

# MATH

Feb 20<sup>th</sup>

$$\frac{dy}{dx} = F(x, y) \leftarrow \text{tells you the slope of the solution}$$

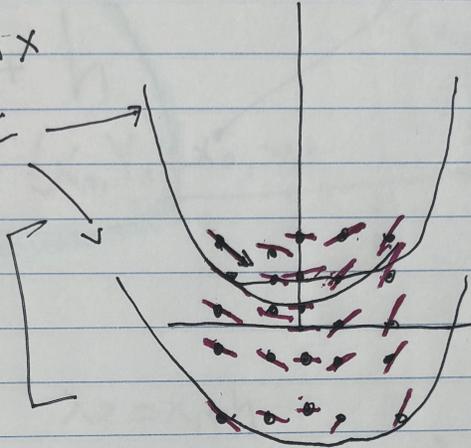


Exp 1  $\frac{dy}{dx} = 2x$

$$dy = 2x dx$$

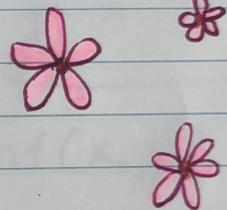
$$y = x^2 + C$$

Slope Field



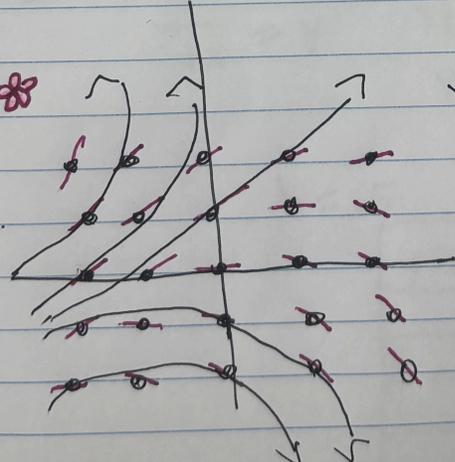
	x				
	-2	-1	0	1	2
2	-4	-2	0	2	4
1	-4	-2	0	2	4
0	-4	-2	0	2	4
-1	-4	-2	0	2	4
-2	-4	-2	0	2	4

slope field chart



Exp 2

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



	x				
	-2	-1	0	1	2
2	4	3	2	1	0
1	3	2	1	0	-1
0	2	1	0	-1	-2
-1	1	0	-1	-2	-3
-2	0	-1	-2	-3	-4

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## slope fields

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

$$y(x_0) = y_0$$

step size h

$$y(?) =$$

$$X_{n+1} = X_n + h$$

$$Y_{n+1} = Y_n + h F(x_n, y_n)$$

$(x_1, y_1)$

$$x_1 = x_0 + h$$

$$y_1 = y_0 + k$$

$$\frac{k}{h} = F(x_0, y_0)$$

$$x_2 = x_1 + h$$

$$y_2 = y_1 + h F(x_1, y_1)$$

$$k = h f(x_0, y_0)$$

$$y_1 = y_0 + h f(x_0, y_0)$$

EXP 3

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

$$y(0) = 1$$

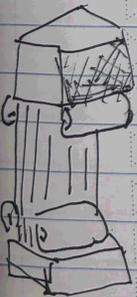
$$y(1) = ?$$

$$h = .5$$

x	y	F(x, y)	hf(x, y)
0	1	1	0.5
0.5	1.5	1.5	0.75
1	2.25	2.25	

$y + hF(x, y)$
1.5
2.25

$$y(1) \approx 2.25$$



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## slope fields

EXP 4

the more steps  
the more accuracy

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

$$y(0) = 1$$

$$y(1) = ?$$

$$h = .1$$

x	y	f(x,y)	hf(x,y)	y + hf
0	1	1	.1	1.1
0.1	1.1	1.1	.11	1.21
0.2	1.21	1.21	.121	1.331
0.3	1.331	1.331	.133	1.464
1	2.59			

$$y(1) \approx 2.59$$

when  $h = 0.1$

$$\frac{dy}{dx} = y \quad \int \frac{1}{y} dy = \int dx$$

$$e^{\ln y} = e^{x+c} \rightarrow y = ce^x$$

$$y = e^x \quad y(0) = e = 2.7$$

logistic growth on monday