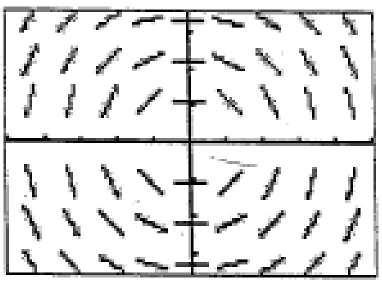
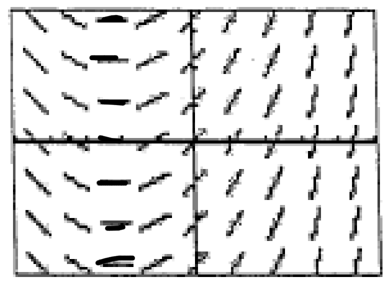
Opener

Match the slope fields with their differential equations.

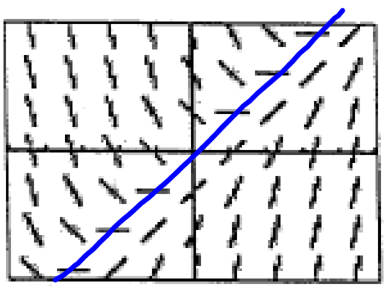
(A)



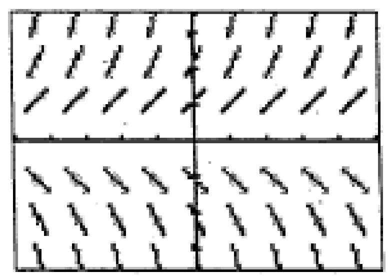
(B)



(C)



(D)



15. $\frac{dy}{dx} = \frac{1}{2}x + 1$ B

$\frac{1}{2}x + 1 = 0$

$\frac{1}{2}x = -1$

$x = -2$

16. $\frac{dy}{dx} = y$ D

17. $\frac{dy}{dx} = x - y$ C

18. $\frac{dy}{dx} = -\frac{x}{y}$ A

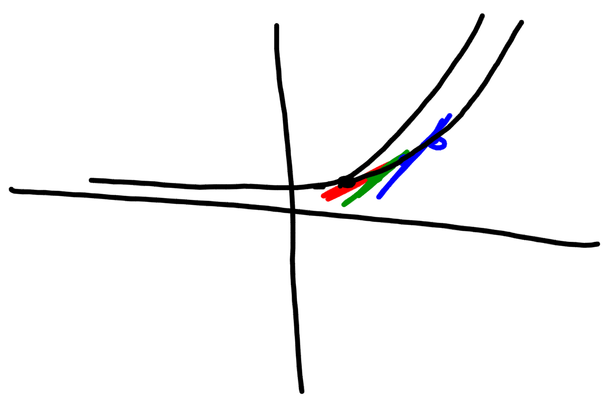
Dec 11-8:06 PM

6-1 day 3 Euler's Method

Learning Objectives:

I can use Euler's Method to estimate the value of a function a given point

Euler's Method is a way to create the graph of a function given its derivative and a point on the graph. This is meant to be used when you can't find the antiderivative of the function.



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

ic (x, y)

Dec 10-7:47 AM

Euler's Method

1. Begin w/point (x,y) specified by the initial condition. This MUST be a point on the graph of f(x).
2. Use the differential equation to find the slope of the tangent line at (x,y)
3. Increase x by some small amount (Δx).
4. Calculate Δy using the formula $\Delta y = \frac{dy}{dx} \cdot \Delta x$
5. This defines a new point (x+Δx, y+ Δy) which is not on the graph of f(x) but on the tangent line and is "sufficiently close" to f(x).
6. Use this new point and repeat steps 1-3.

   NOTE: To construct the approximation of the graph of f(x) to the left of x, use negative values of Δx.

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Ex1. Let f be the function with derivative $\frac{dy}{dx} = x - y$ with initial condition (0,1). Use Euler's Method and increments of $\Delta x = .1$ to approximate f(1)

(x, y)	dy/dx	Δx	$\Delta y = \frac{dy}{dx} \cdot \Delta x$	$(x + \Delta x, y + \Delta y)$
(0,1)	−1	.1	−.1	(.1, .9)
(.1, .9)	−.8	.1	−.08	(.2, .82)
(.2, .82)				

B
D
C
A

Euler's Method - to create a graph of a function given its derivative & a point on the graph

(x,y)	dy/dx	Δx	$\Delta y = \frac{dy}{dx} \Delta x$	(x+Δx, y+Δy)
(0,1)	−1	0.1	−0.1	(0.1, 0.9)
(0.1, 0.9)	−0.8	0.1	−0.08	(0.2, 0.82)
(0.2, 0.82)	−0.62	0.1	−0.062	(0.3, 0.758)
(0.3, 0.758)	−0.458	0.1	−0.0458	(0.4, 0.7122)
(0.4, 0.7122)	−0.3122	0.1	−0.03122	(0.5, 0.68098)
(0.5, 0.68098)	−0.18098	0.1	−0.01810	(0.6, 0.66288)
(0.6, 0.66288)	−0.06288	0.1	−0.006288	(0.7, 0.6566)
(0.7, 0.6566)	0.0434	0.1	0.00434	(0.8, 0.66094)
(0.8, 0.66094)	0.13906	0.1	0.13906	(0.9, 0.67485)
(0.9, 0.67485)	0.22515	0.1	0.02252	(1.0, 0.69737)

$f(1) \approx .697$

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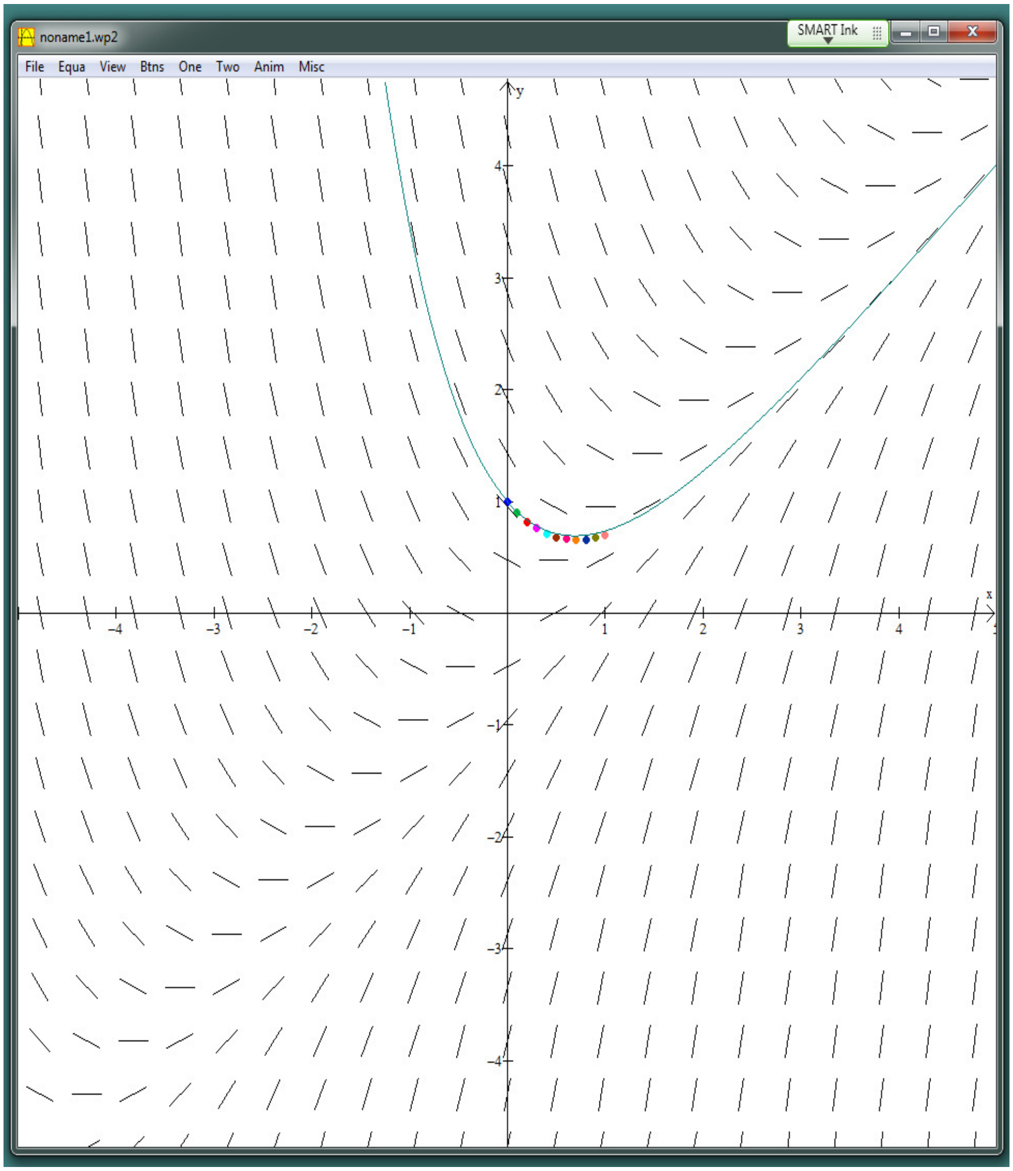
noname1.wp2
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y
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3
2
1
-1
-2
-3
-4

Dec 12-9:29 AM

Ex2. Given the differential equation $\frac{dy}{dx} = e^{xy}$ with initial condition (0,1). Use Euler's Method and increments of Δx=.2 to approximate f(-1)

(x, y)	dy/dx	Δx	$\Delta y = \frac{dy}{dx} \cdot \Delta x$	$(x+\Delta x, y+\Delta y)$
(0,1)				

$\frac{dy}{dx} = e^{xy}$ (0,1) Δx = .2

(x, y)	$\frac{dy}{dx}$	Δx	Δy	(x, y)
(0,1)	1	-.2	-.2	(-.2, .8)
(-.2, .8)	.85214	-.2	-.17043	(-.4, .62957)
(-.4, .62957)	.77738	-.2	-.15578	(-.6, .47409)
(-.6, .47409)	.75242	-.2	-.15048	(-.8, .32361)
(-.8, .32361)	.77191	-.2	-.15438	(-1, .16923)

f(-1) ≈ .169

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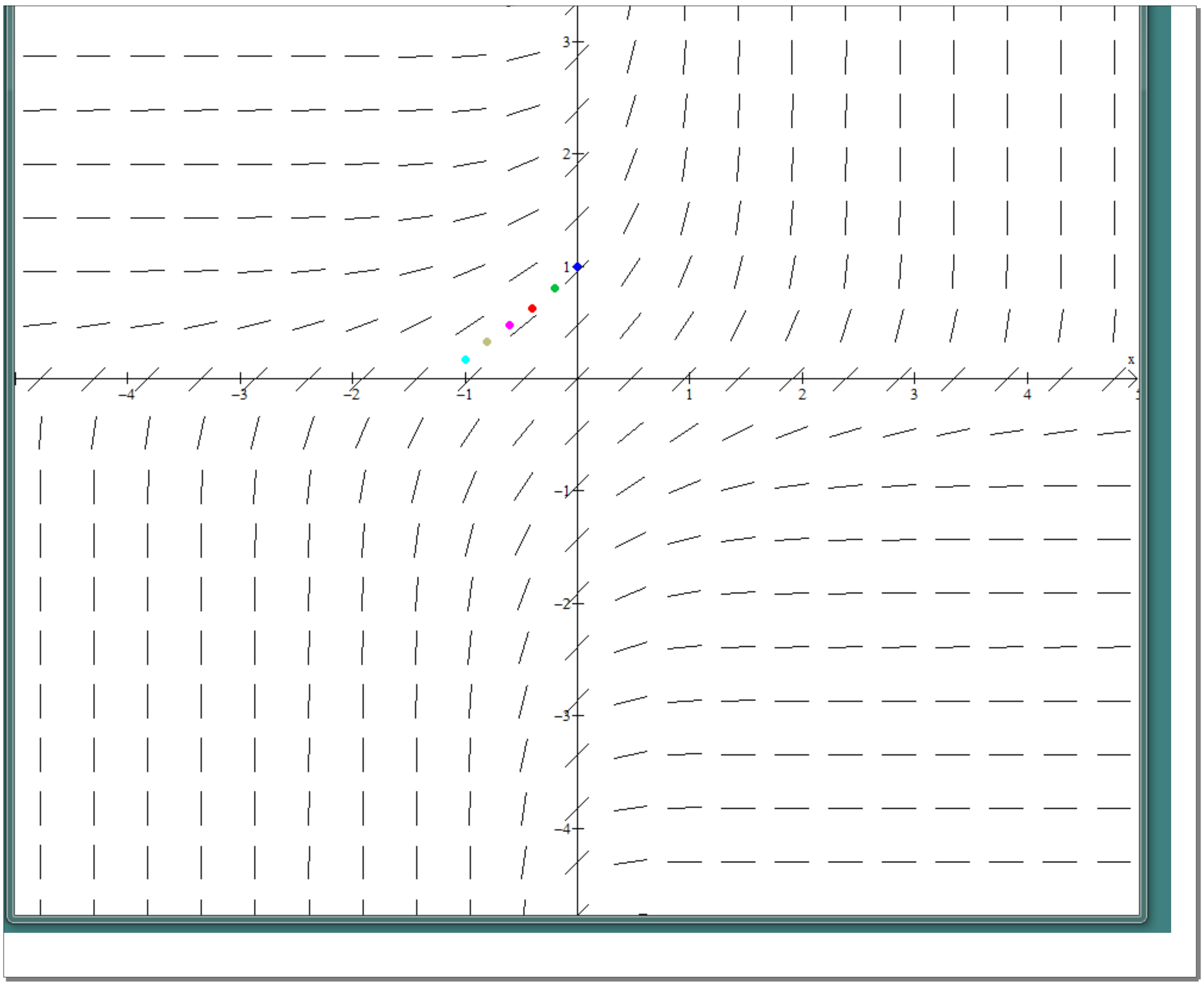

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Homework

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