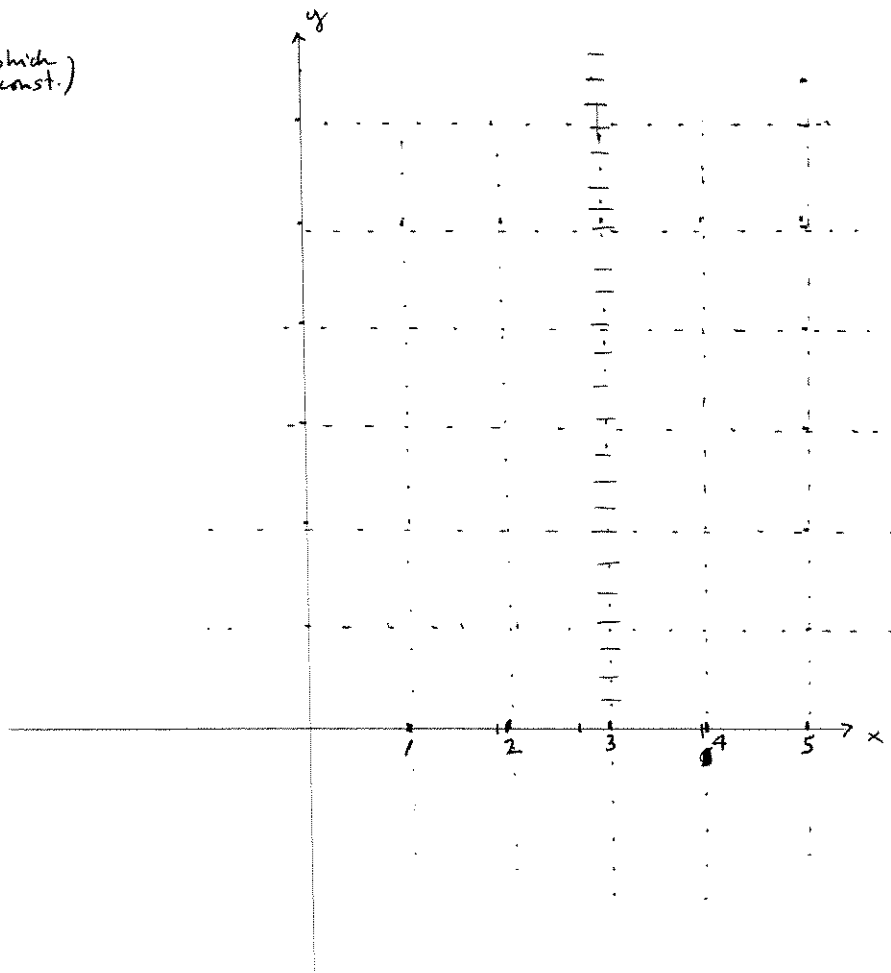
is determined by the point $(x,y(x))$, i.e. slope = $f(x,y)$

So if you draw a picture of the slope field $m=f(x,y)$ in the x - y plane, solution graphs $y=y(x)$ will be tangent to the field.

example 1 : • draw the slope field corresponding to the DE $\frac{dy}{dx} = x-3$; i.e. $m(x,y) = x-3$

• sketch the IVP sol'n from page 1 onto this slope field.

slope value m	equation of corresponding isocline (curve on which slope is const.)
0	$x-3=0$ or $x=3$
1	$x=4$
2	$x=5$
-1	$x-3=-1$ or $x=2$
-2	$x=1$



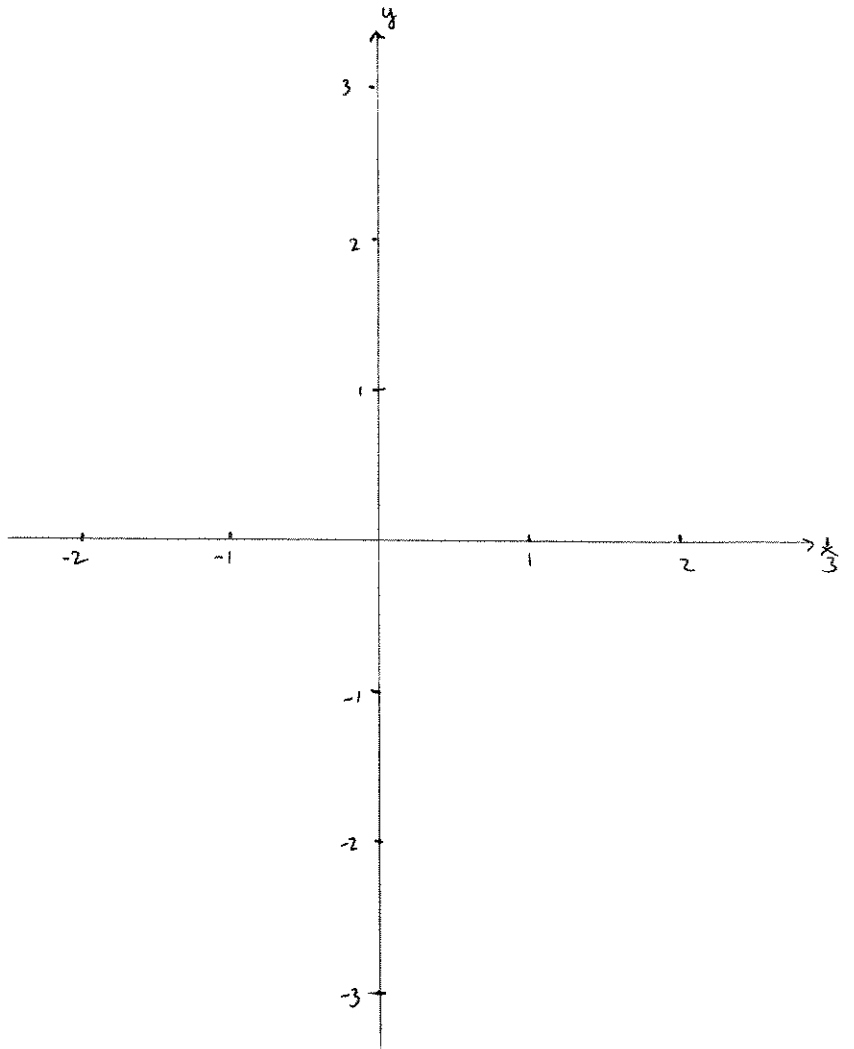
example 2

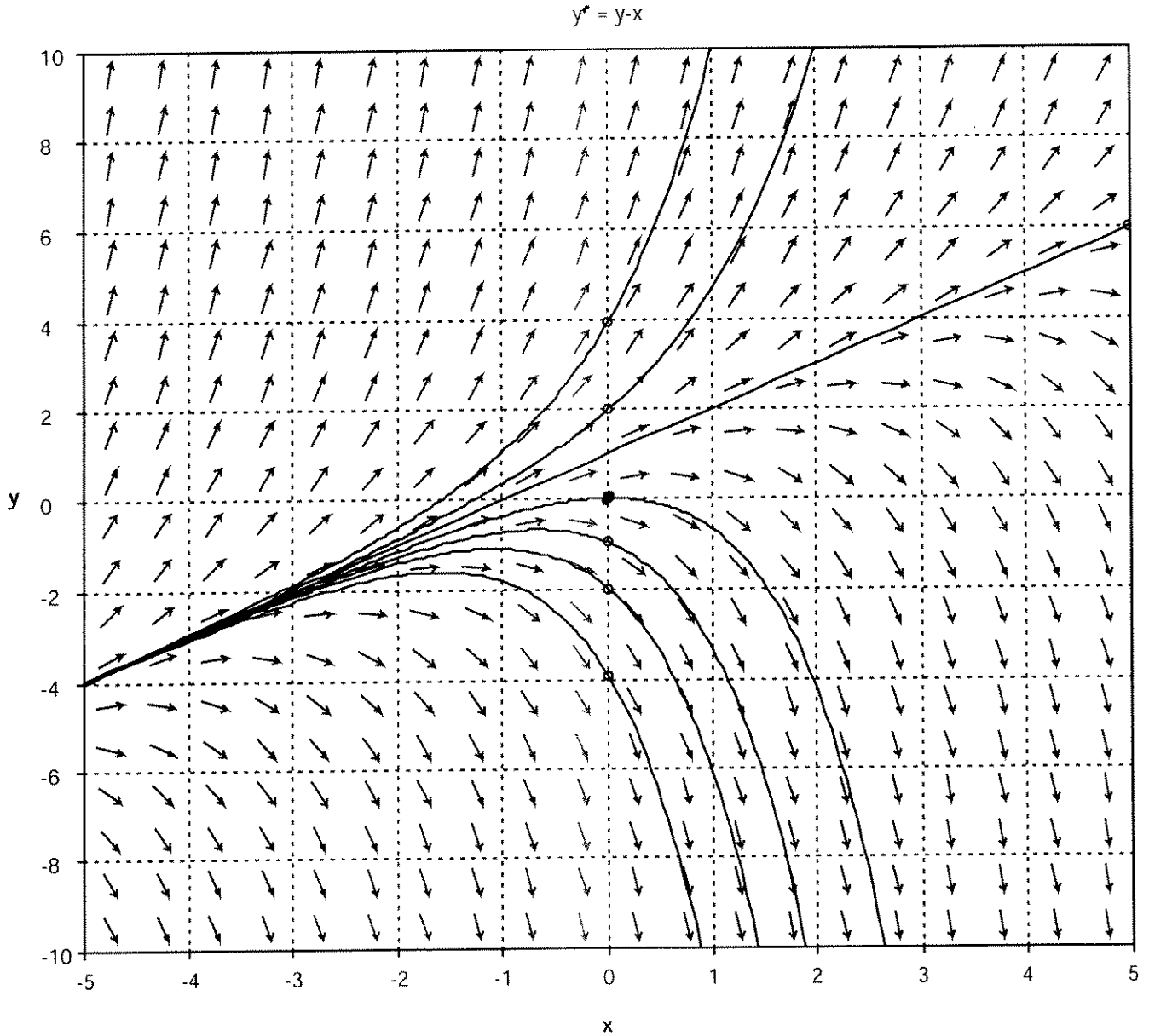
Make the slope field picture
for example 2,

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

Then sketch the IVP solution
onto the slope field

slope value	isocline equation
0	
1	
-1	
2	
-2	





java applet to draw slope fields

<http://math.rice.edu/~dfield/dfpp.html>

or google "dfield"
(or "pplane").

- trouble printing from math dept. system,
but try your P.C. (or ones in Marriott).