



# *Lecture 34*

11/29/2021

*Qualitative  
analysis*

8/30/2021 near Mather house

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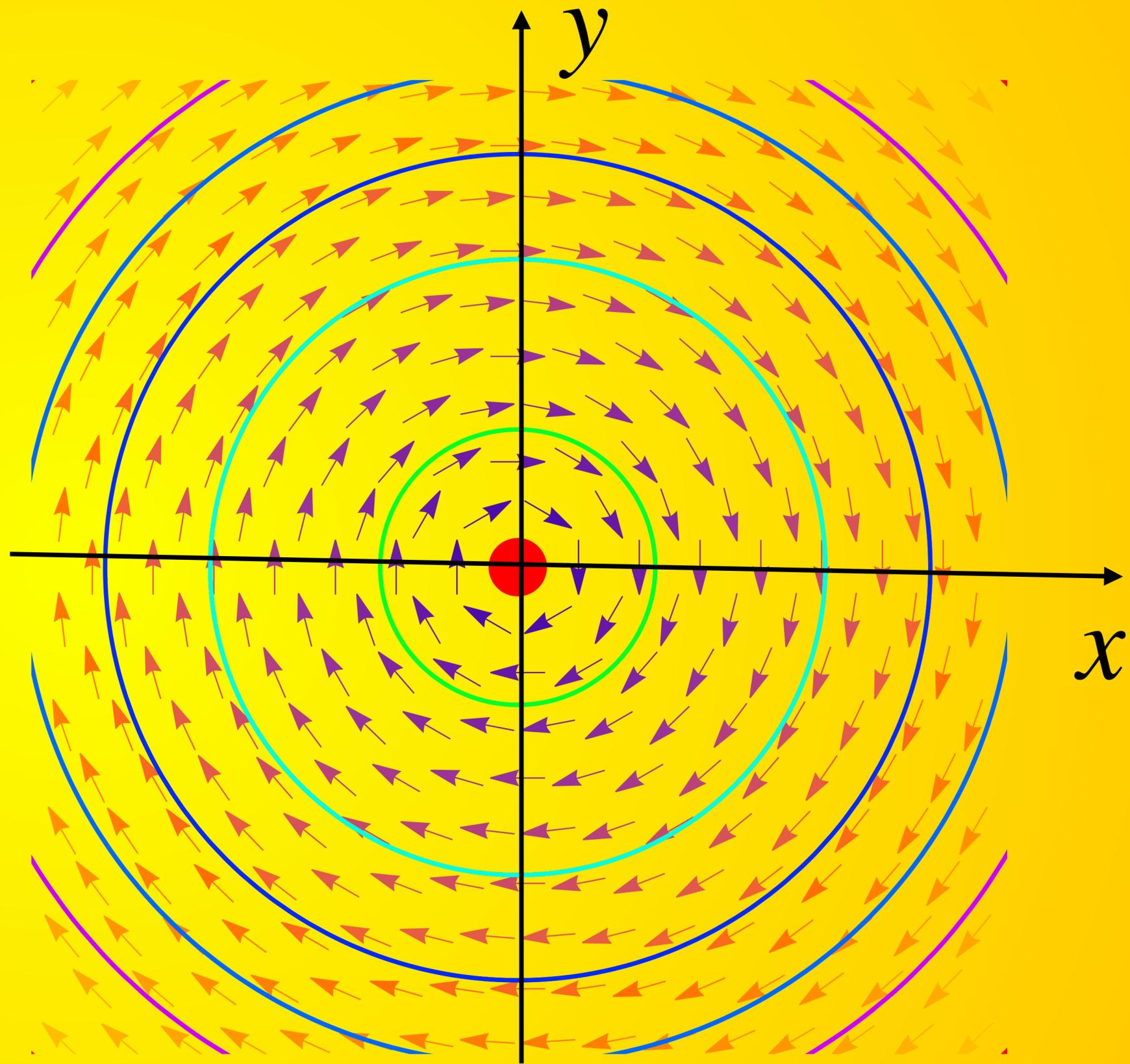
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# Harmonic Oscillator

$$x'(t) = y$$

$$y'(t) = -x$$



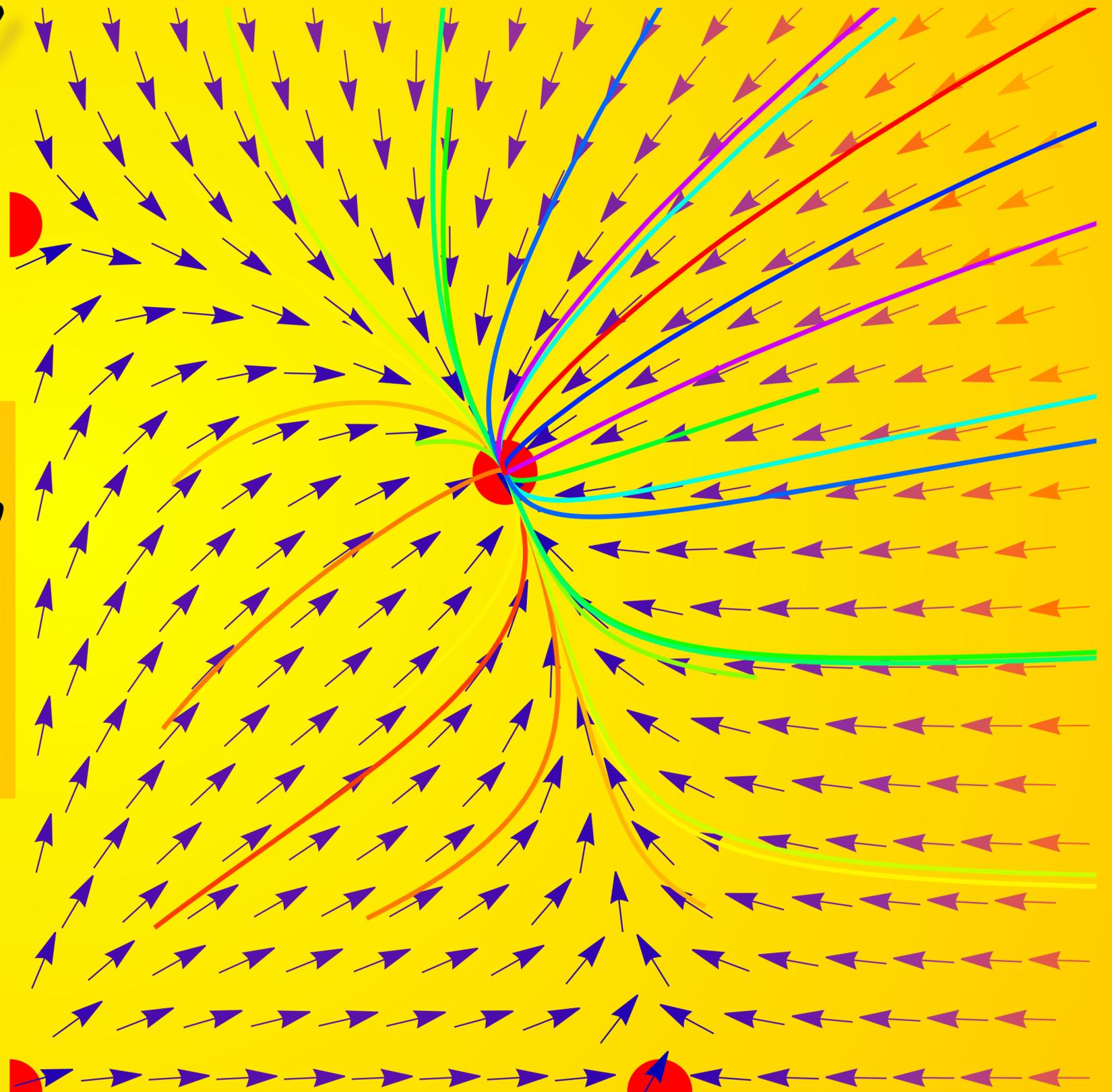
# Review Murray

$$x'(t) = x(6 - 2x) - xy$$

$$y'(t) = y(4 - y) - xy$$

growth of x  
gets slowed  
with large y

growth of y  
gets slowed  
with large x

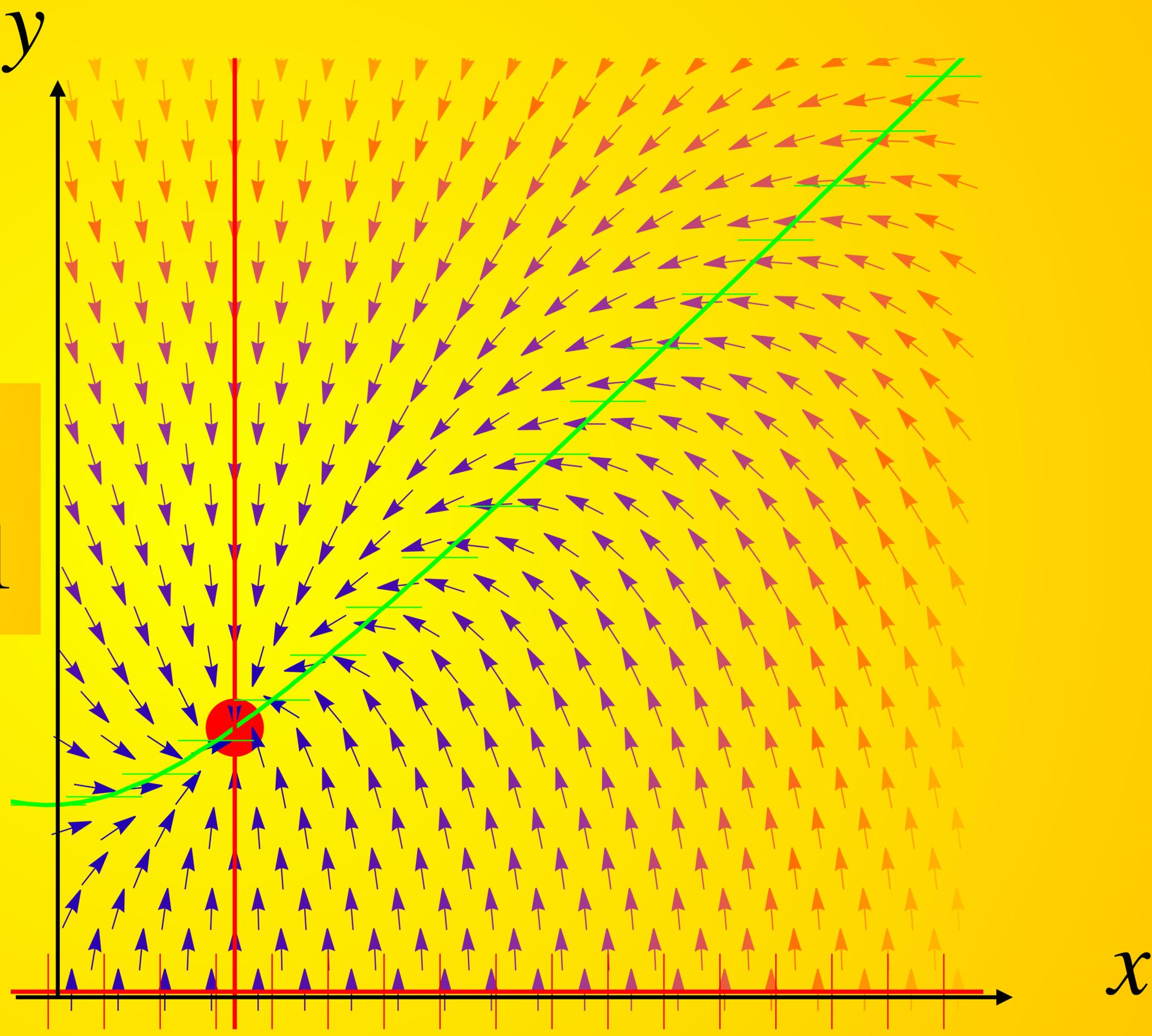


*The worksheet problems*

1

$$x'(t) = y - xy$$

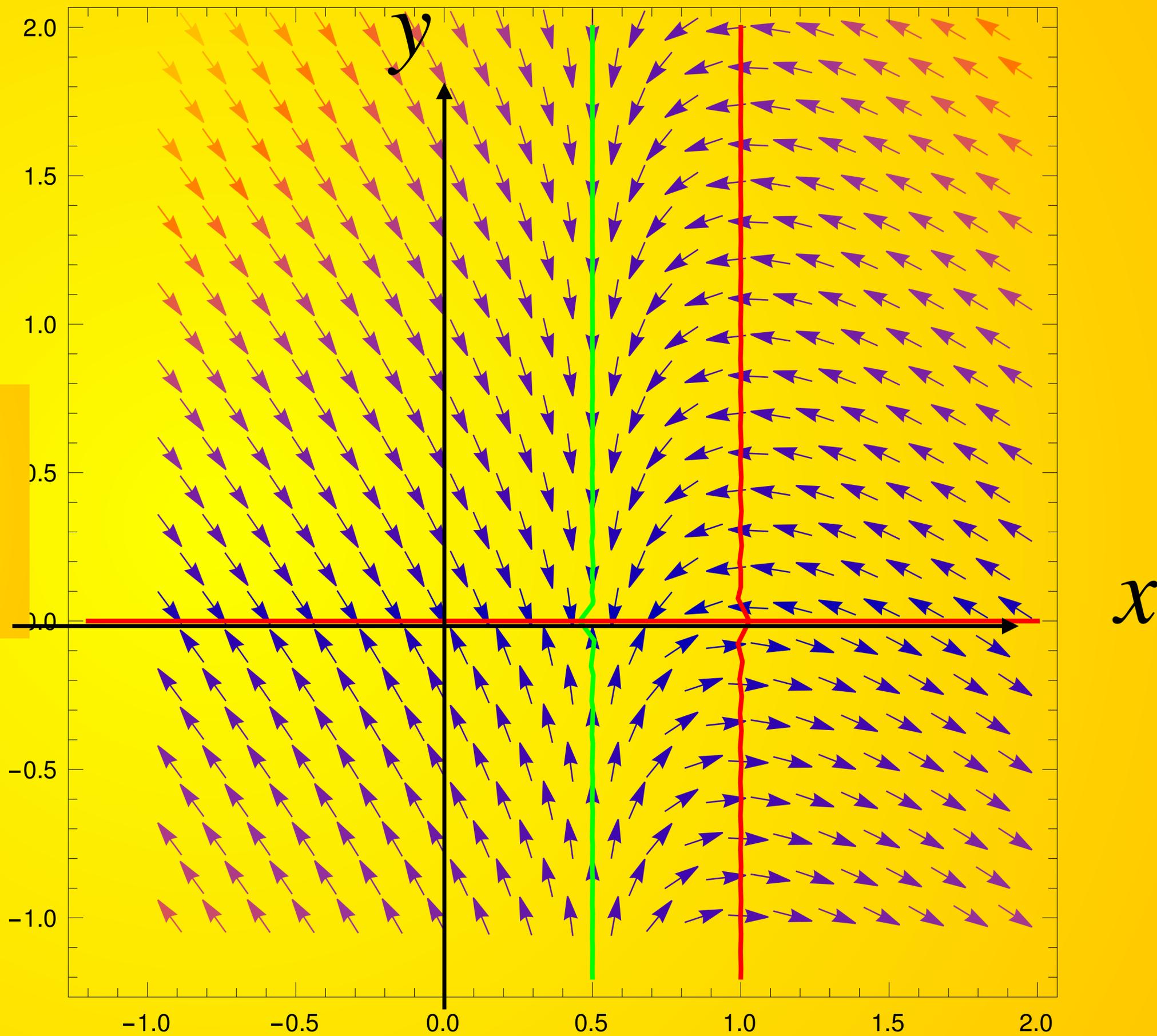
$$y'(t) = x^2 - y^2 + 1$$



2

$$x'(t) = -xy + y/2$$

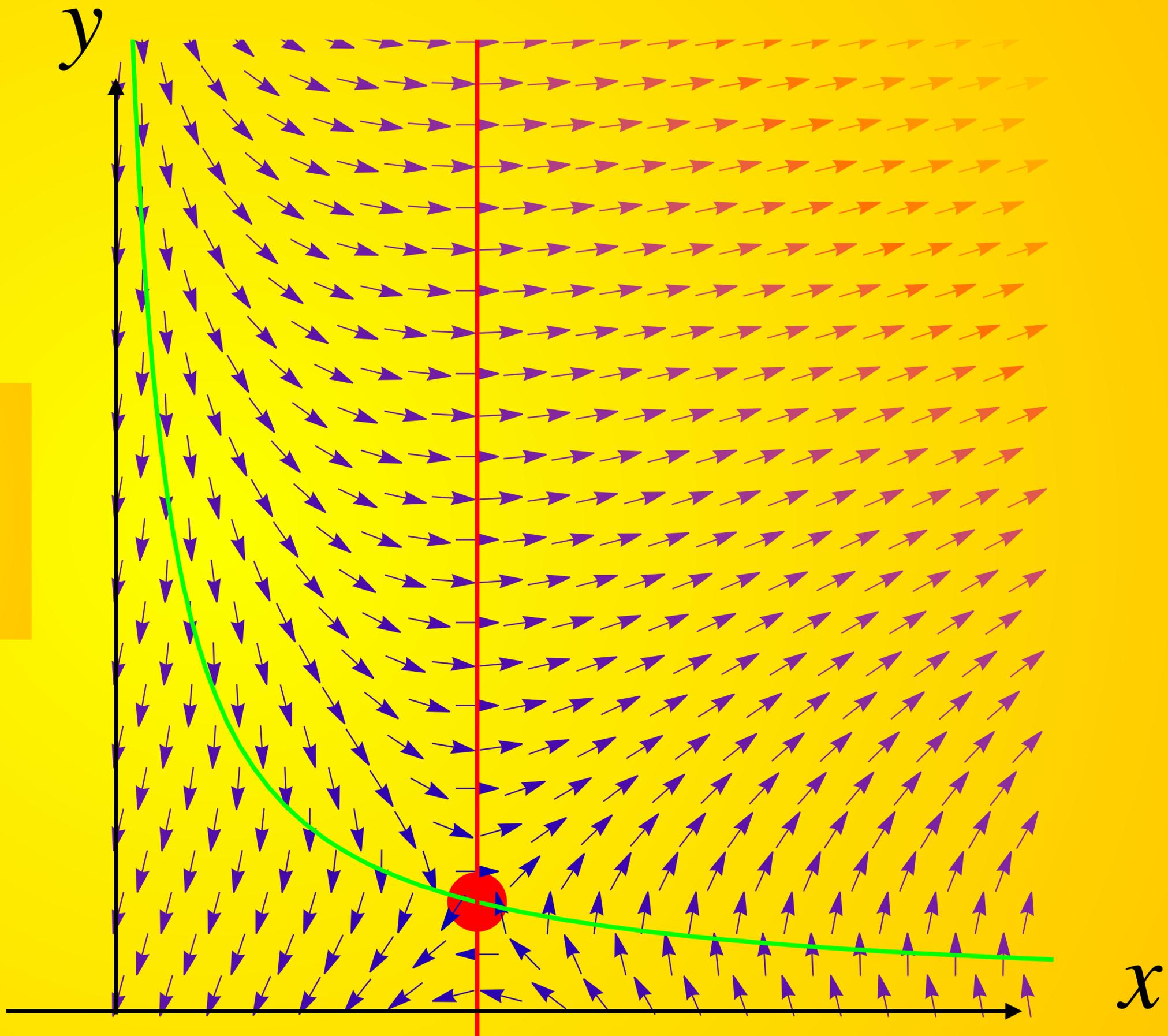
$$y'(t) = xy - y$$



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$$x'(t) = xy - 1$$

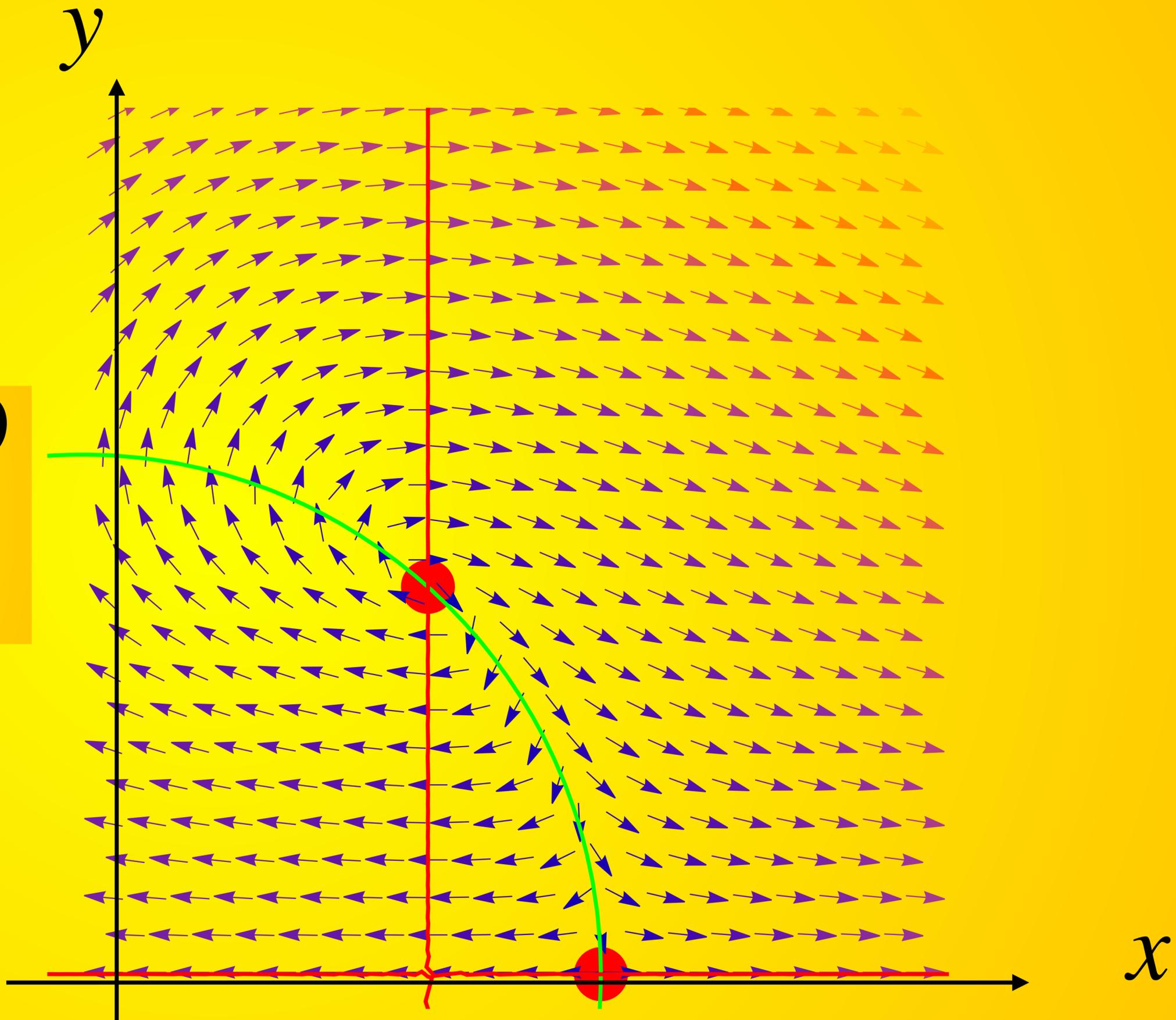
$$y'(t) = 2x - 4$$



4

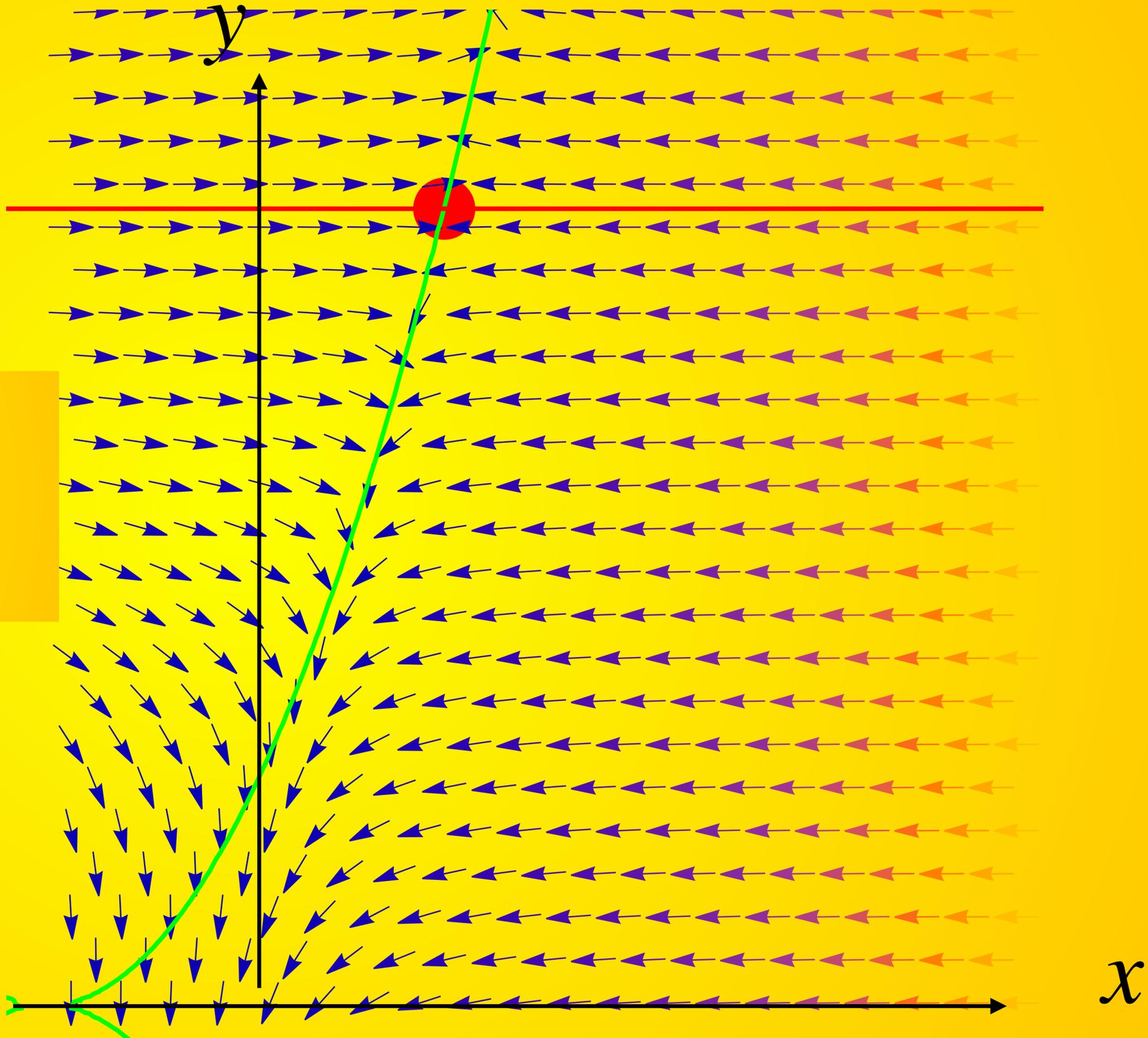
$$x'(t) = x^2 + y^2 - 9$$

$$y'(t) = 2y - xy$$



5

$$x'(t) = y^2 - x^4$$
$$y'(t) = y - 4$$



*The End*