Today

- Midterm - pick up M 2-2:45, 4-5, W11-12:30, 2-3:30.
- More qualitative analysis of DEs

Midterm 2

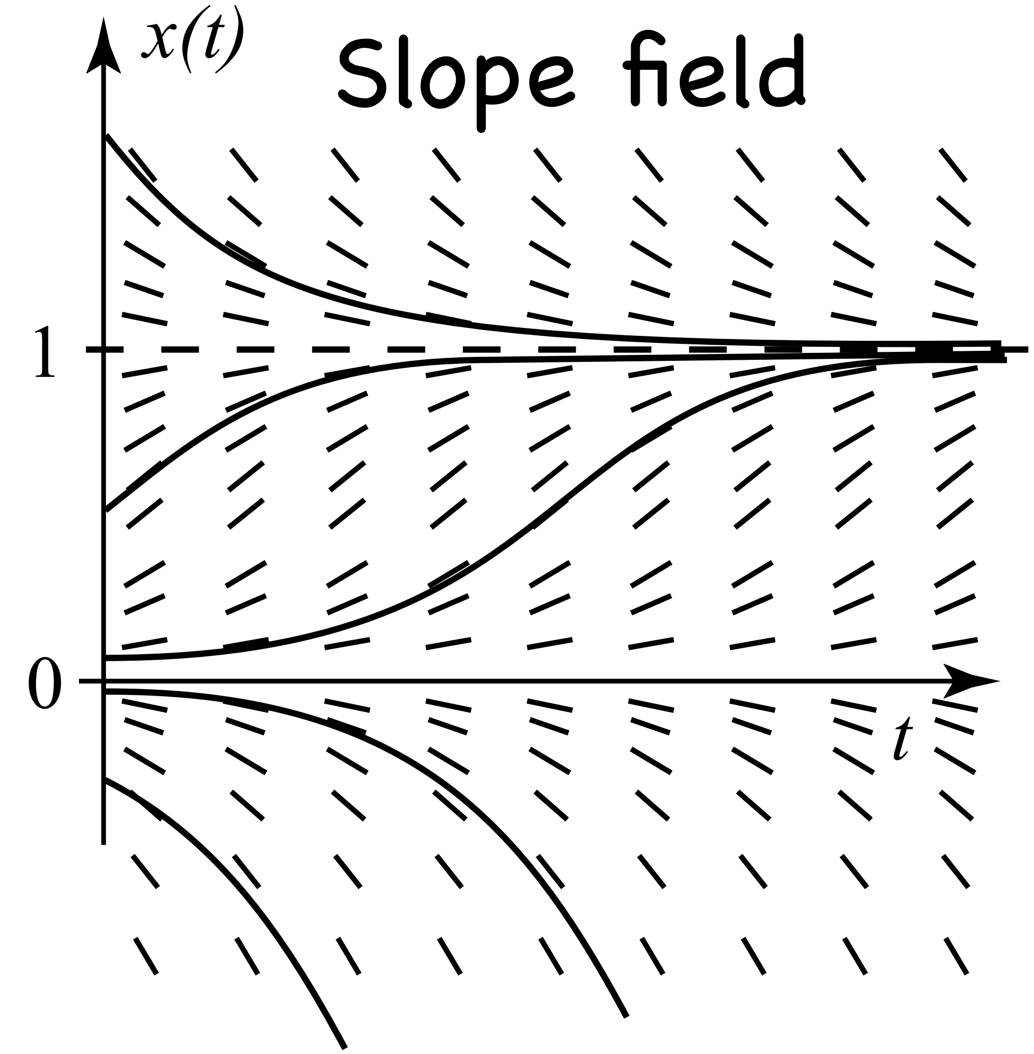
	Points	Percent
MC	3.7 / 6	62%
SAP (pg 1)	6.2 / 8	77%
SAP (pg 2)	5.1 / 8	64%
LAP 1	5.4 / 7	77%
LAP 2	8.4 / 14	60%
LAP 3	6.1 / 7	88%
Overall	35 / 50	70%

Midterm 2

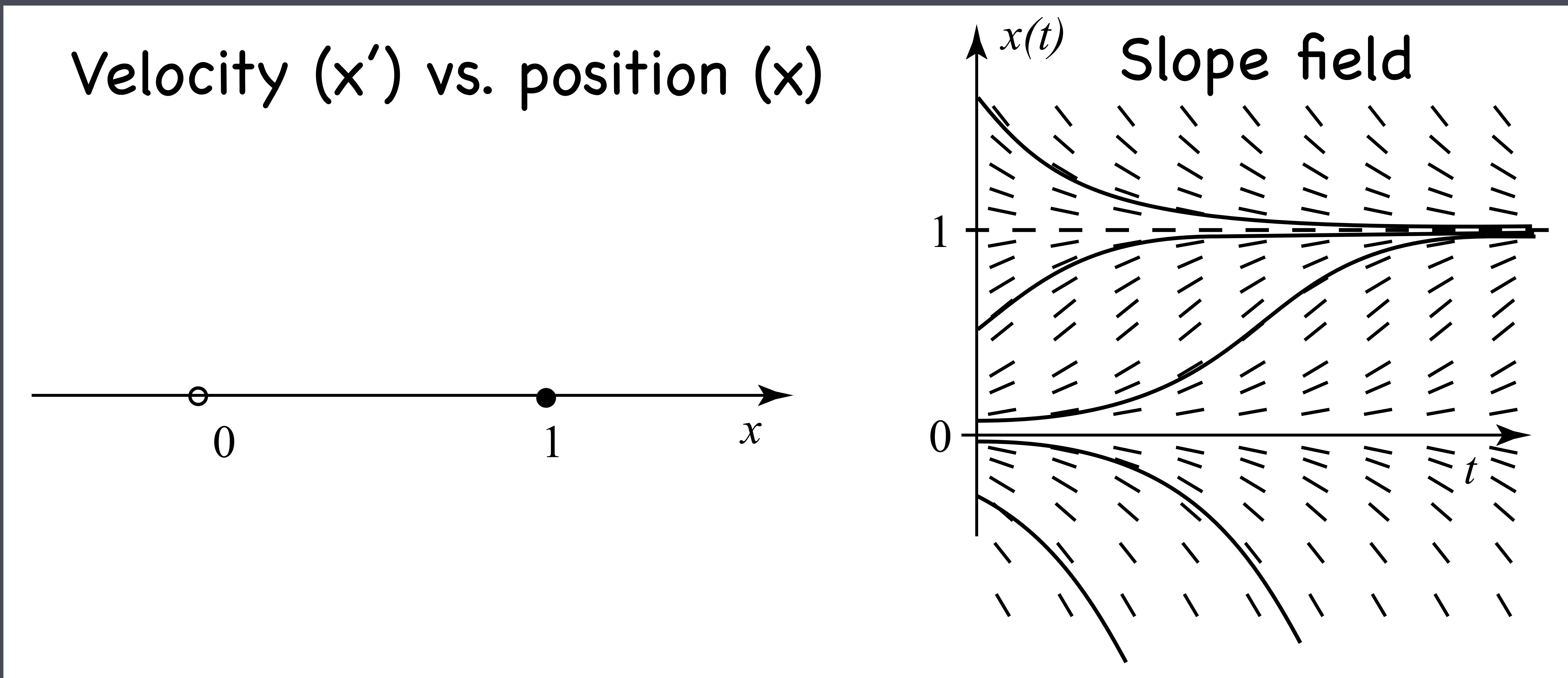
	Points	Percent
MC	3.2 / 6	53%
SAP (pg 1)	5.9 / 8	74%
SAP (pg 2)	4.8 / 8	60%
LAP 1	5.1 / 7	72%
LAP 2	7.5 / 14	53%
LAP 3	5.6 / 7	80%
Overall	32 / 50	64%

Velocity versus position

Velocity (x′) vs. position (x)



Velocity versus position



Velocity versus position

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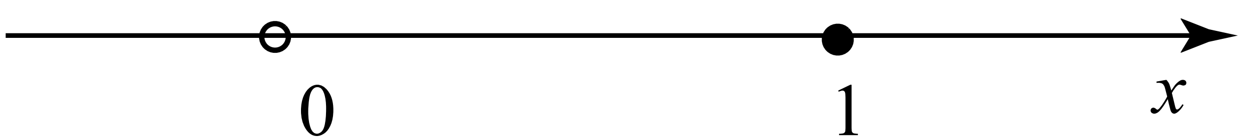
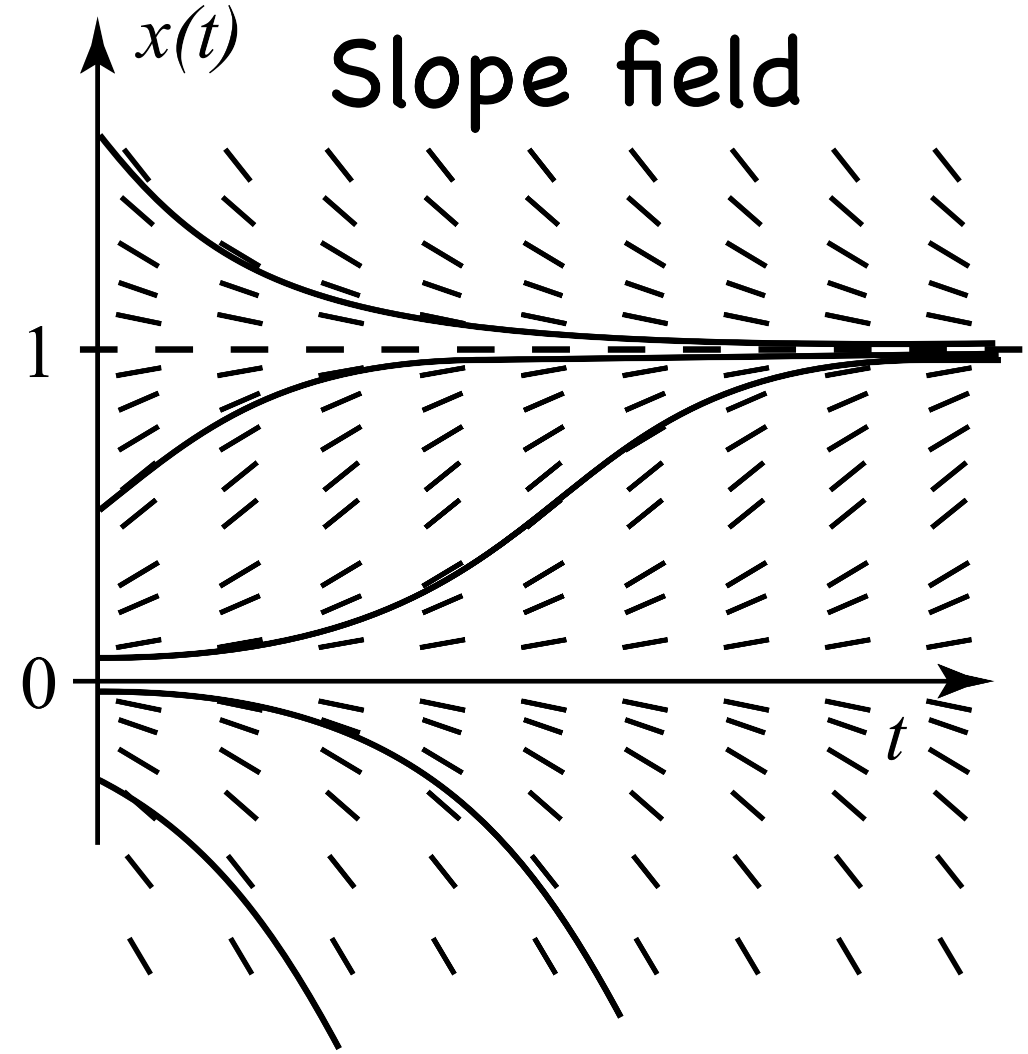
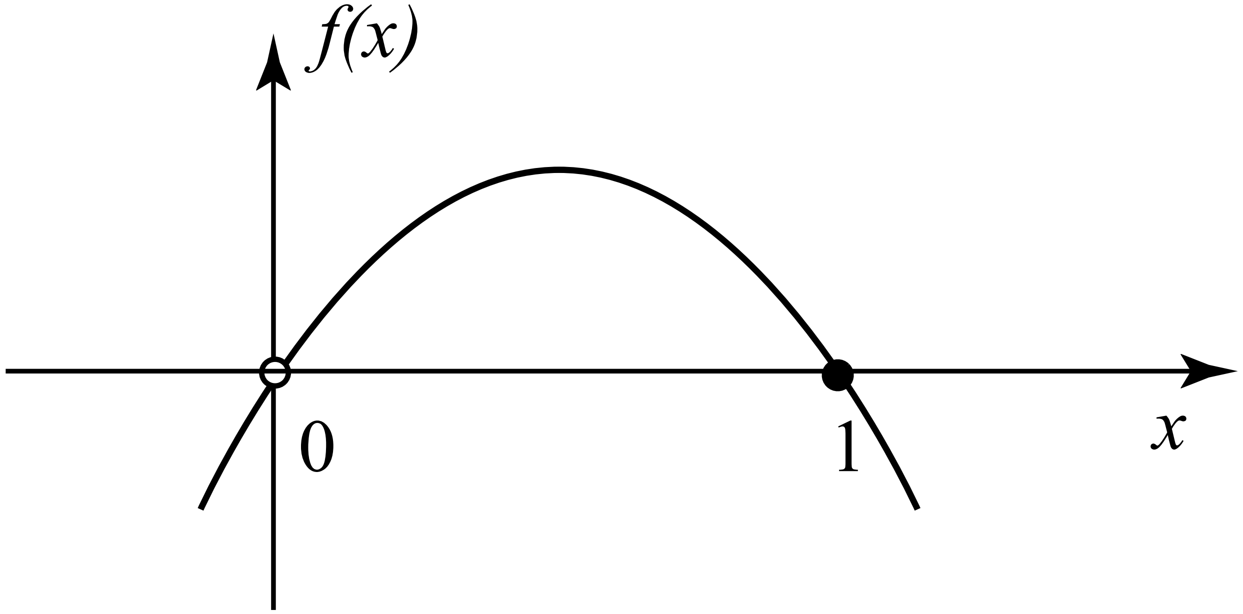




$$x' = f(x) = x(1-x)$$

Velocity versus position

Velocity (x′) vs. position (x)



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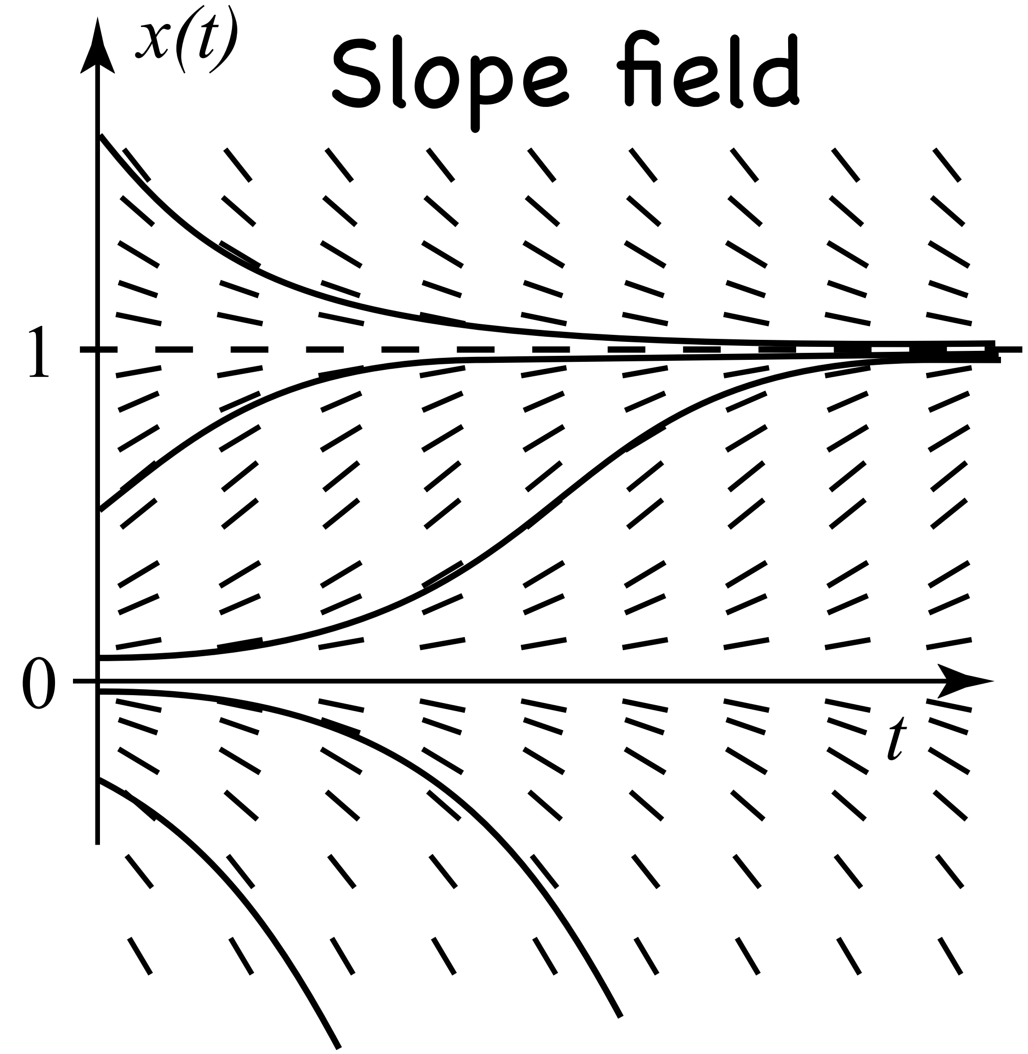

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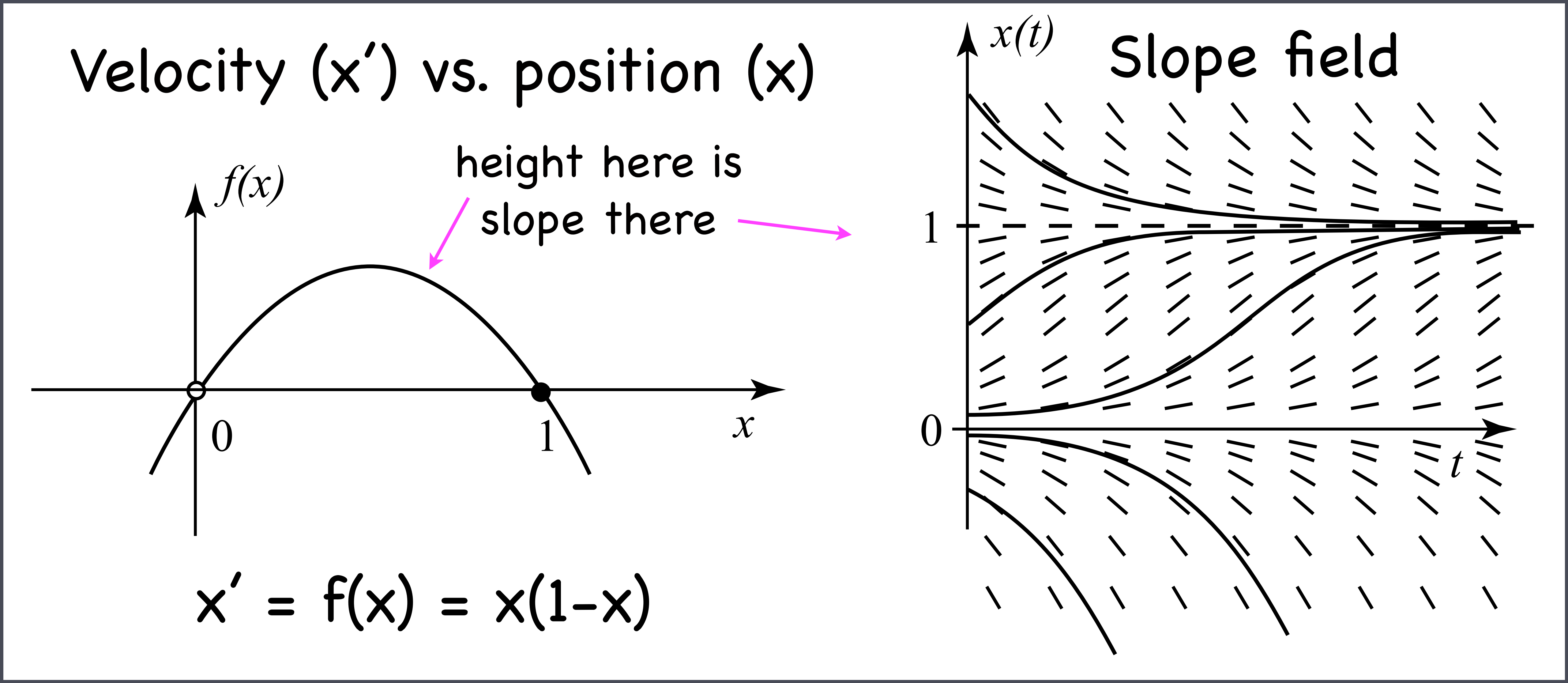
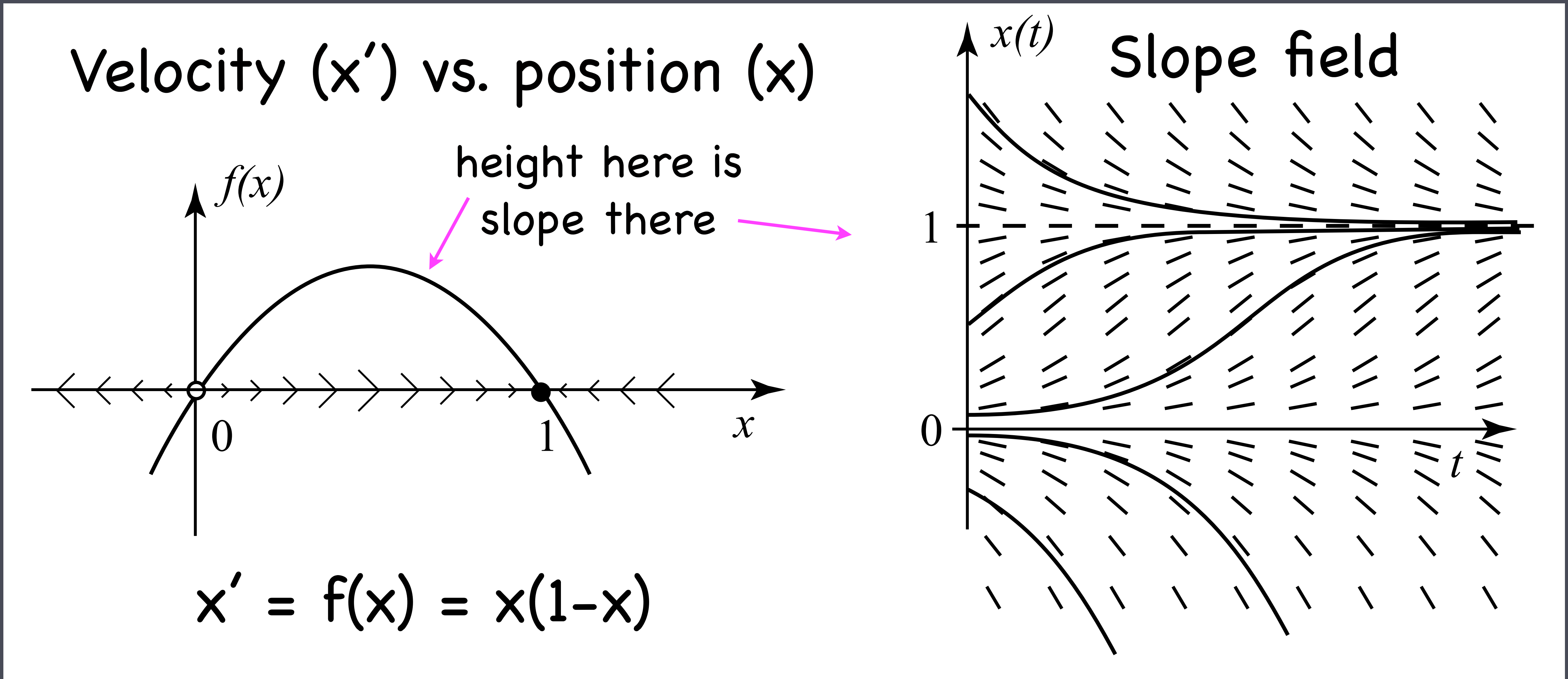
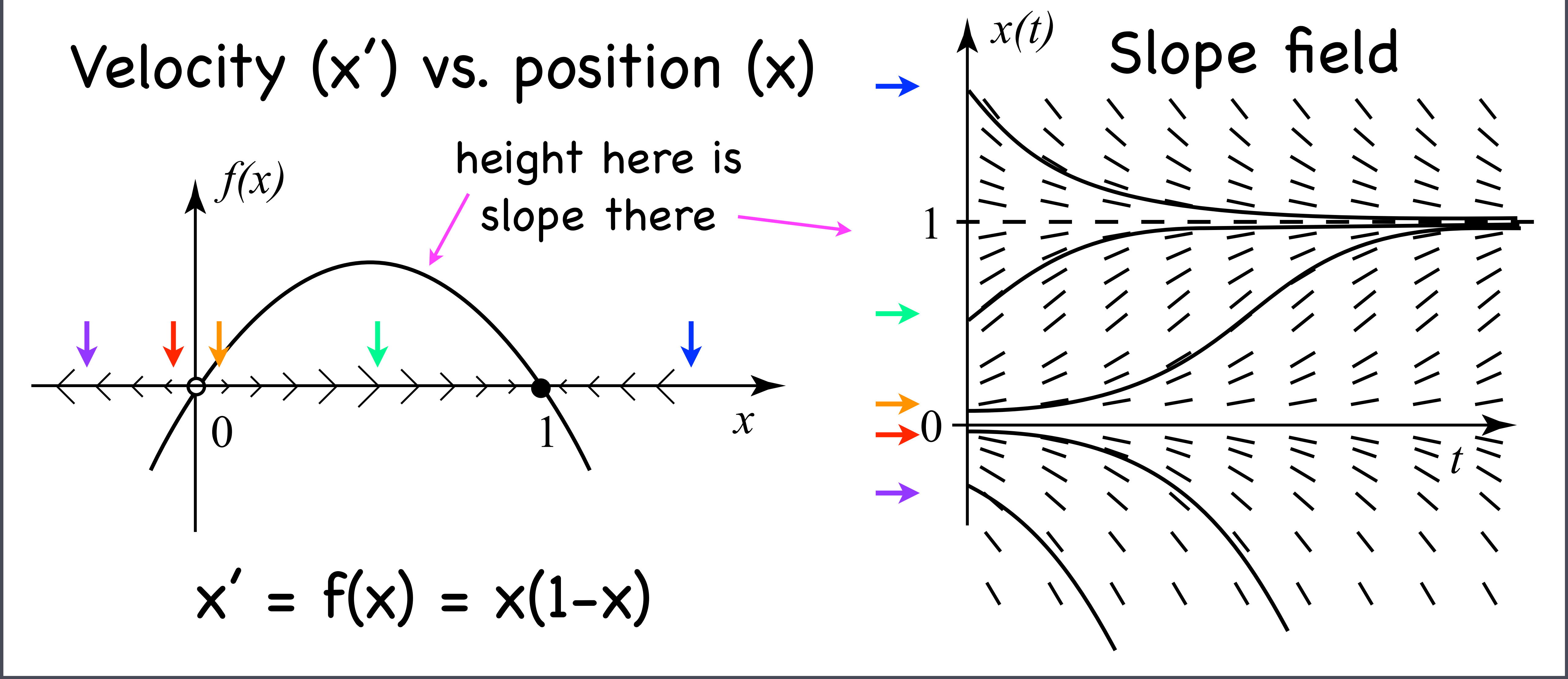


Velocity versus position



Velocity versus position



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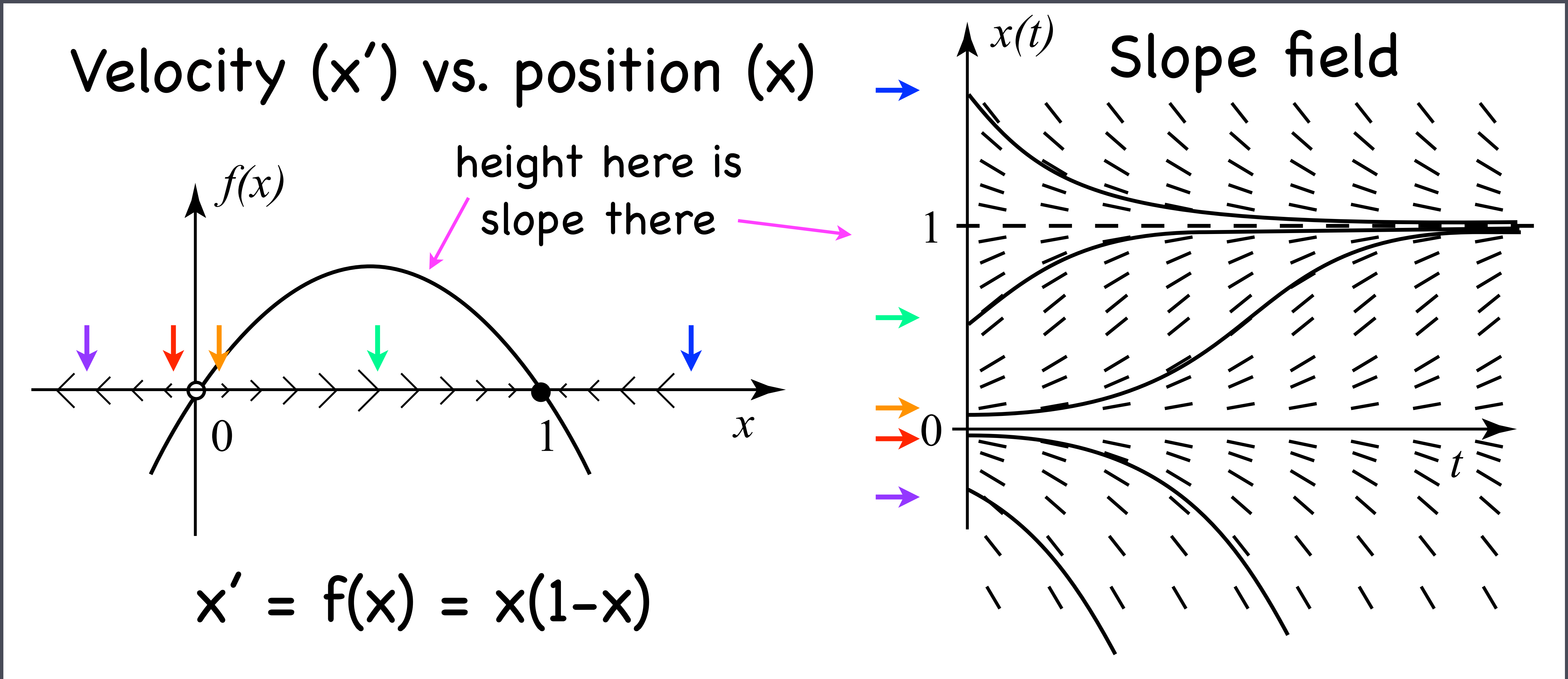
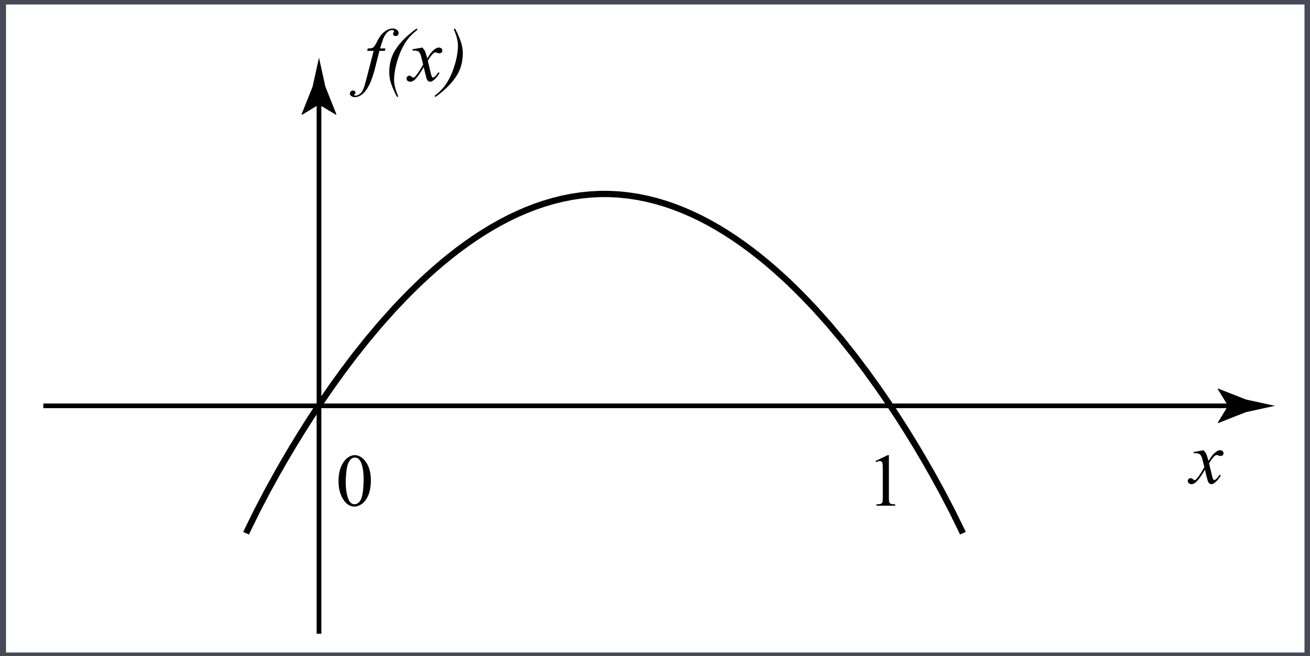


Stable steady state- all nearby solutions approach

Unstable steady state - at least one nearby solution leaves

Determine stability

$$x' = x(1-x)$$



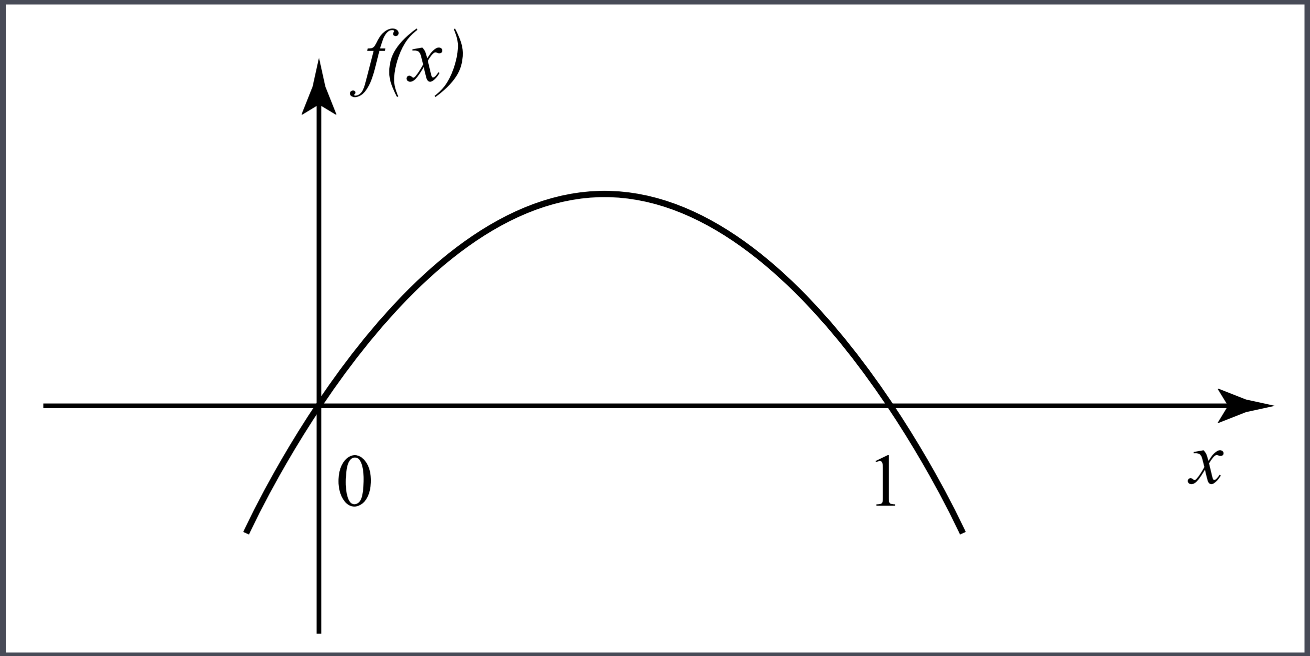
- If you start at x(0) = -0.01, the solution

(A) increases

(B) decreases

Determine stability

$$x' = x(1-x)$$



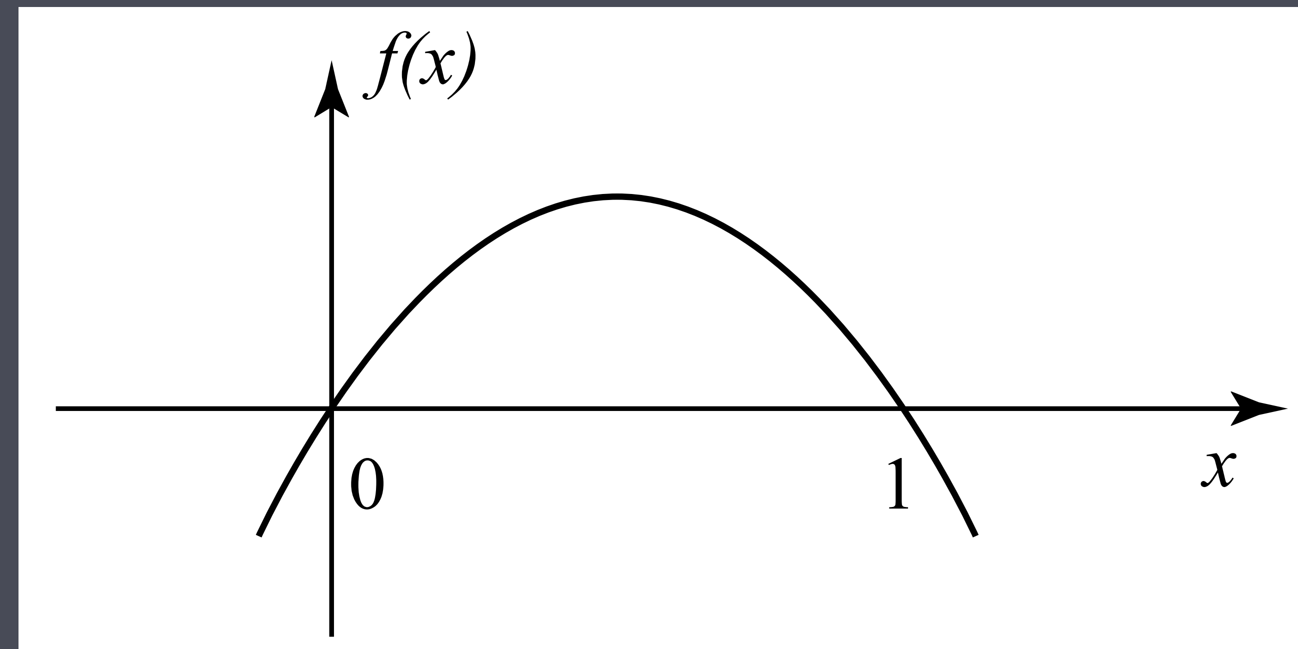
- If you start at x(0) = 0.01, the solution

(A) increases

(B) decreases

Determine stability

$$x' = x(1 - x)$$



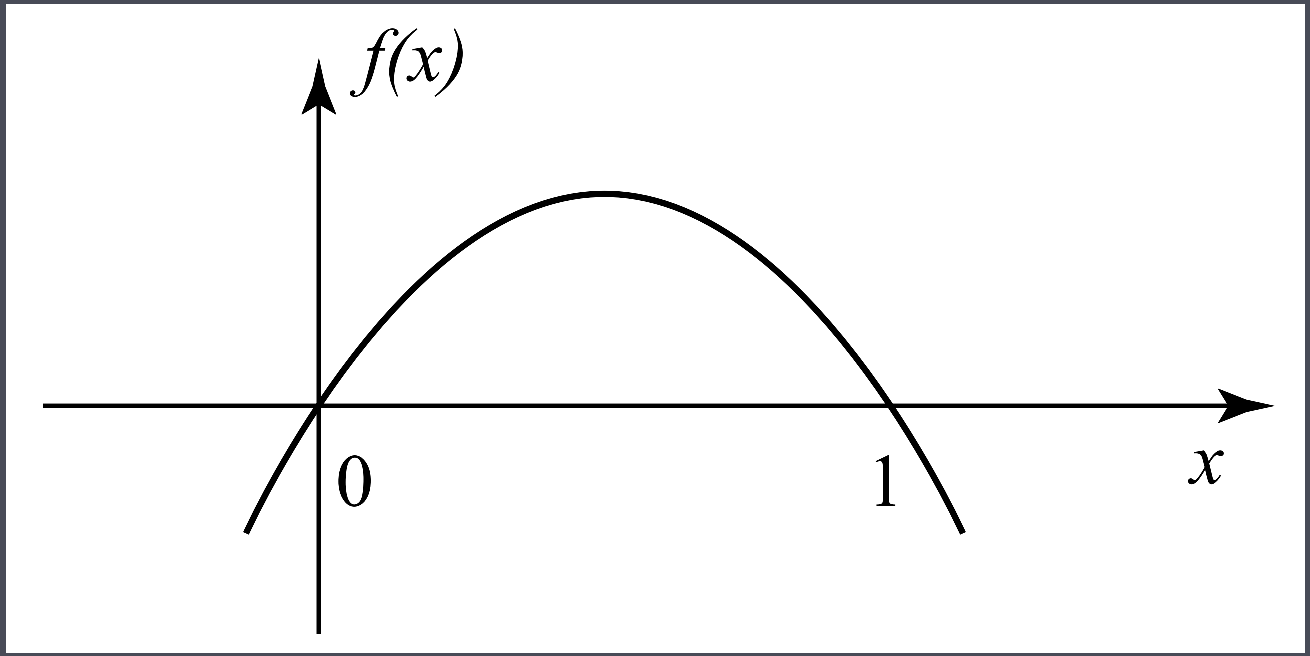
- If you start at x(0) = 0.99, the solution

(A) increases

(B) decreases

Determine stability

$$x' = x(1 - x)$$



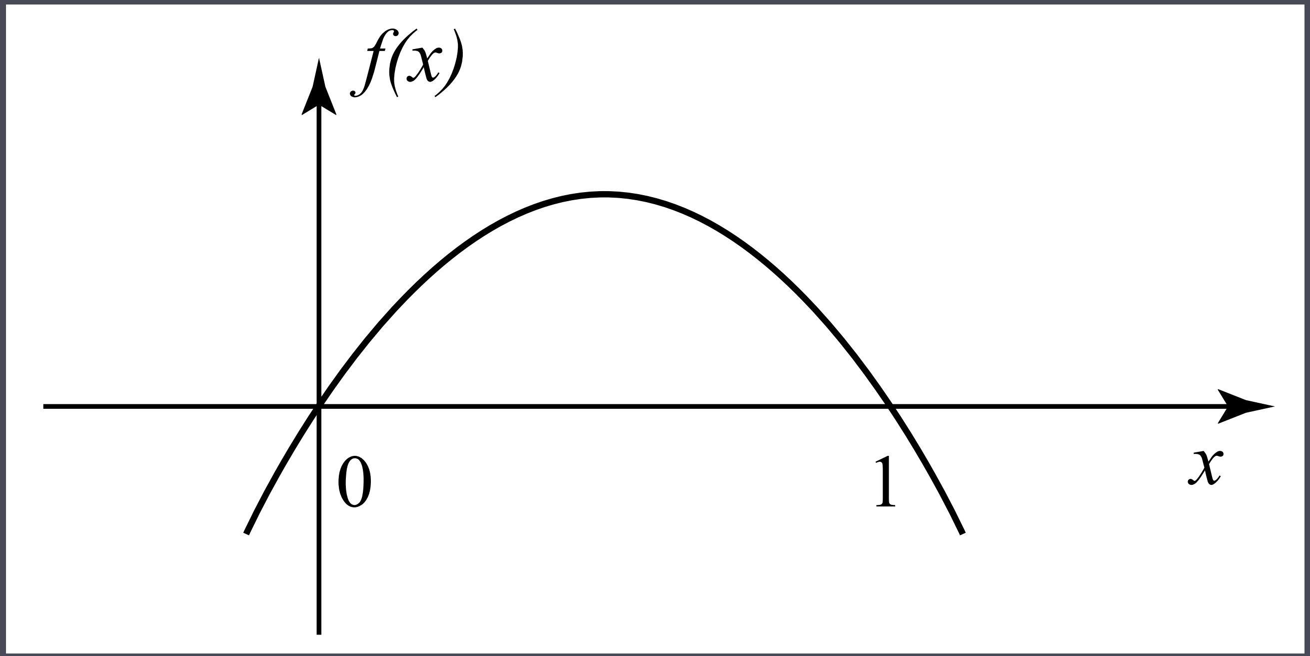
- If you start at x(0) = 1.01, the solution

(A) increases

(B) decreases

Determine stability

$$x' = x(1-x)$$



(A) Both x(t)=0 and x(t)=1 are stable steady states.

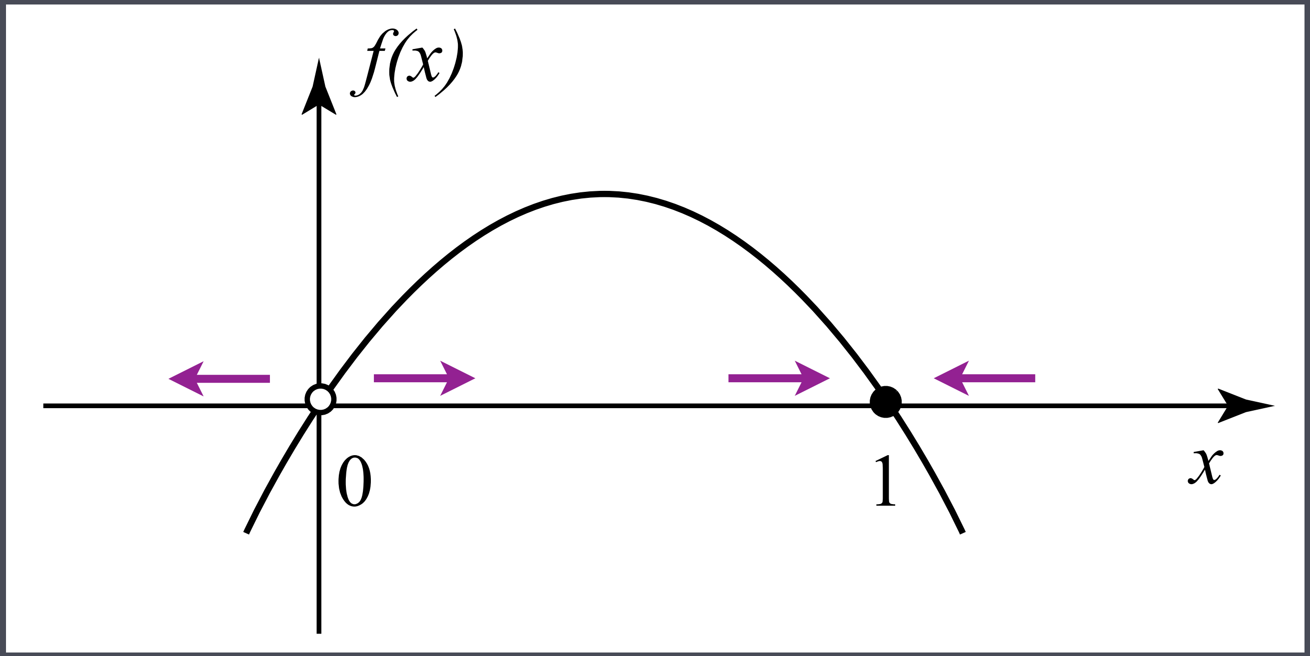
(B) x(t)=0 is stable and x(t)=1 is unstable.

(C) x(t)=0 is unstable and x(t)=1 is stable.

(D) Both x(t)=0 and x(t)=1 are unstable steady states.

Determine stability

$$x' = x(1-x)$$



(A) Both x(t)=0 and x(t)=1 are stable steady states.

(B) x(t)=0 is stable and x(t)=1 is unstable.

(C) x(t)=0 is unstable and x(t)=1 is stable.

(D) Both x(t)=0 and x(t)=1 are unstable steady states.

Stable - solid dot. Unstable - empty dot.

Given that position tells you velocity, i.e. $x'=f(x)$, which of the following is false?

(A) A solution $x(t)$ cannot have a local max (as a function of t).

(B) If $x(t)$ is a solution then so is $y(t)=x(t-c)$.

(C) If $x(t)$ is a solution then so is $y(t)=x(t)+C$.

(D) If $x(t)$ and $y(t)$ are two different solutions, they cannot cross.

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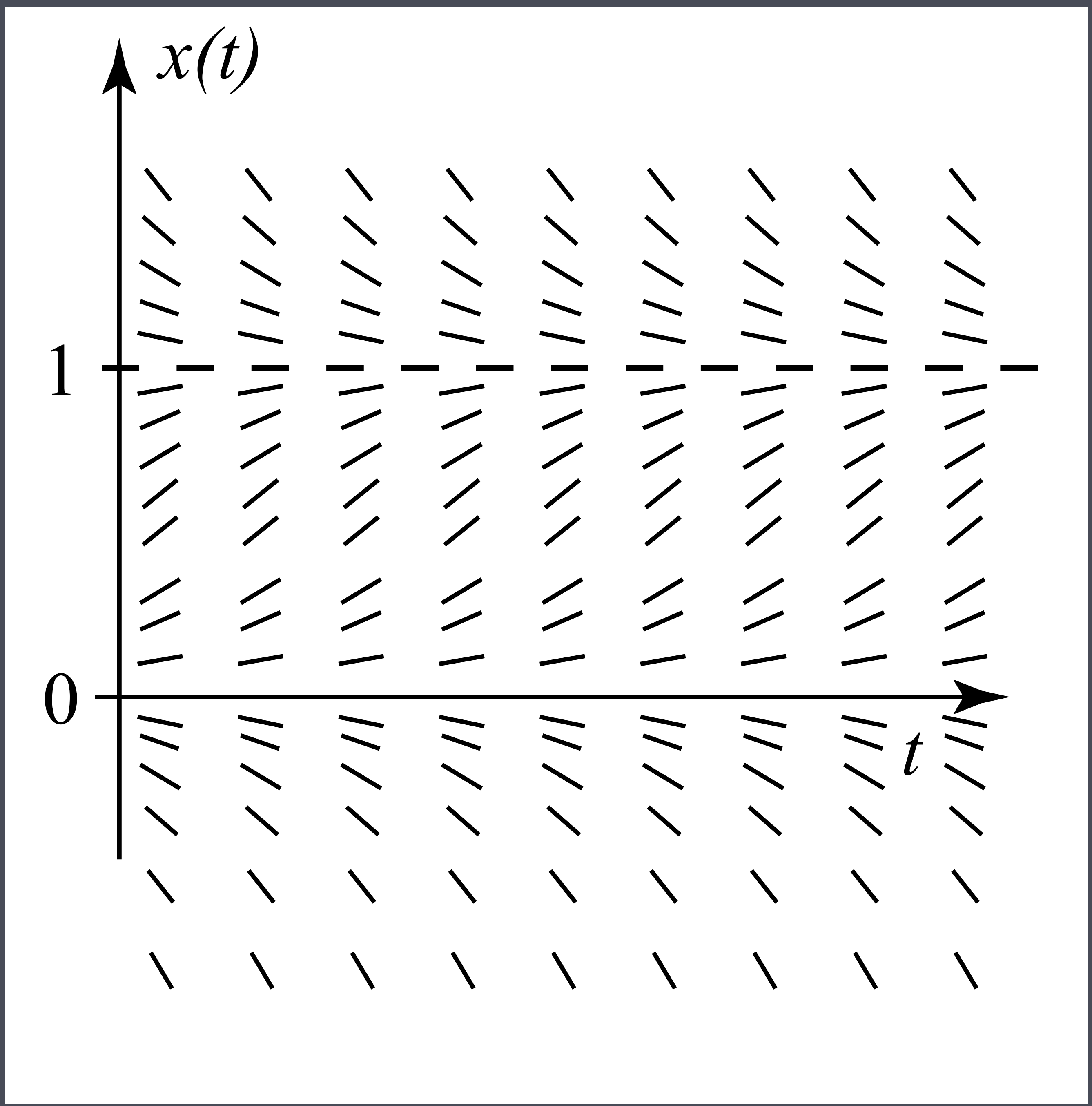

(A) A solution x(t) to x′=f(x) cannot have a local max (as a function of t).

(B) If x(t) is a solution then so is y(t)=x(t−c).

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This is only true for "nice" functions f(x) like the ones we usually talk about in Math 102.

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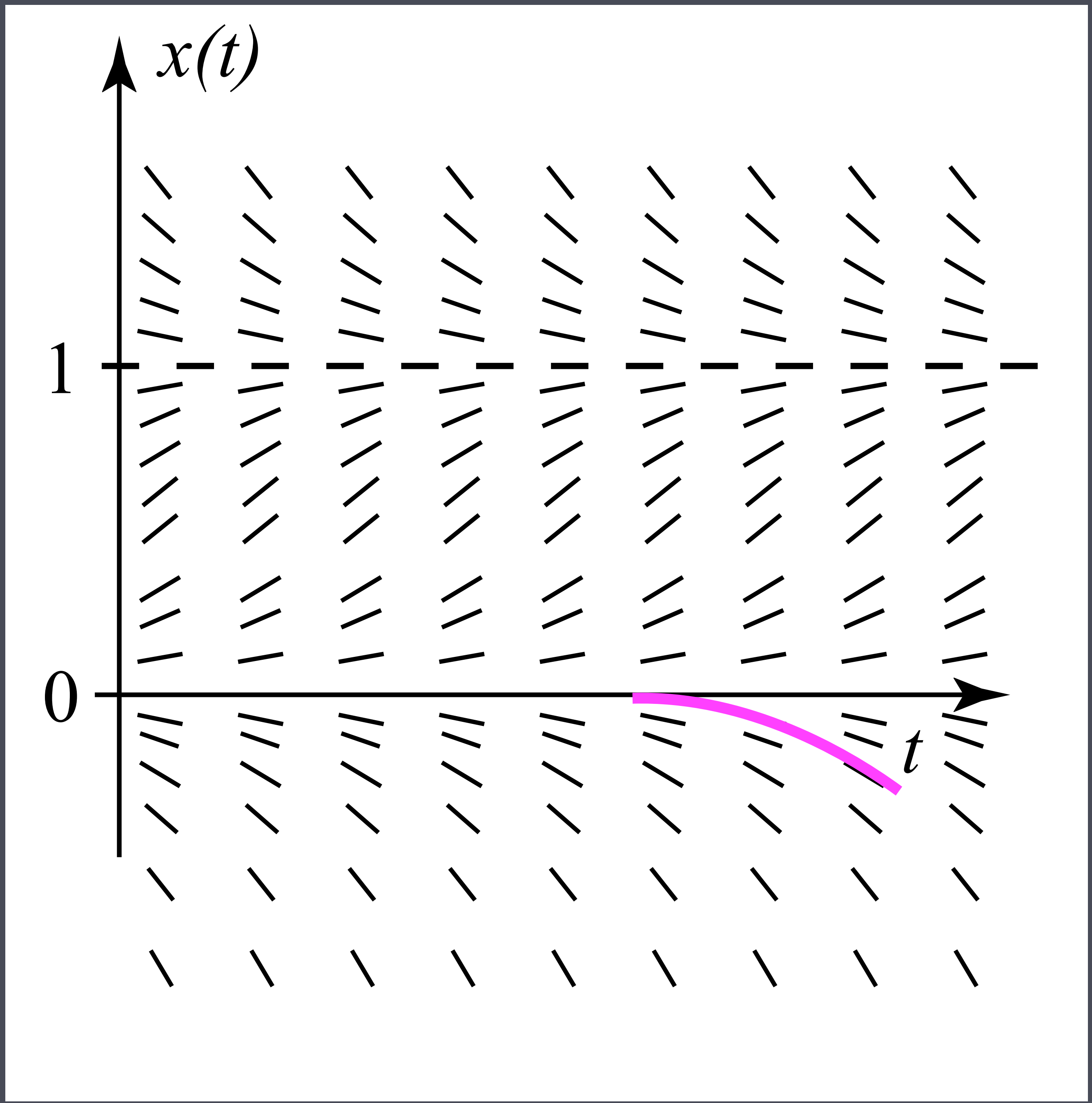

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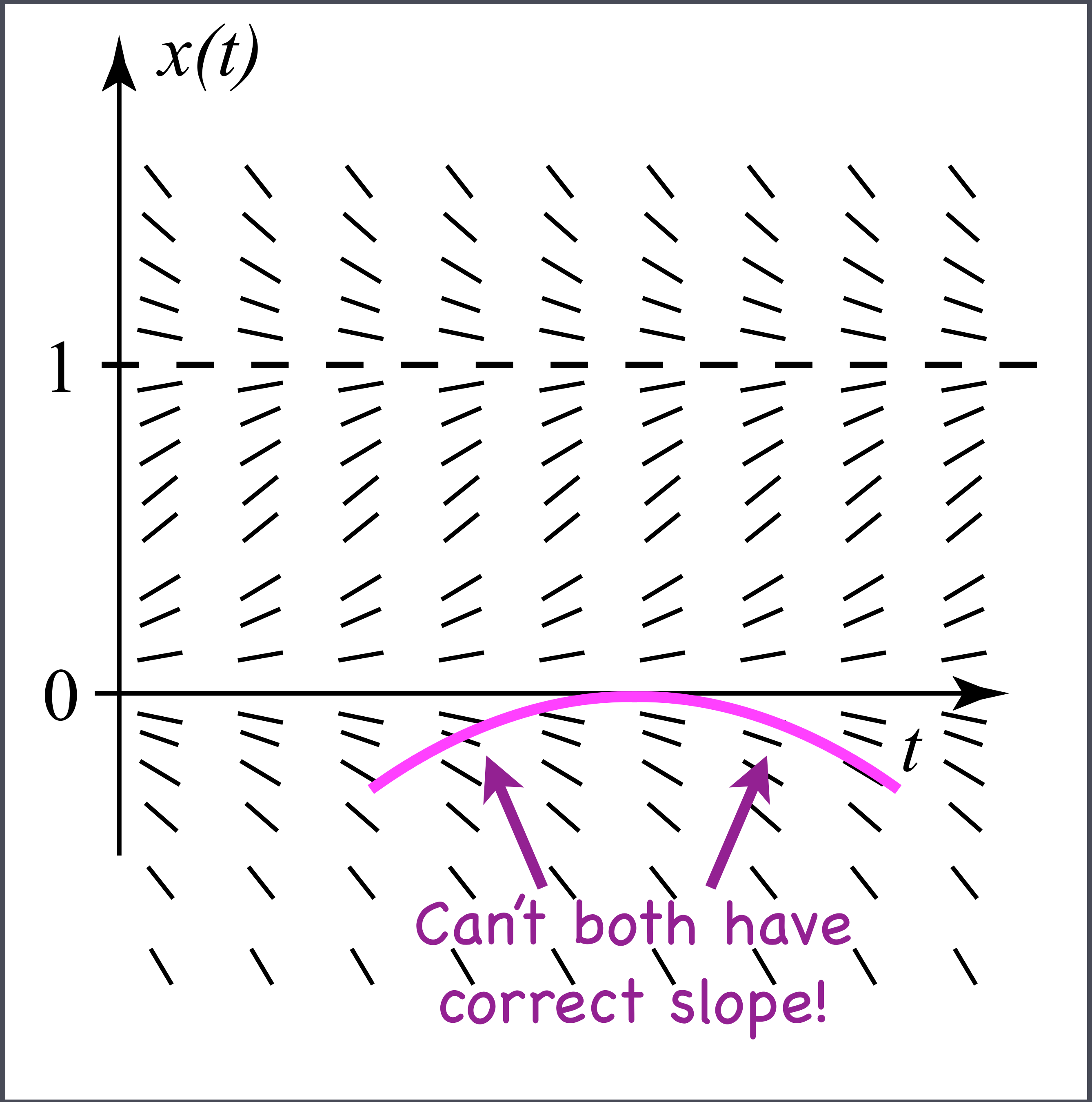

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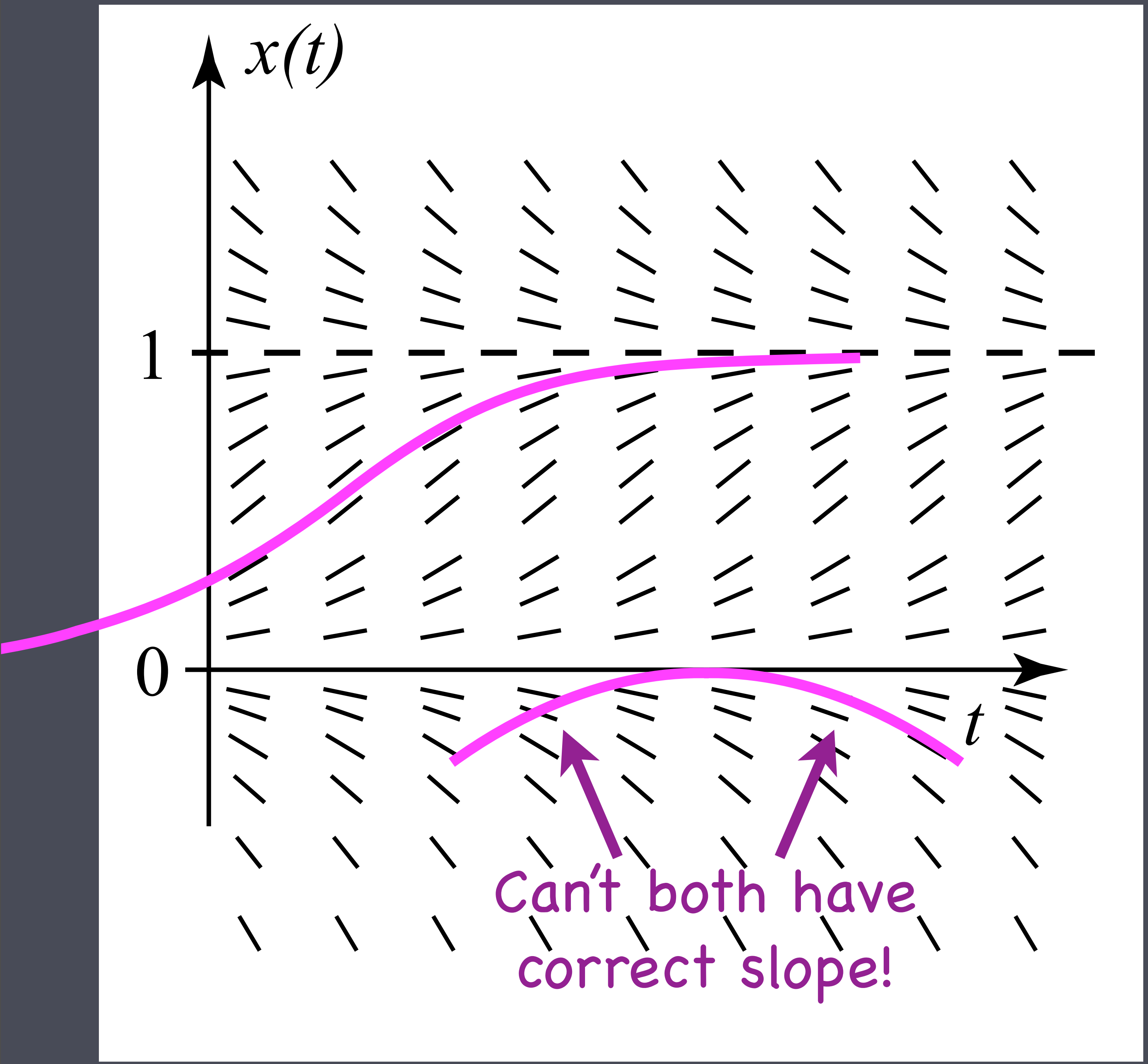

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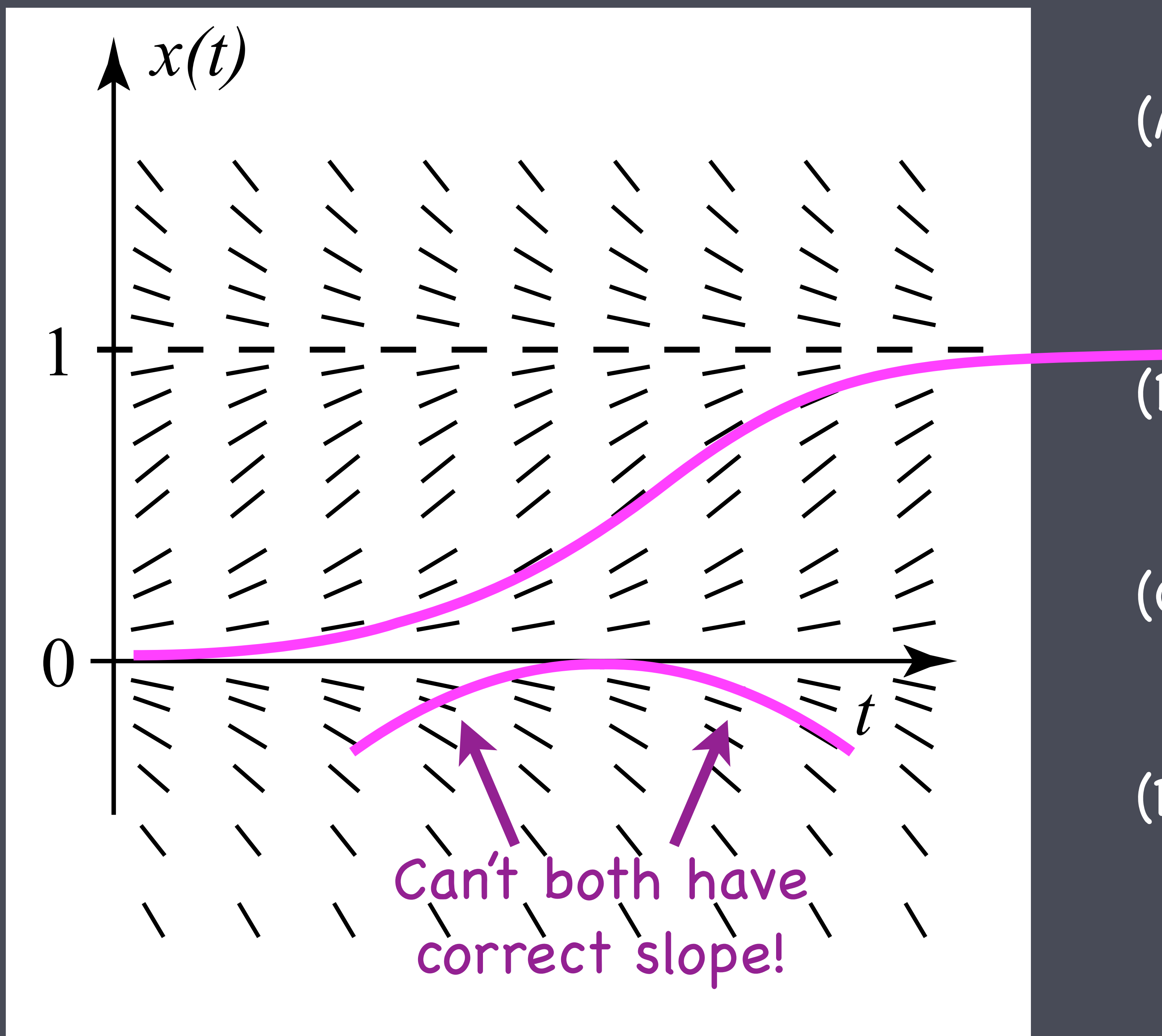

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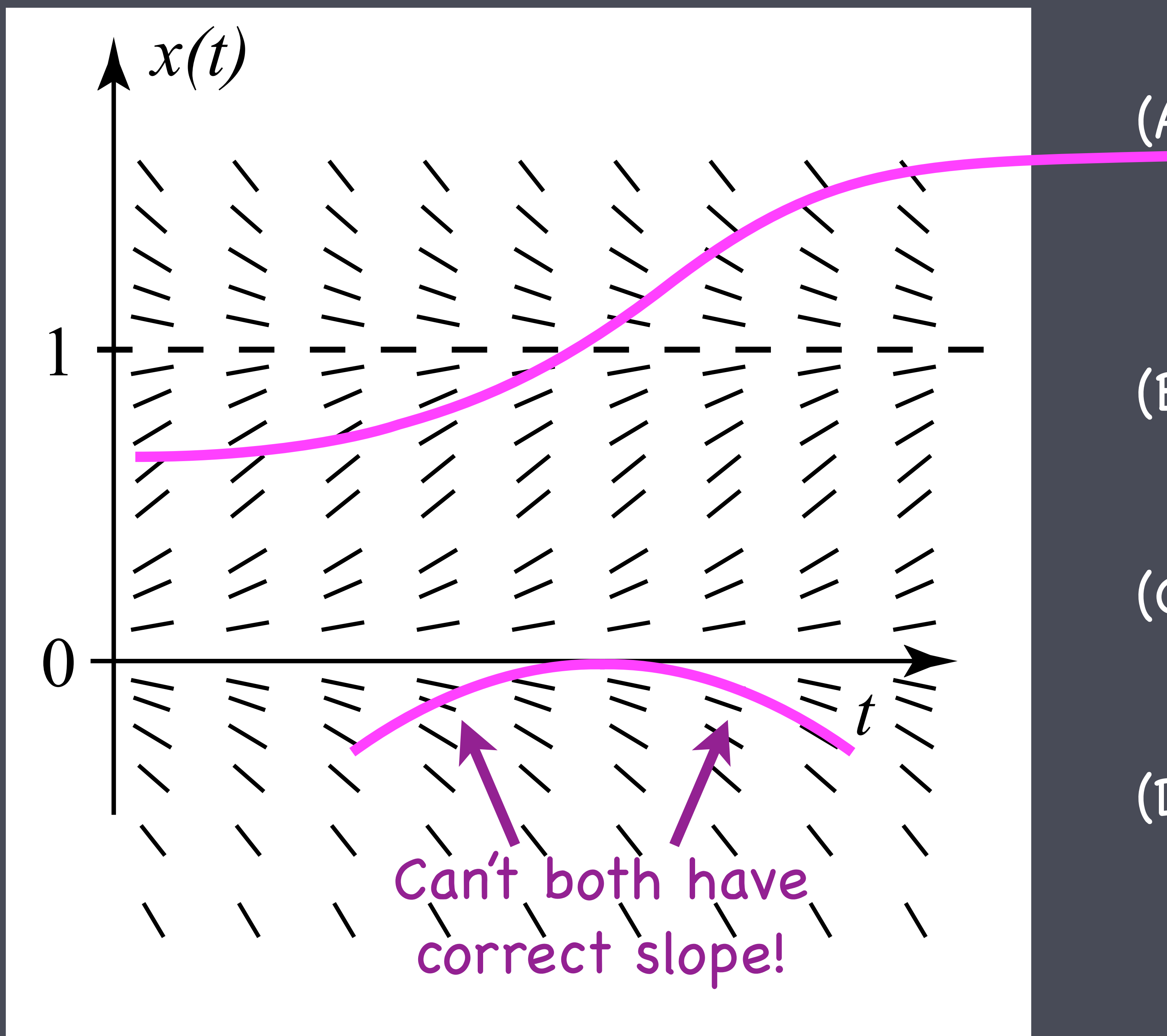

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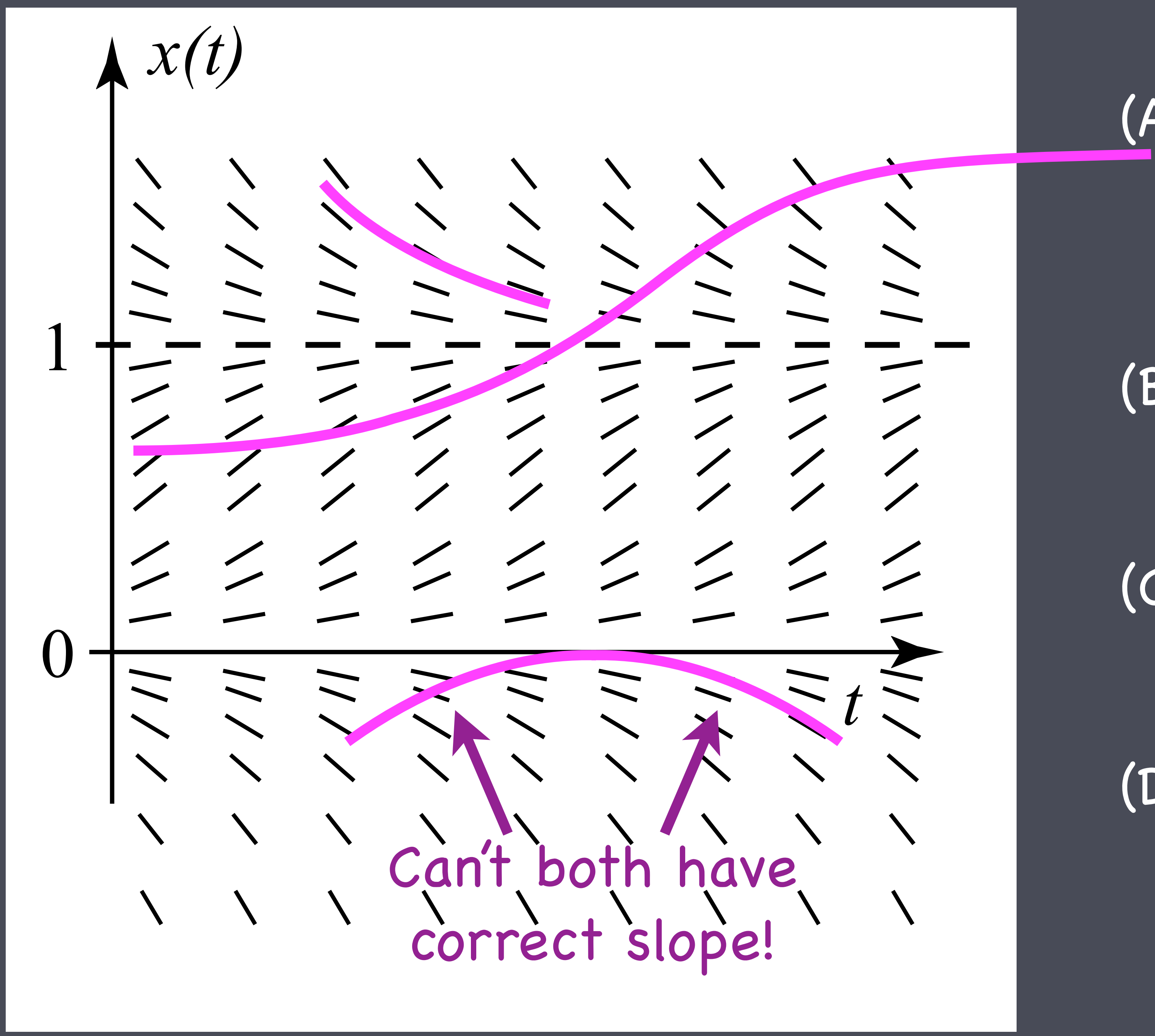

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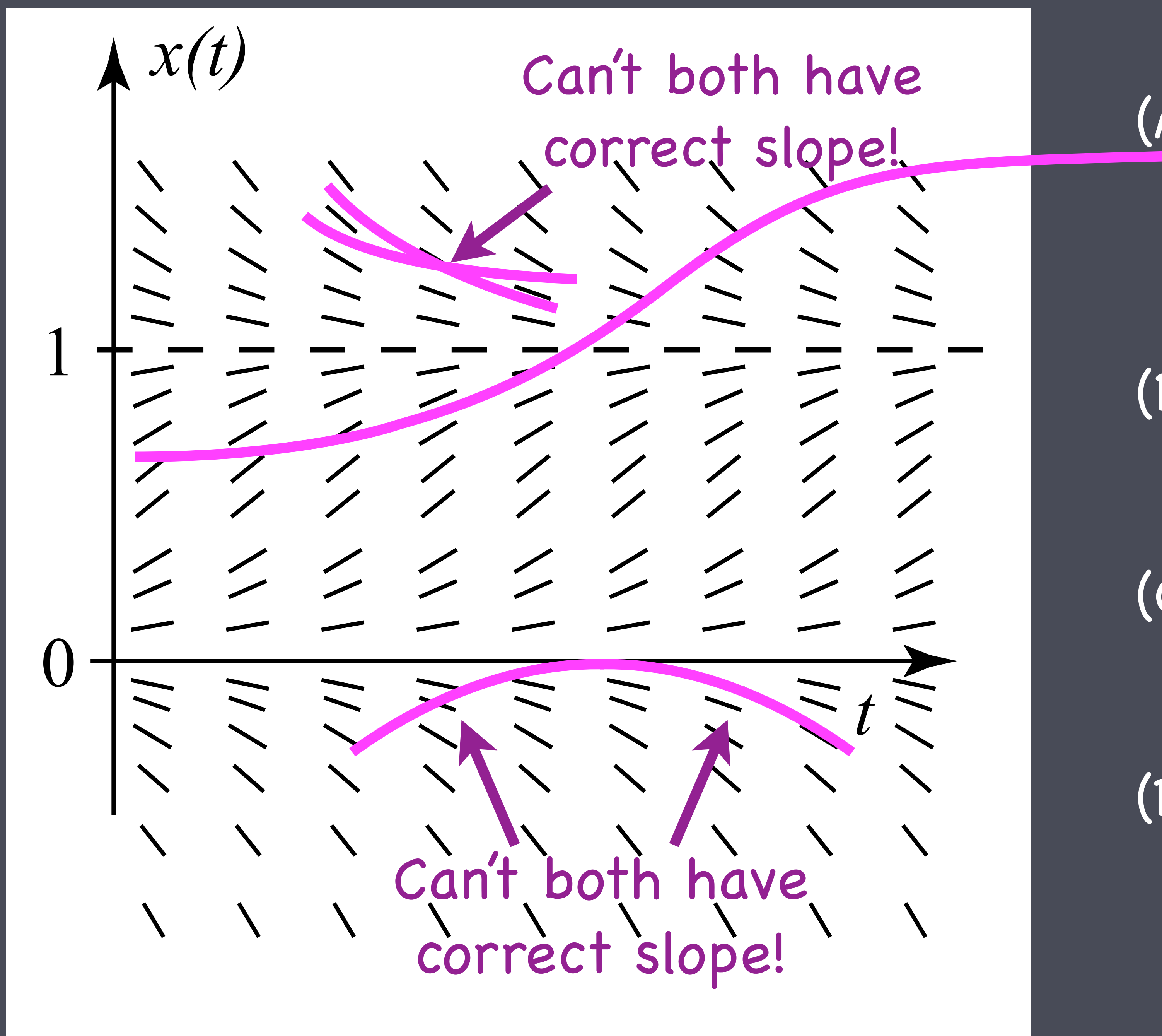

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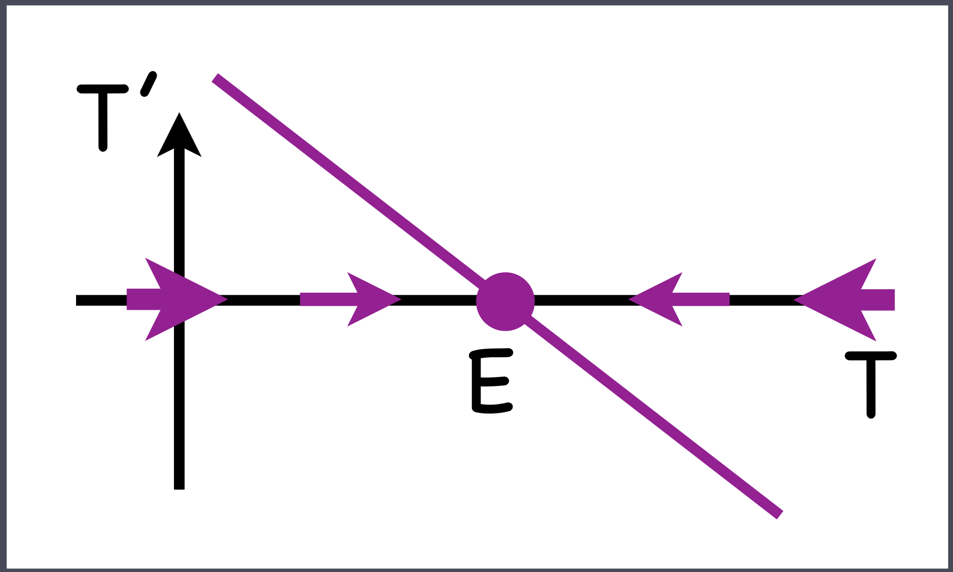
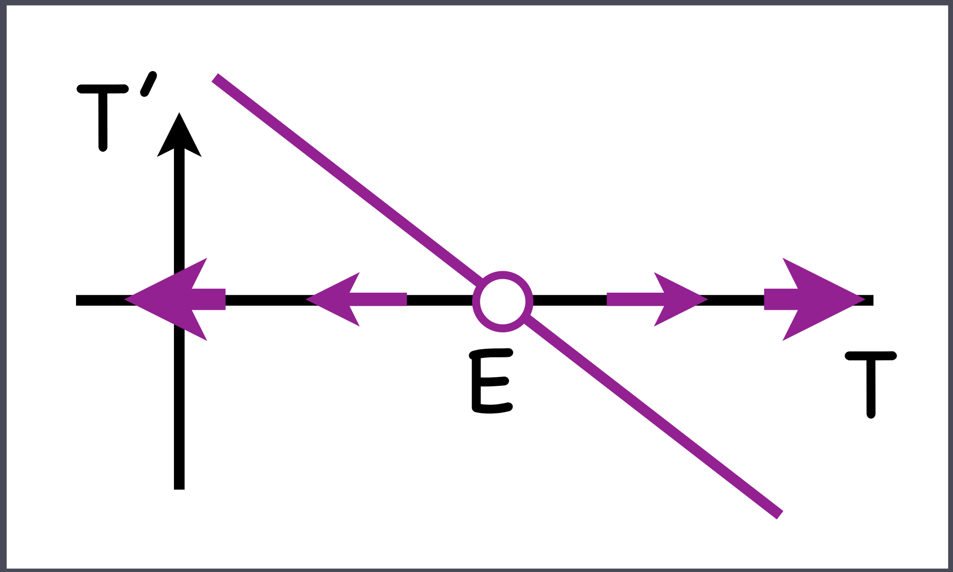
Phase line for NLC:

$$\frac{dT}{dt} = k(E - T)$$

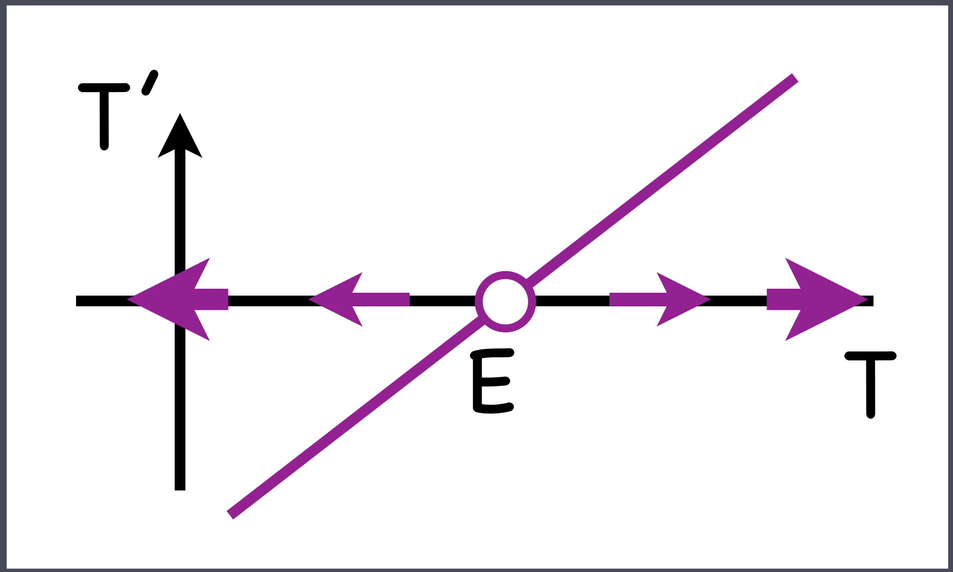
(A)



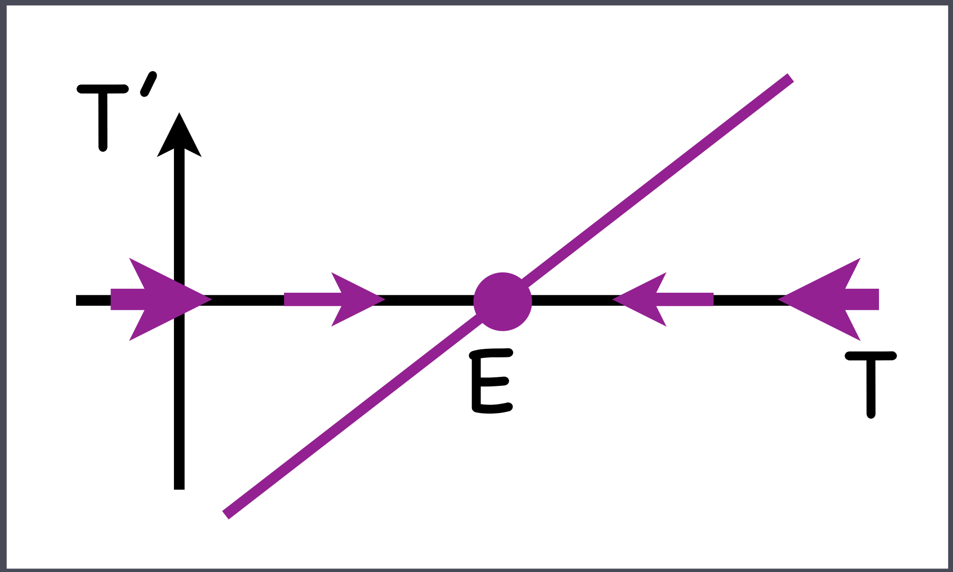
(B)



(C)



(D)



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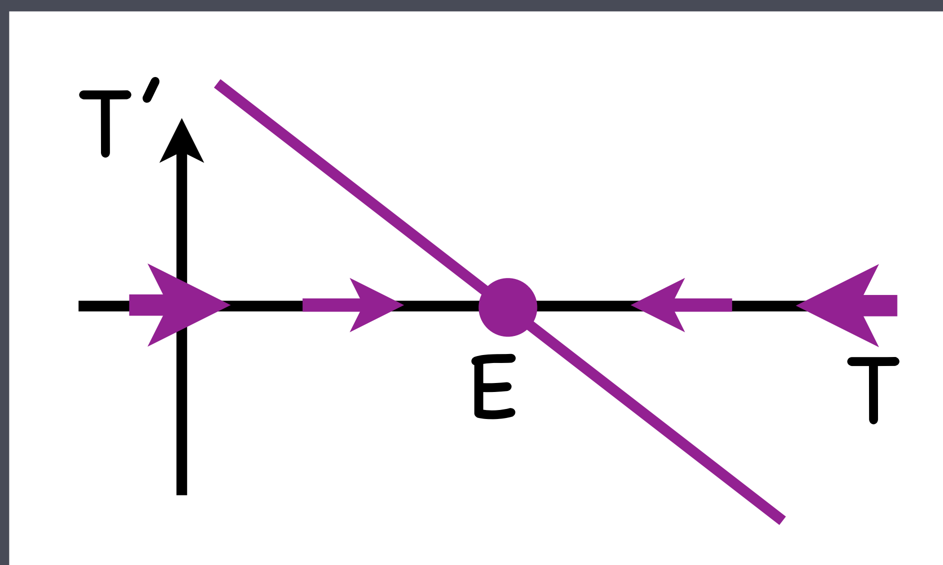
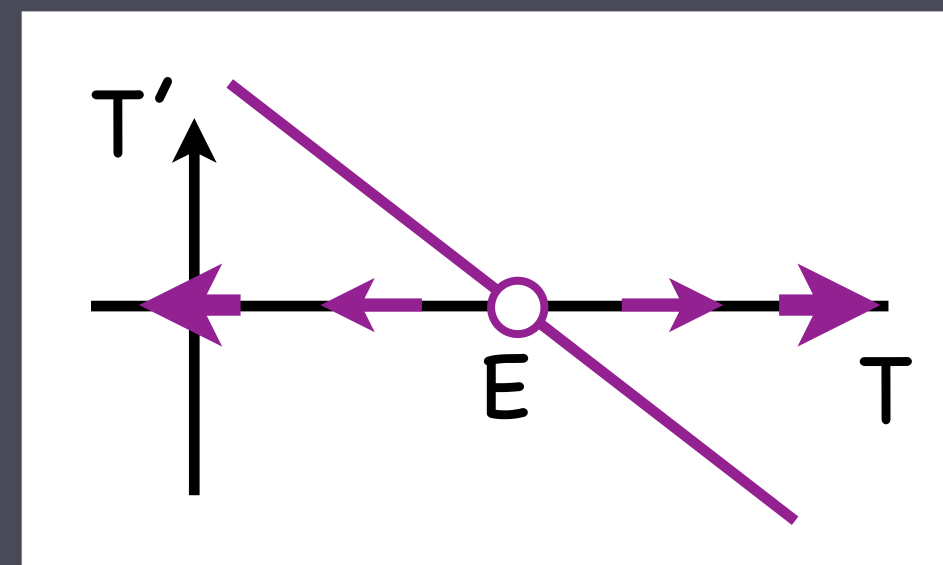
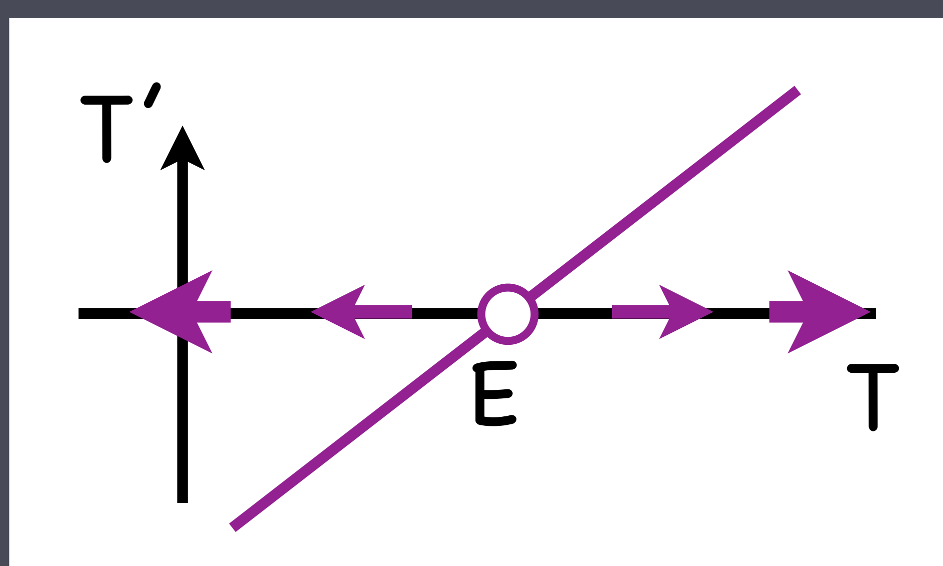


(B)



(C)



(D)