

# February 6, Week 4

Today: Chapter 3, Two-Dimensional Motion

Homework Assignment #4 - Due February 8

**Mastering Physics:** 8 problems from chapters 1 and 3.

**Written Question:** 3.65

Exam #1: Wednesday, February 13

Practice Exam on website tomorrow

Help sessions with Jonathan:

M: 1000-1100, RH 111

T: 1000-1100, RH 114

Th: 0900-1000, RH 114

# Two-Dimensional Motion

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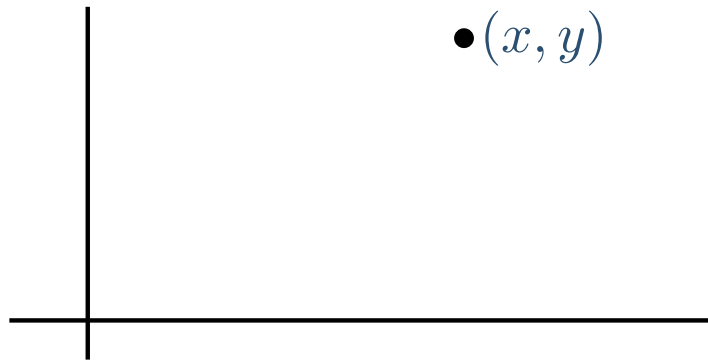
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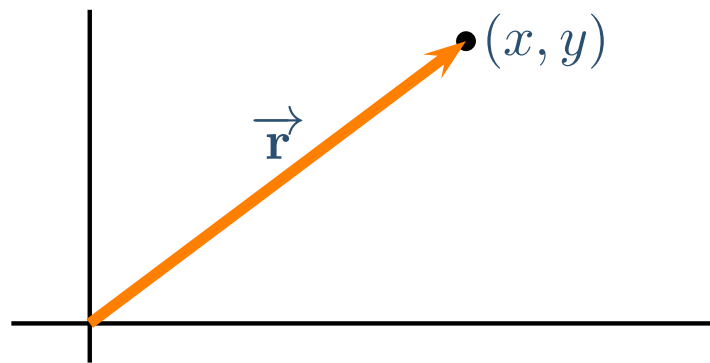


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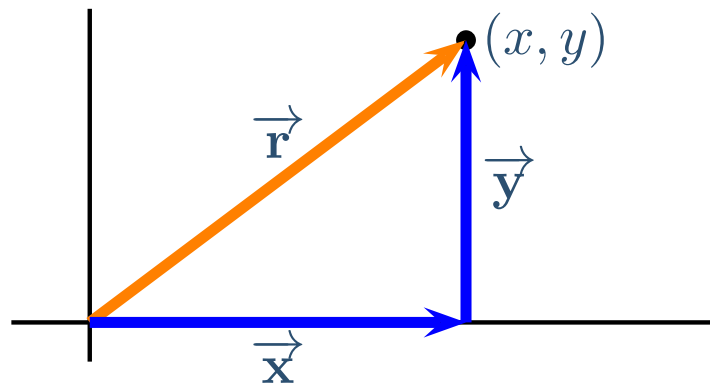


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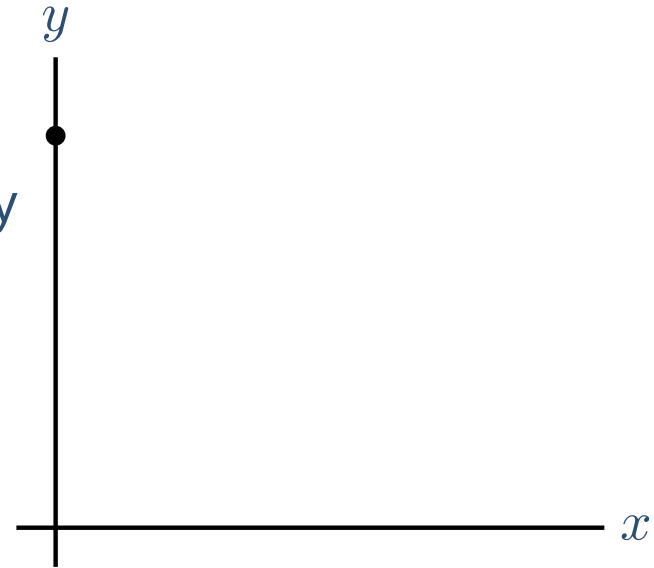
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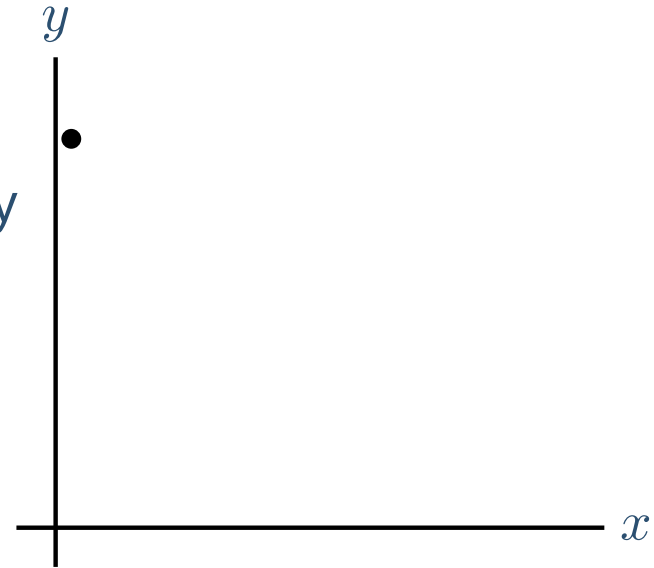
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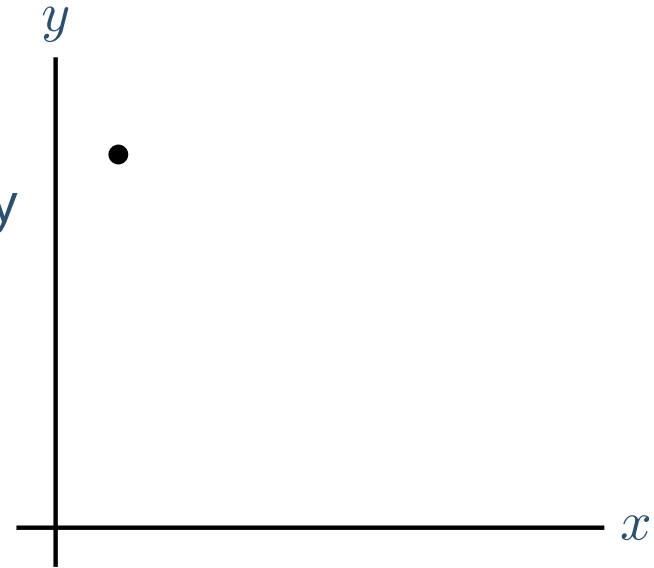
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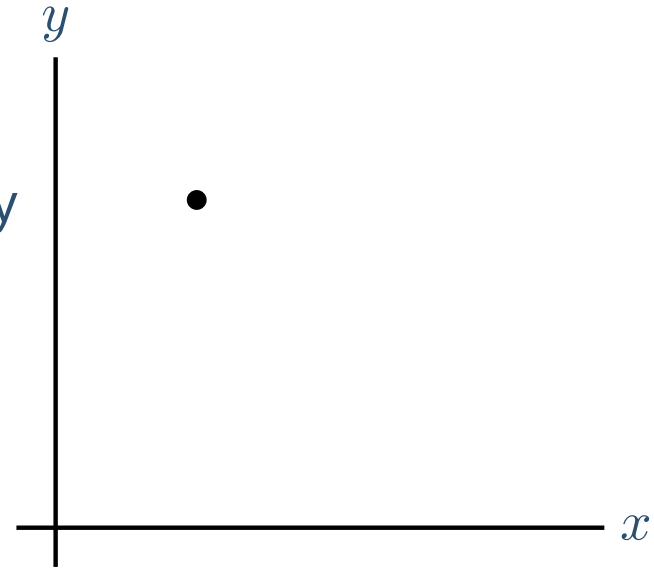
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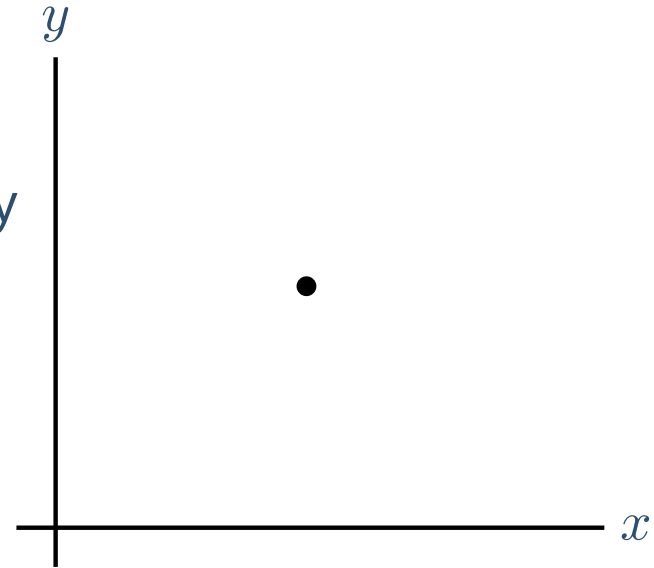
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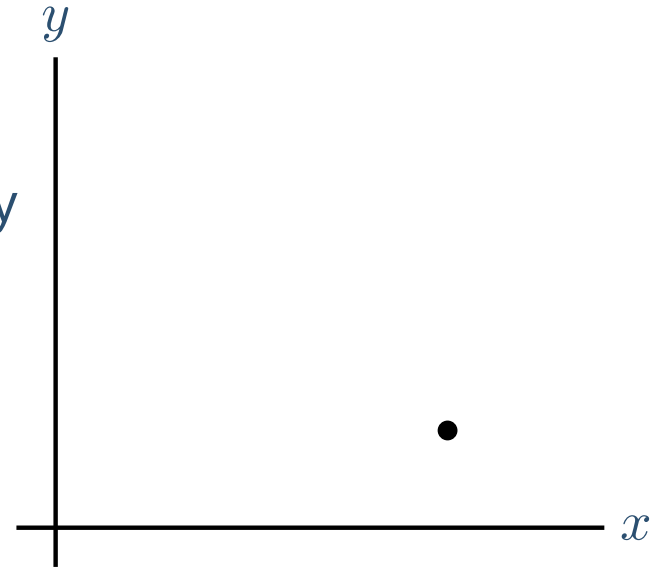
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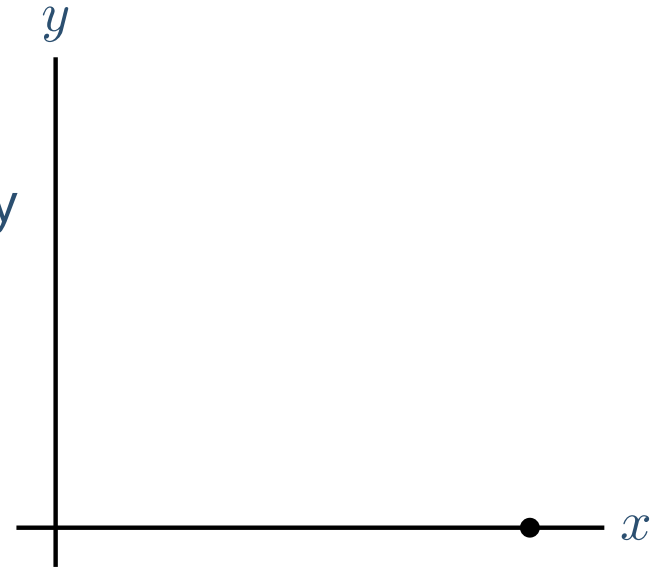
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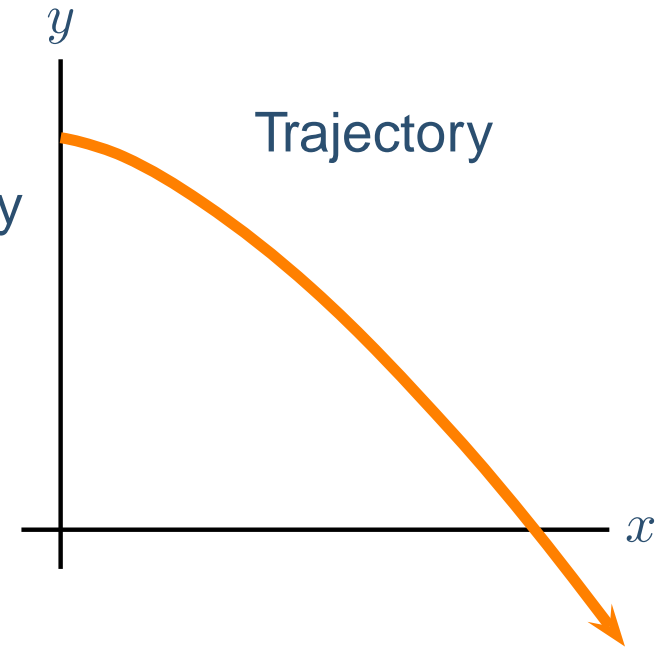
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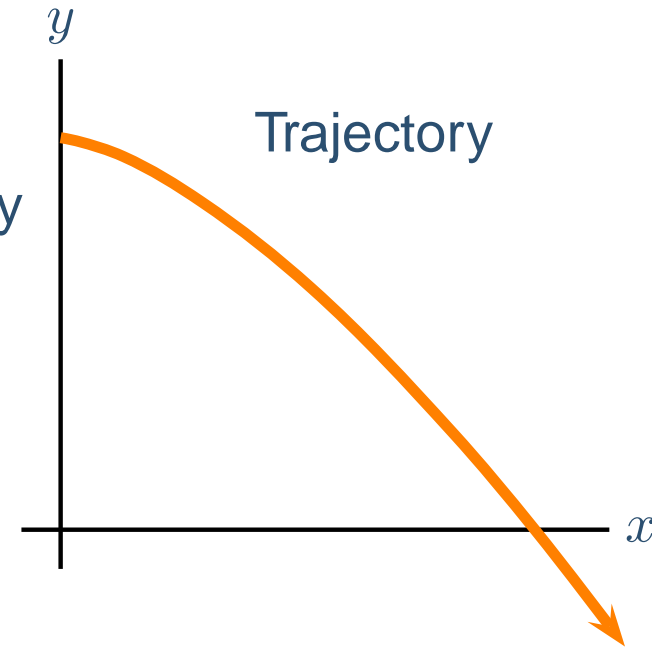
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# Velocity Components

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There are two separate position plots which give the velocity vector's components

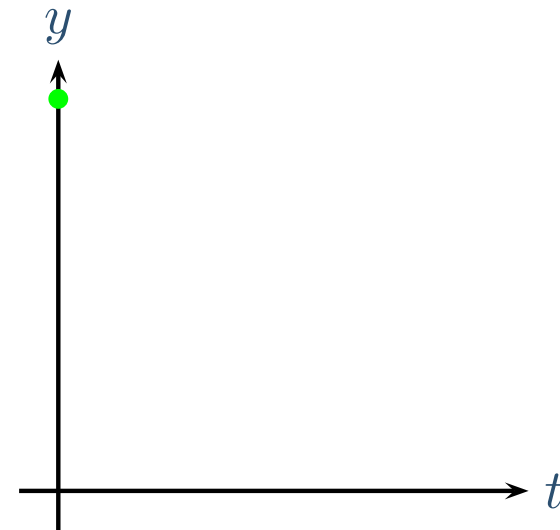
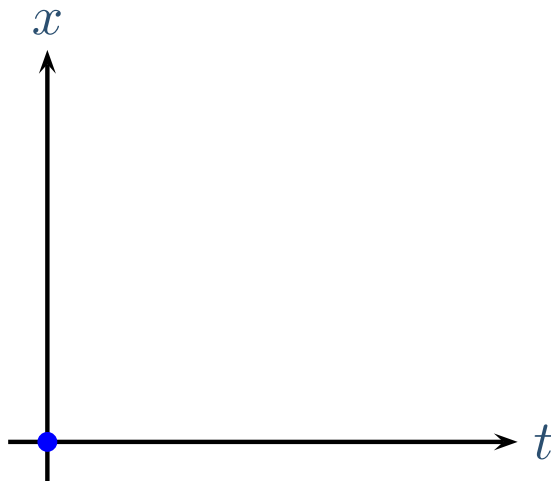
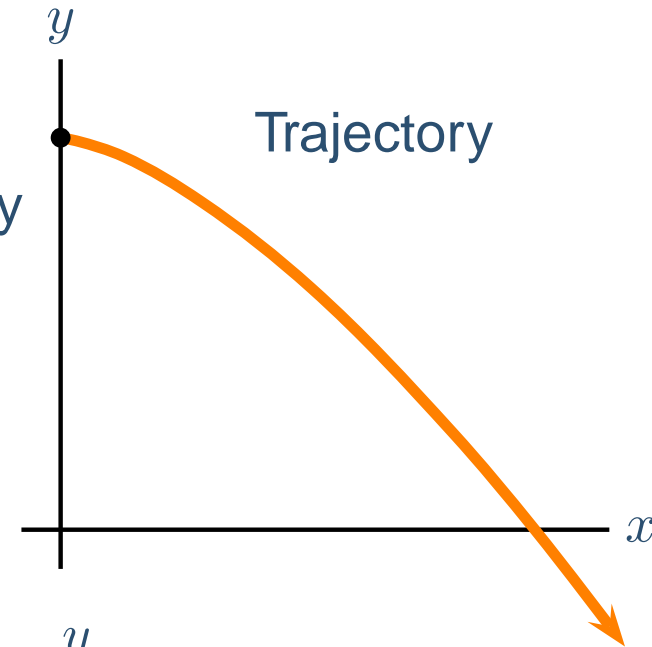




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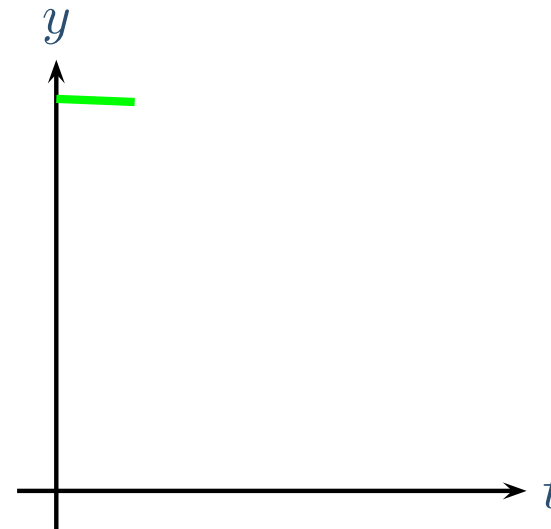
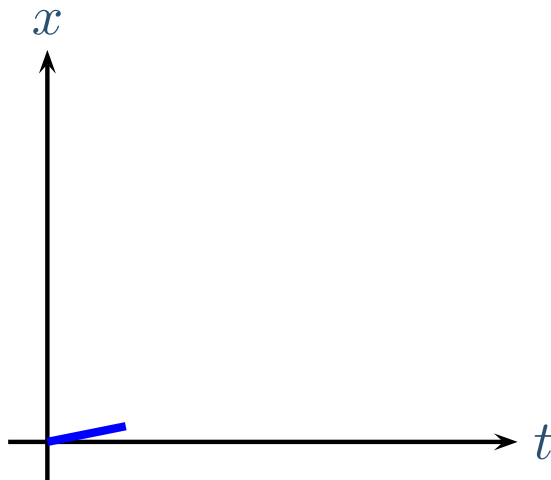
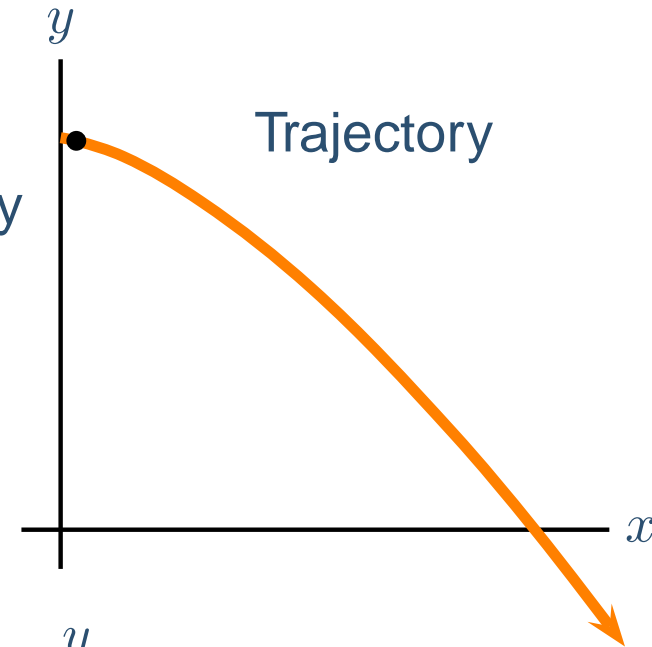
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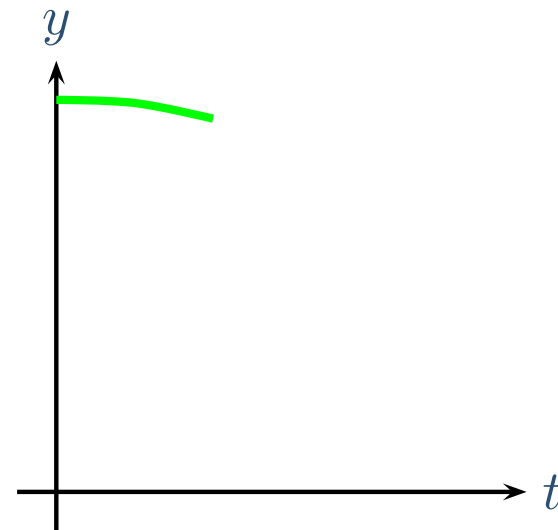
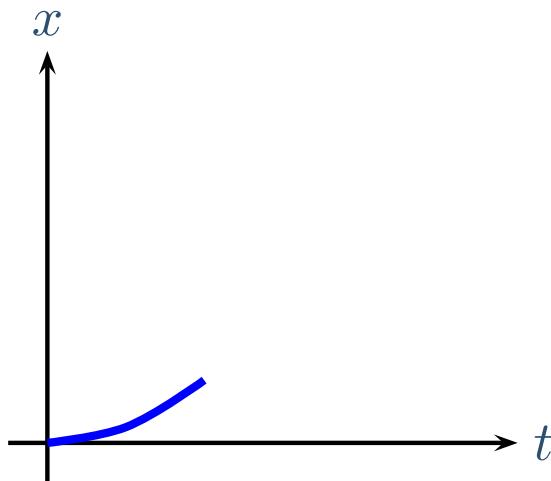
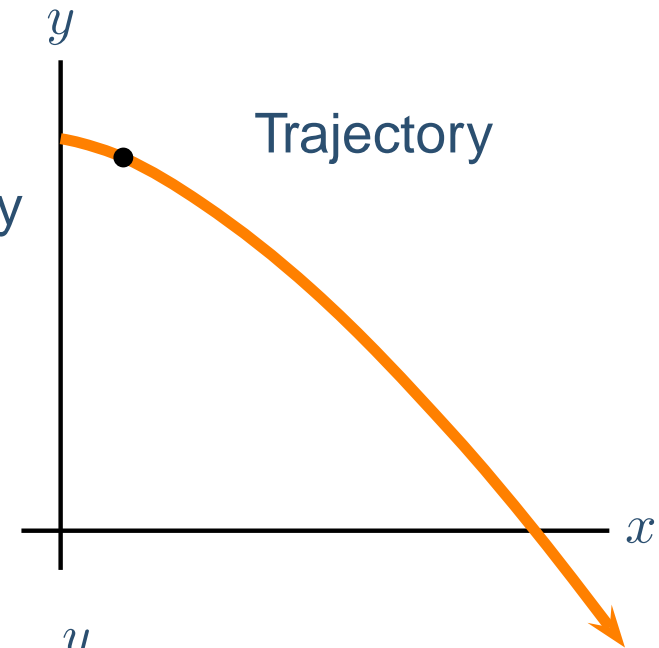
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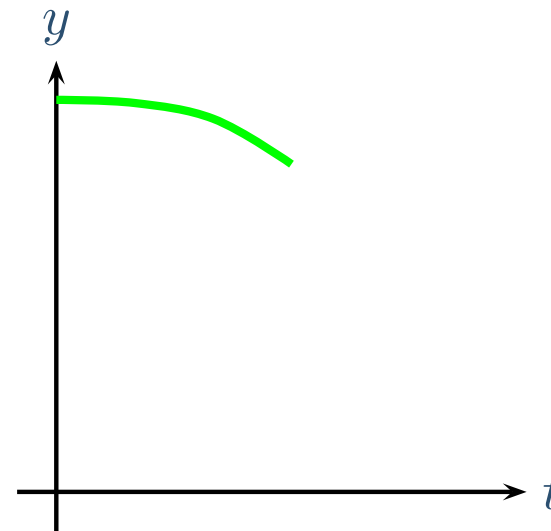
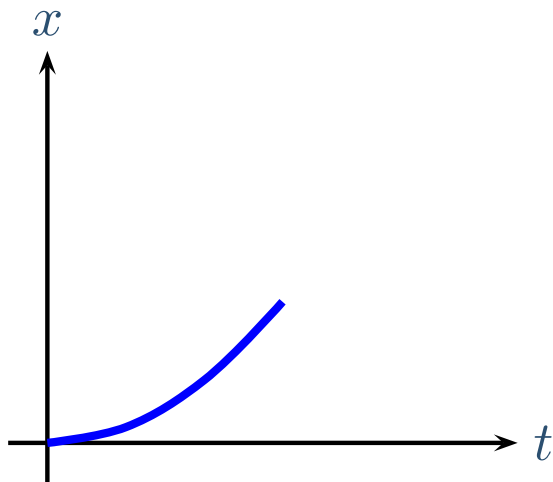
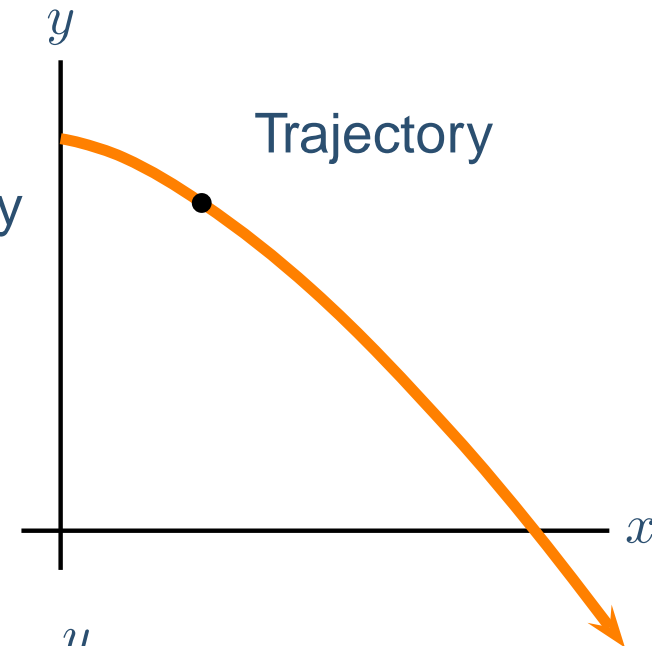
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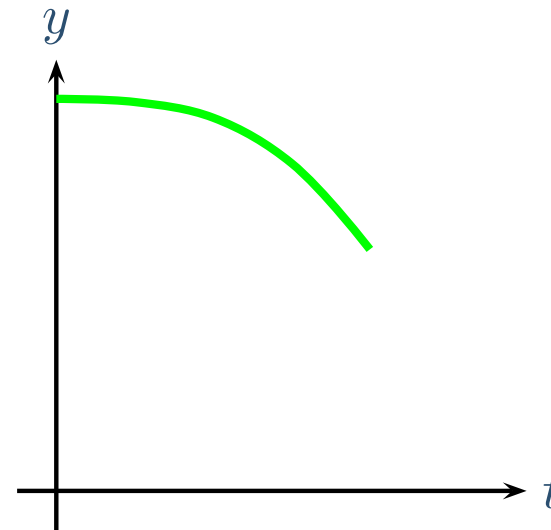
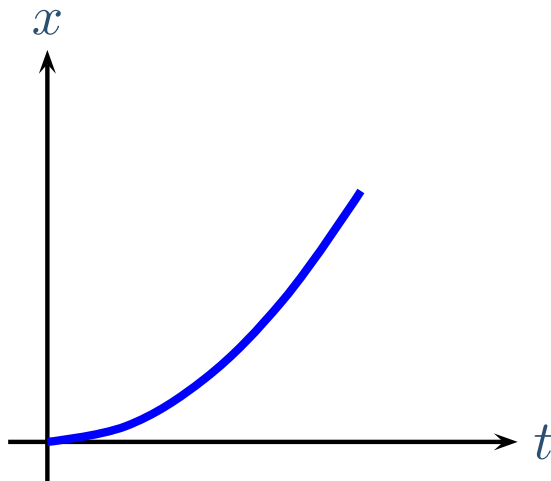
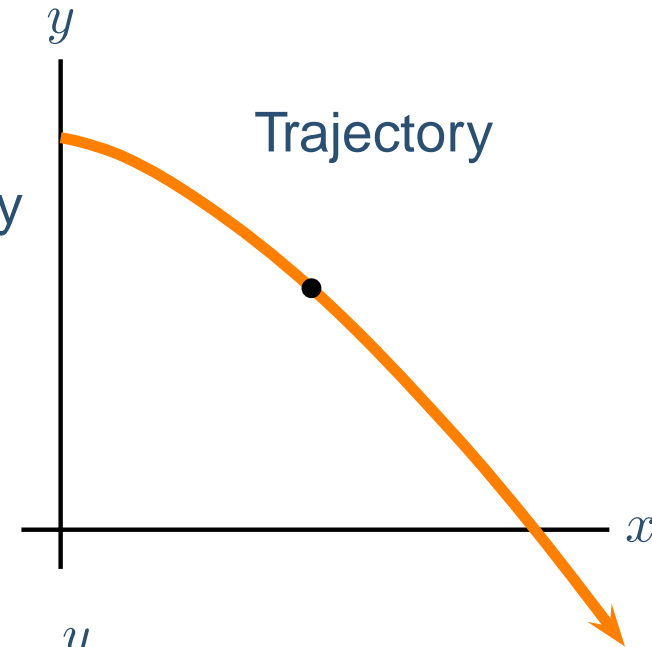
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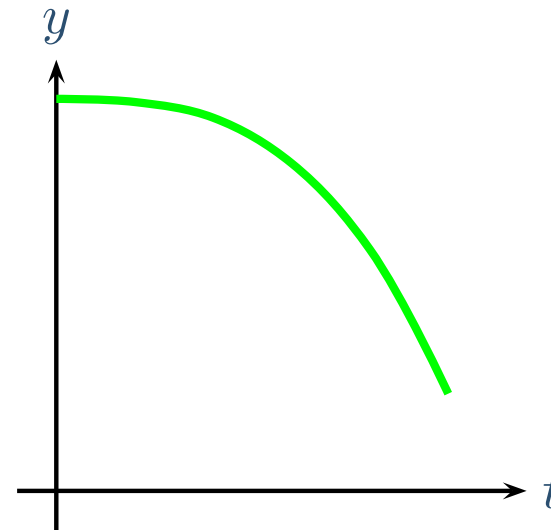
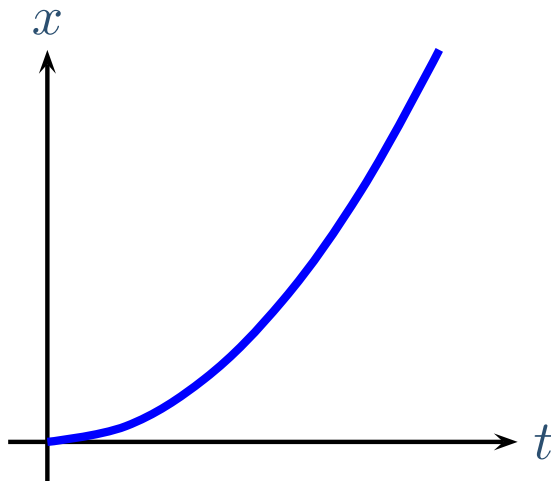
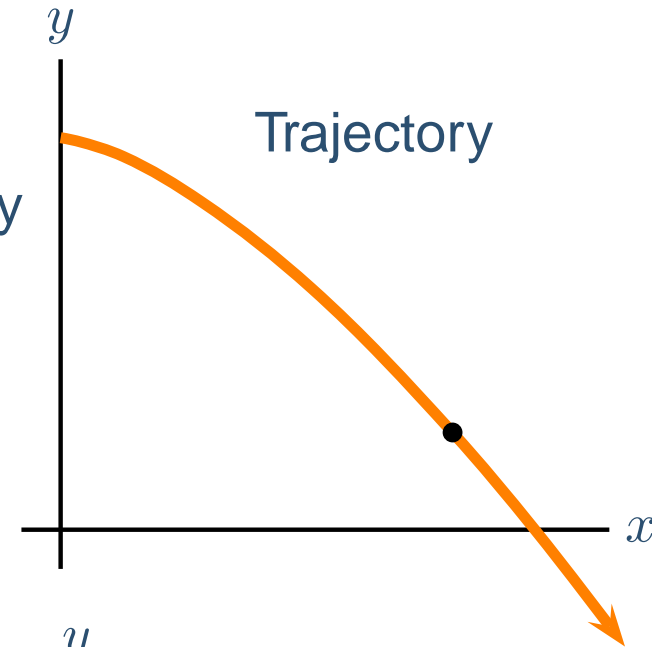
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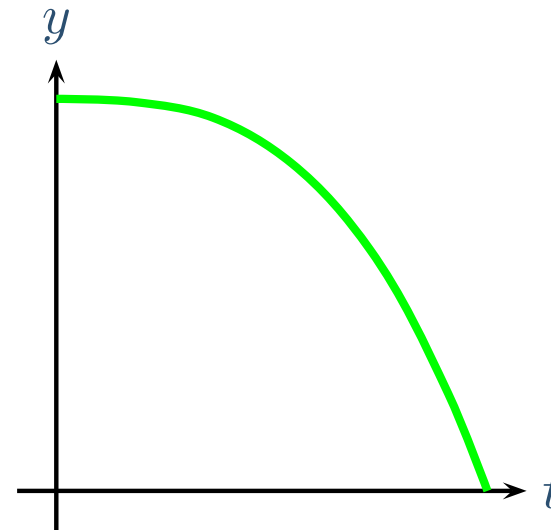
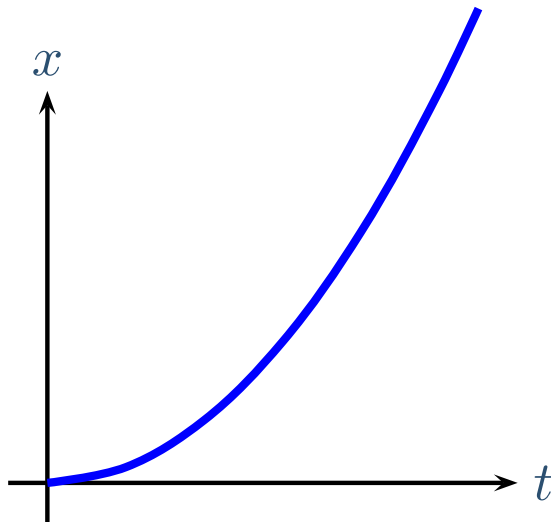
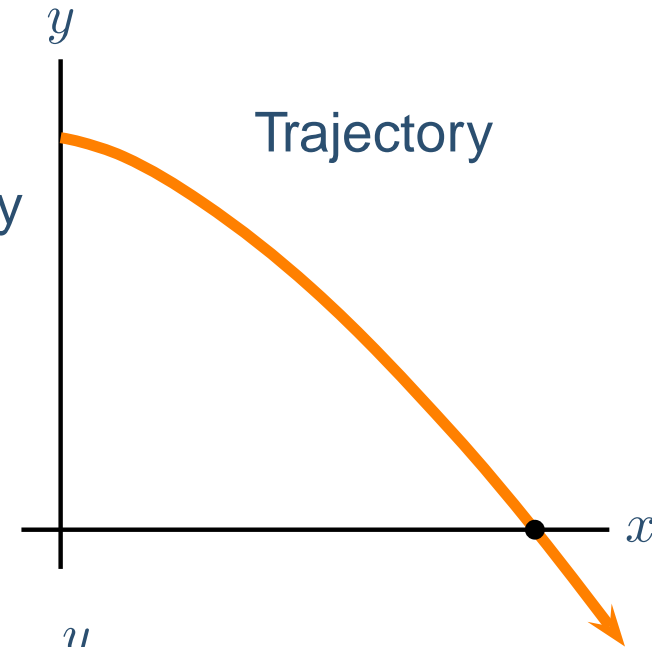
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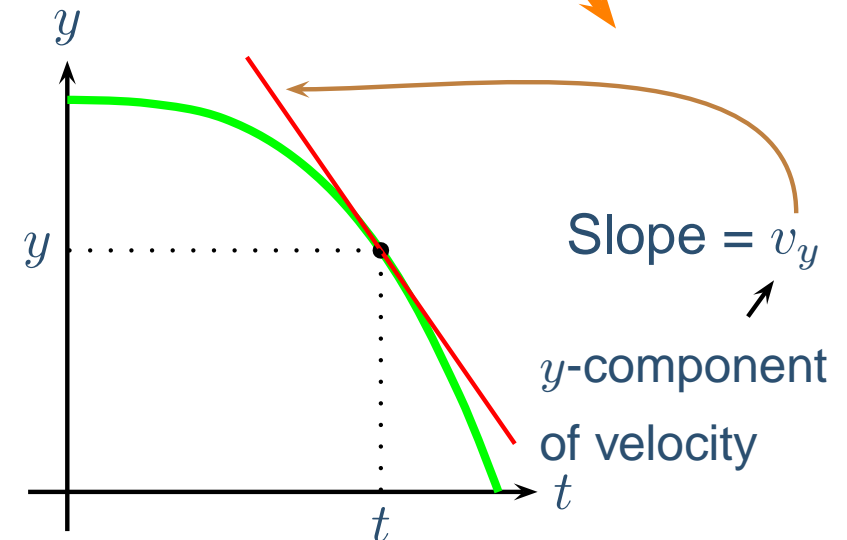
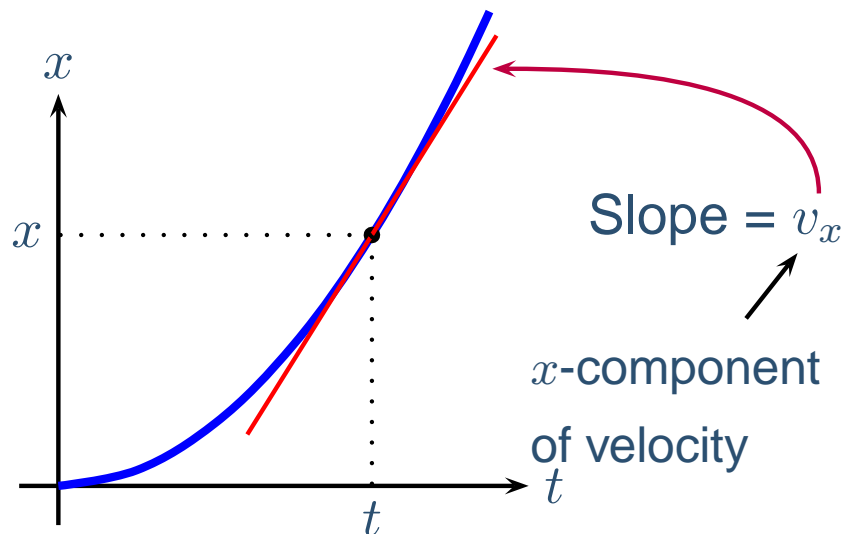
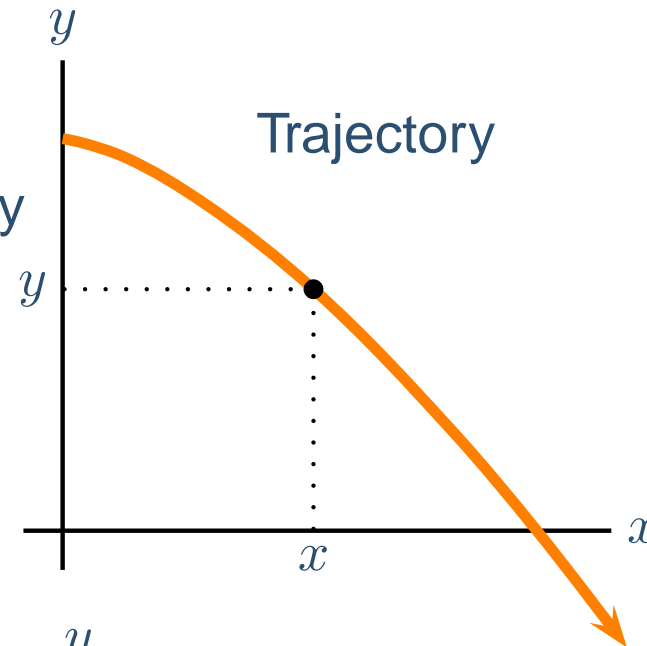
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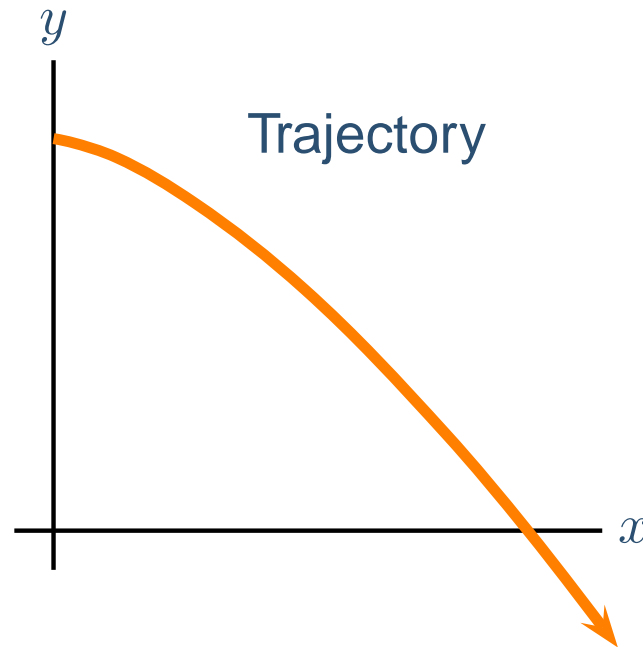
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The velocity vector is at the same angle as the slope of the trajectory graph.

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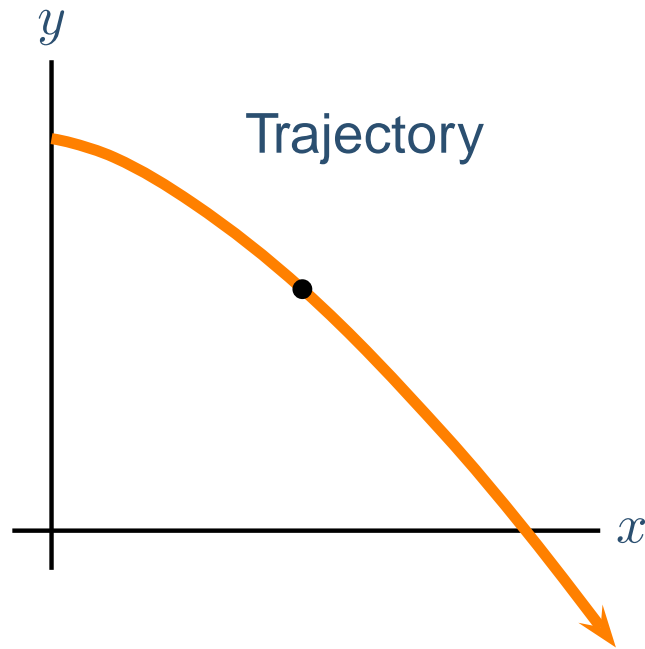
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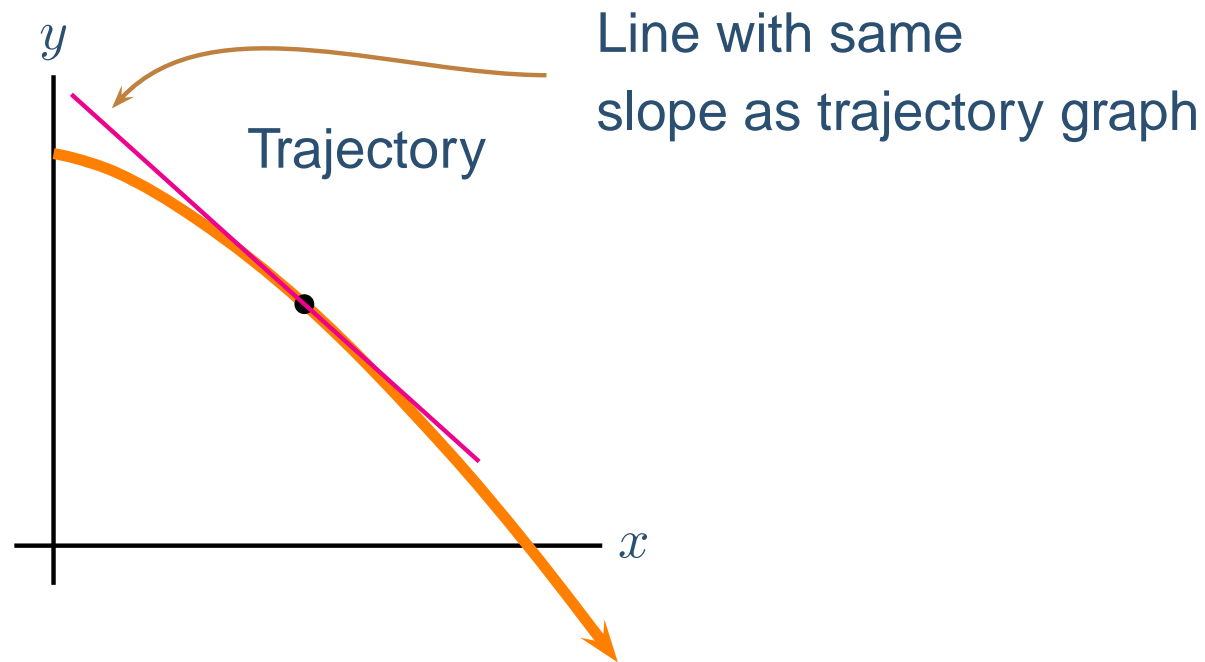
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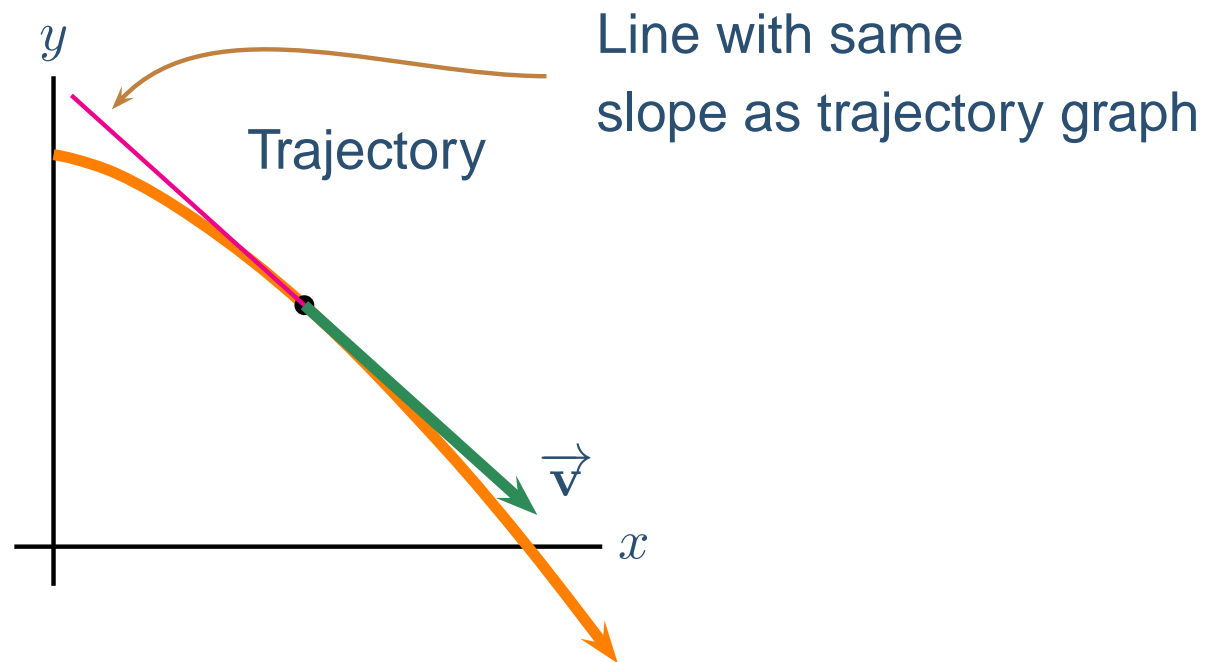
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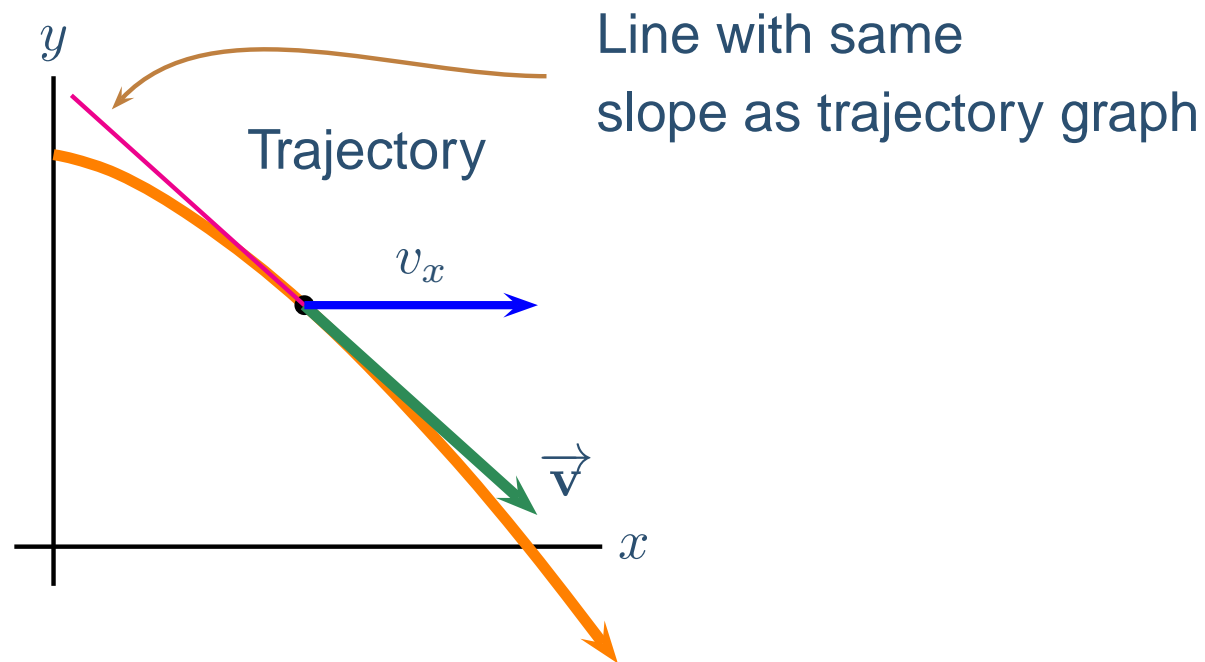
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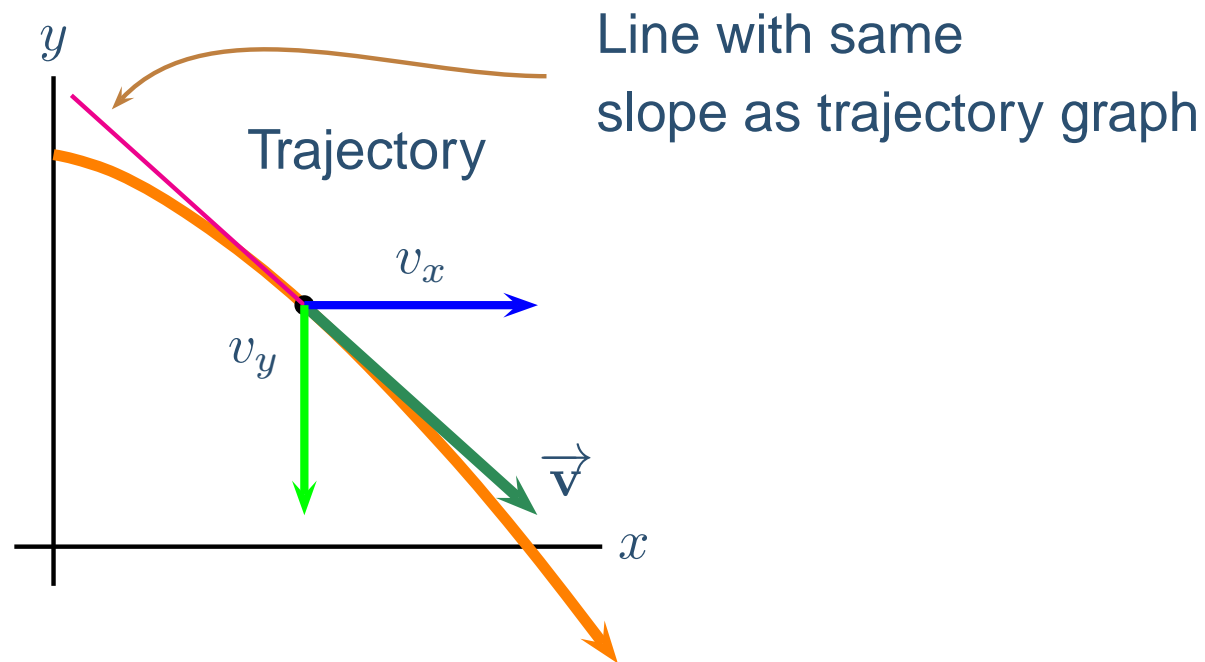
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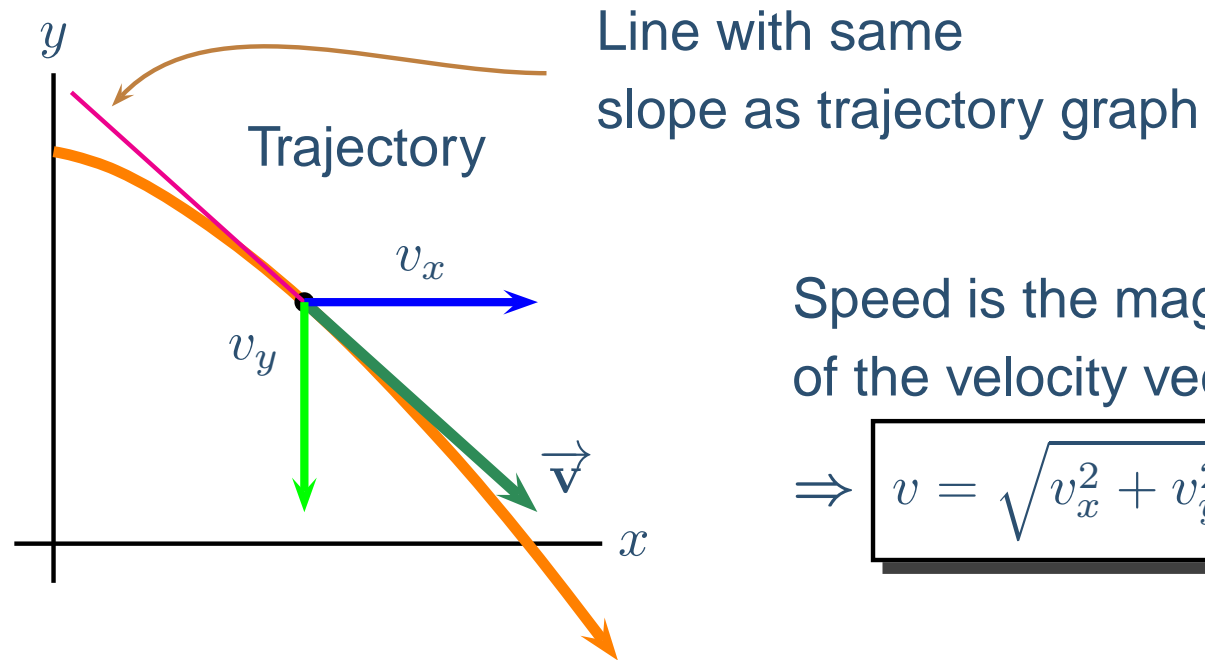




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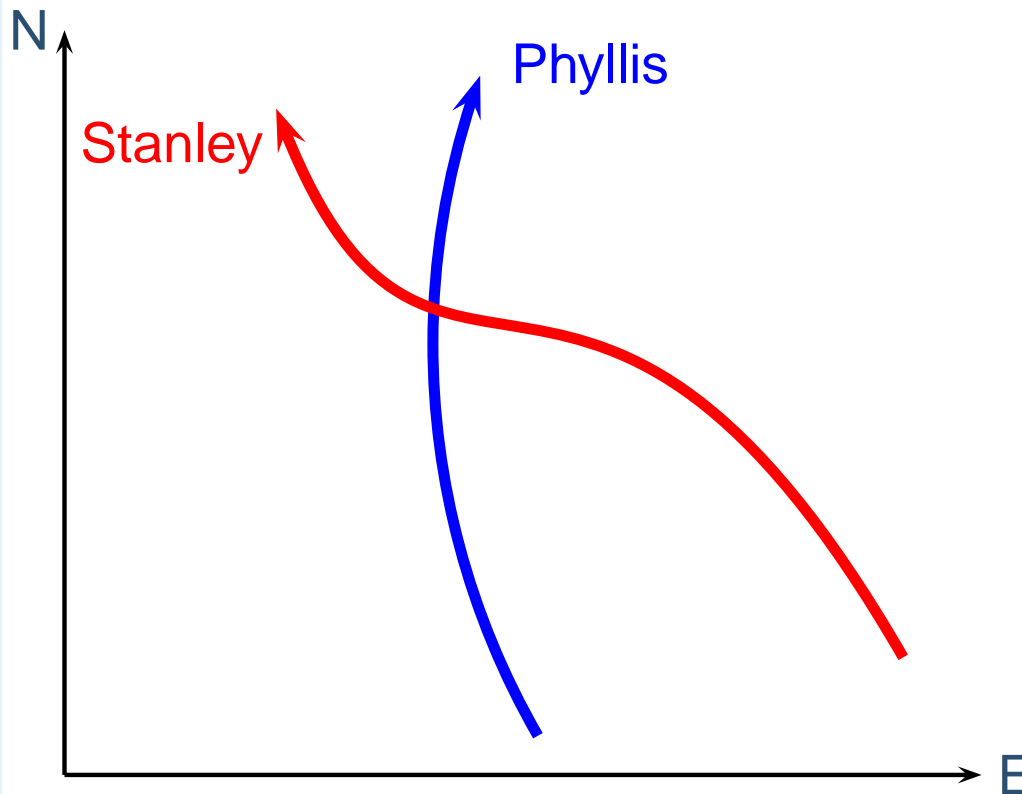


Speed is the magnitude of the velocity vector

$$\Rightarrow v = \sqrt{v_x^2 + v_y^2}$$

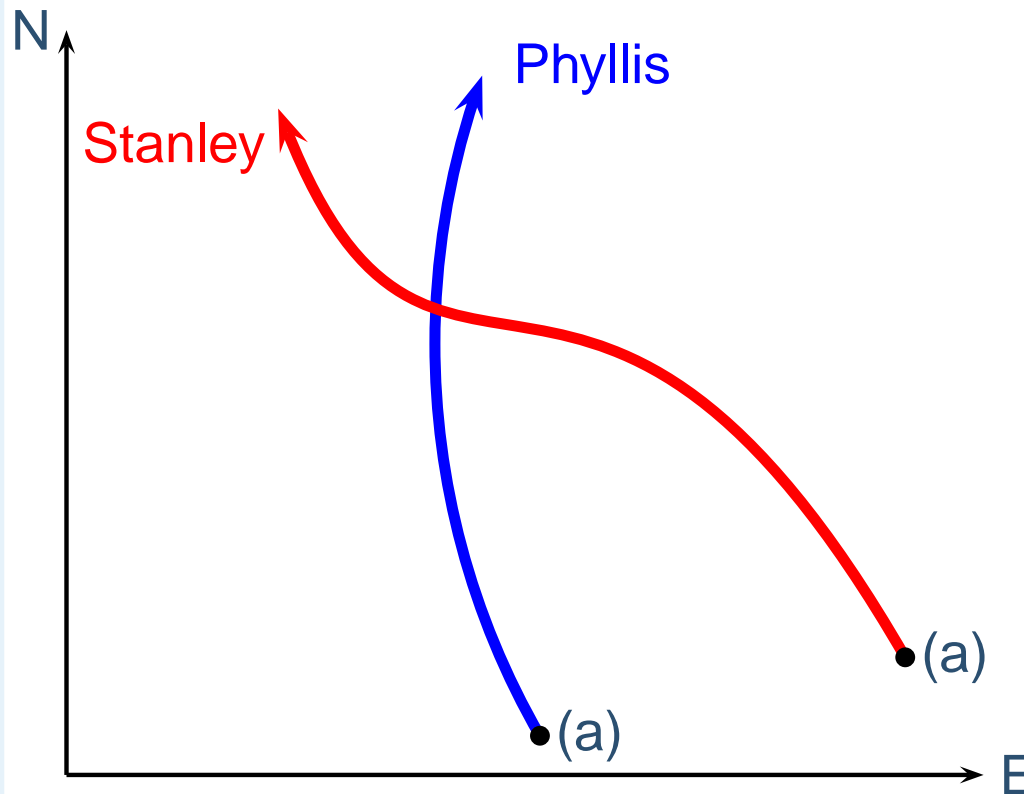
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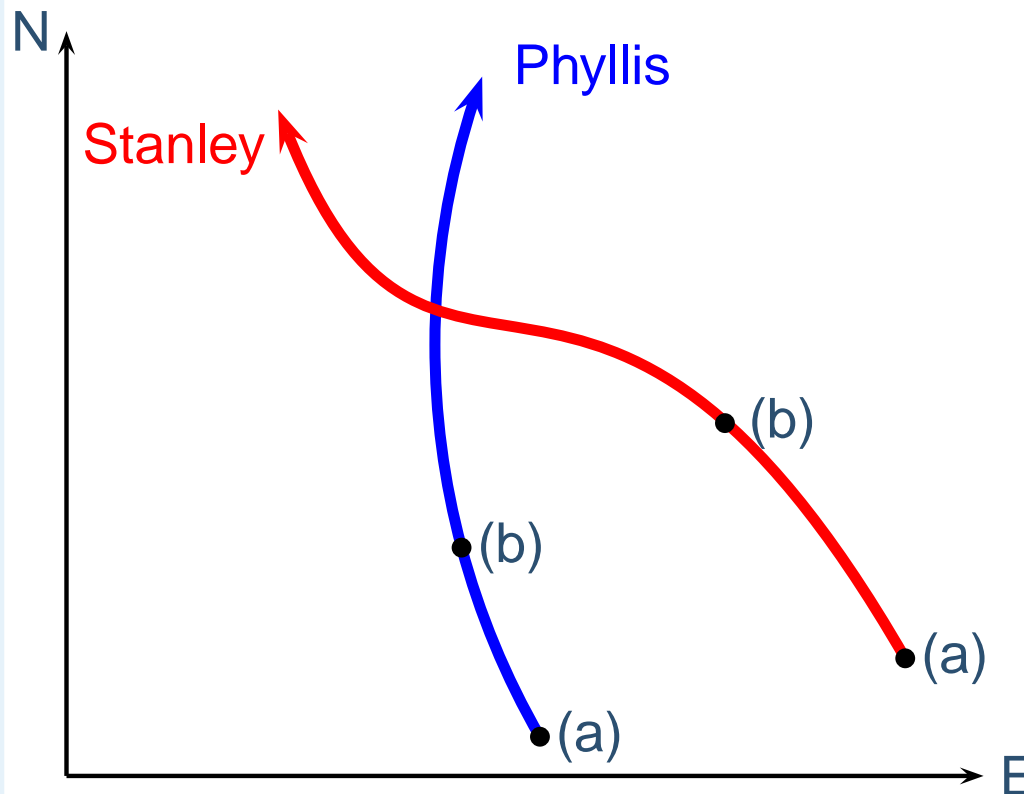
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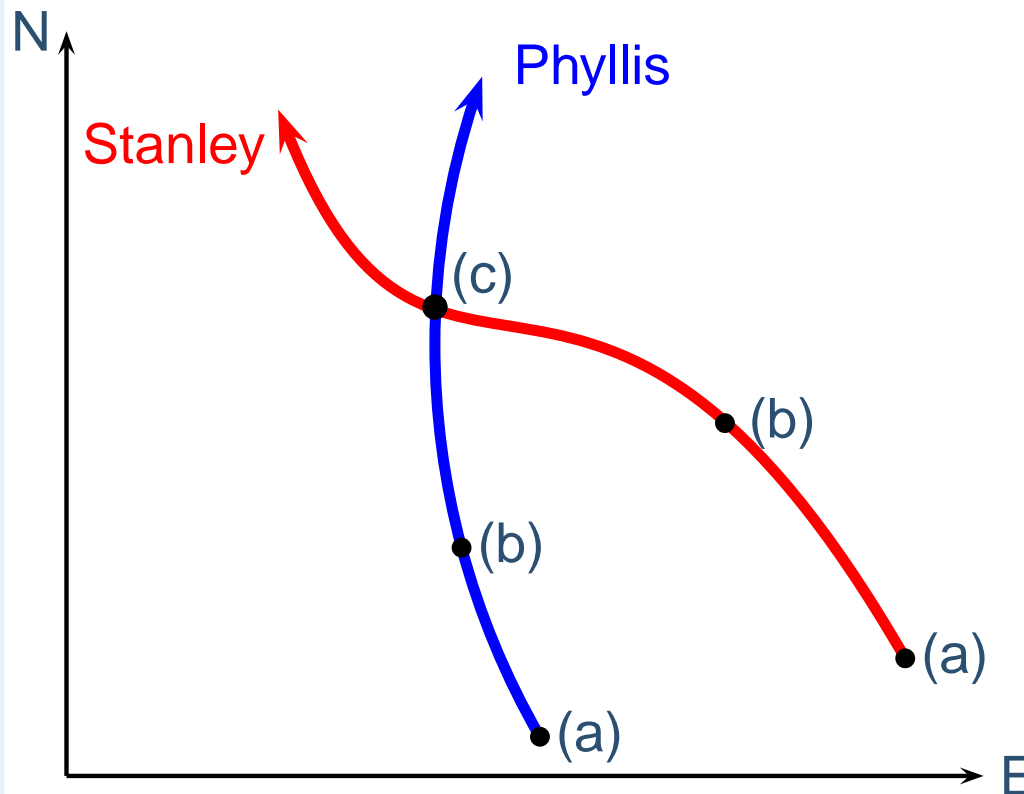
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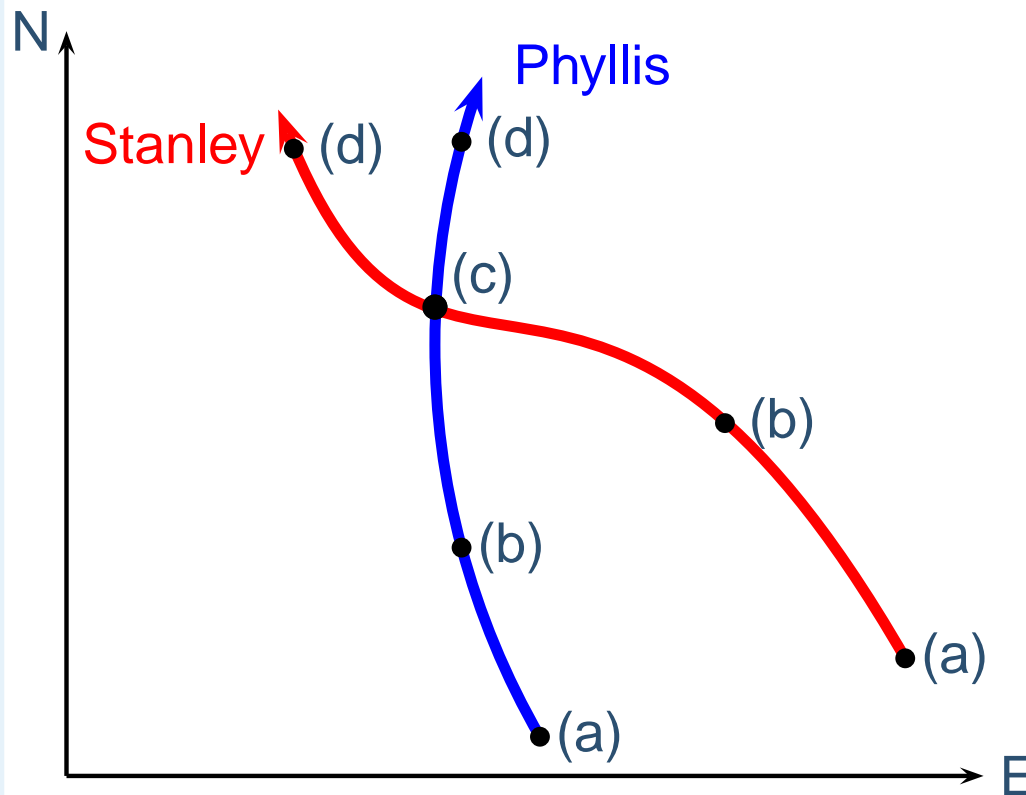
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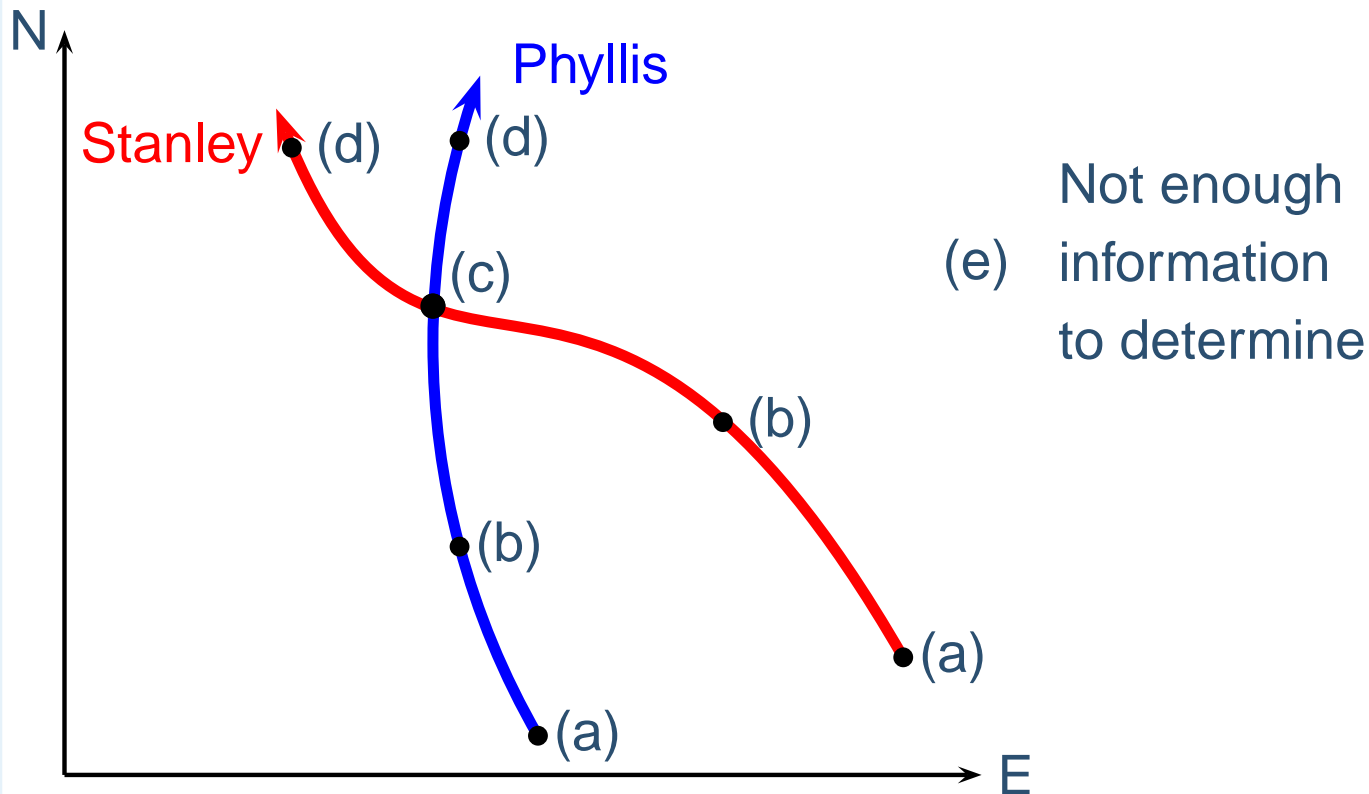
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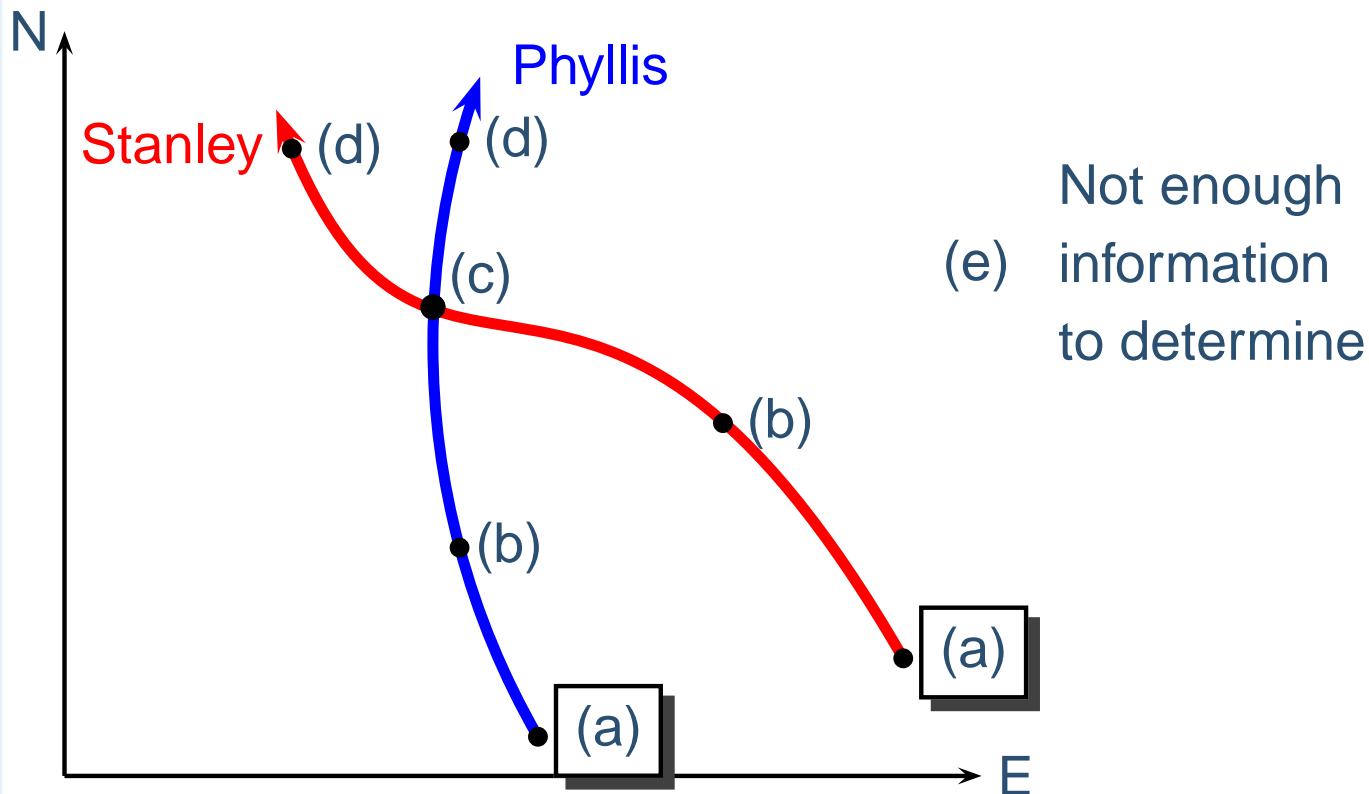
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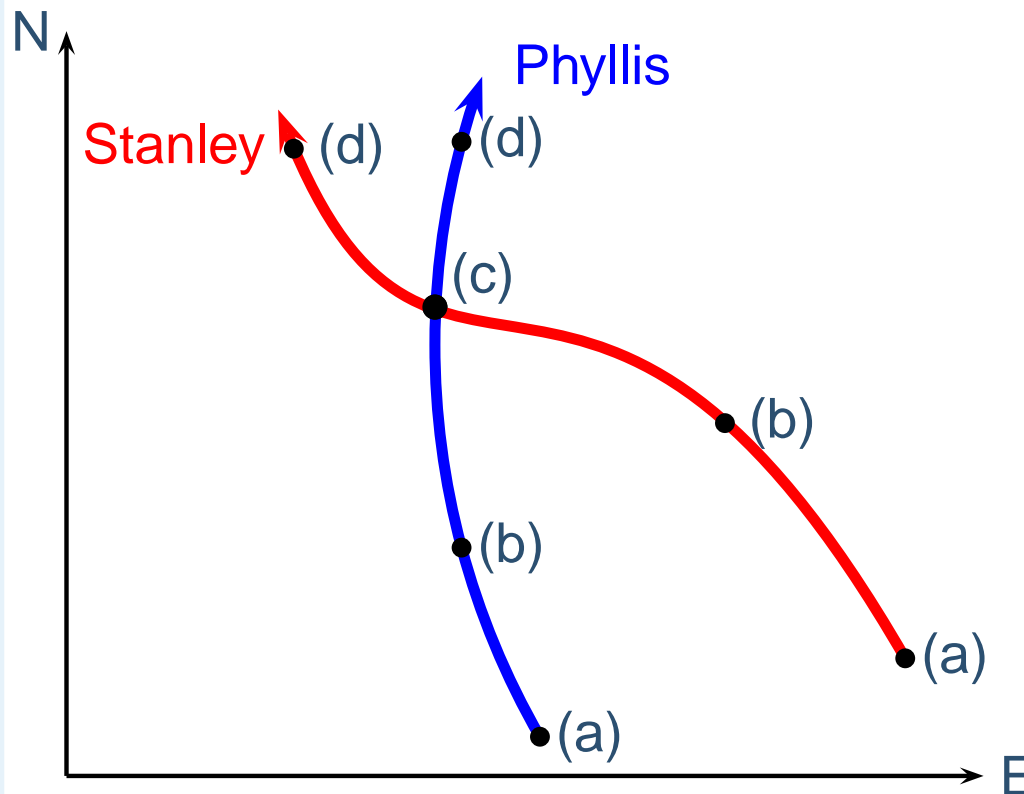
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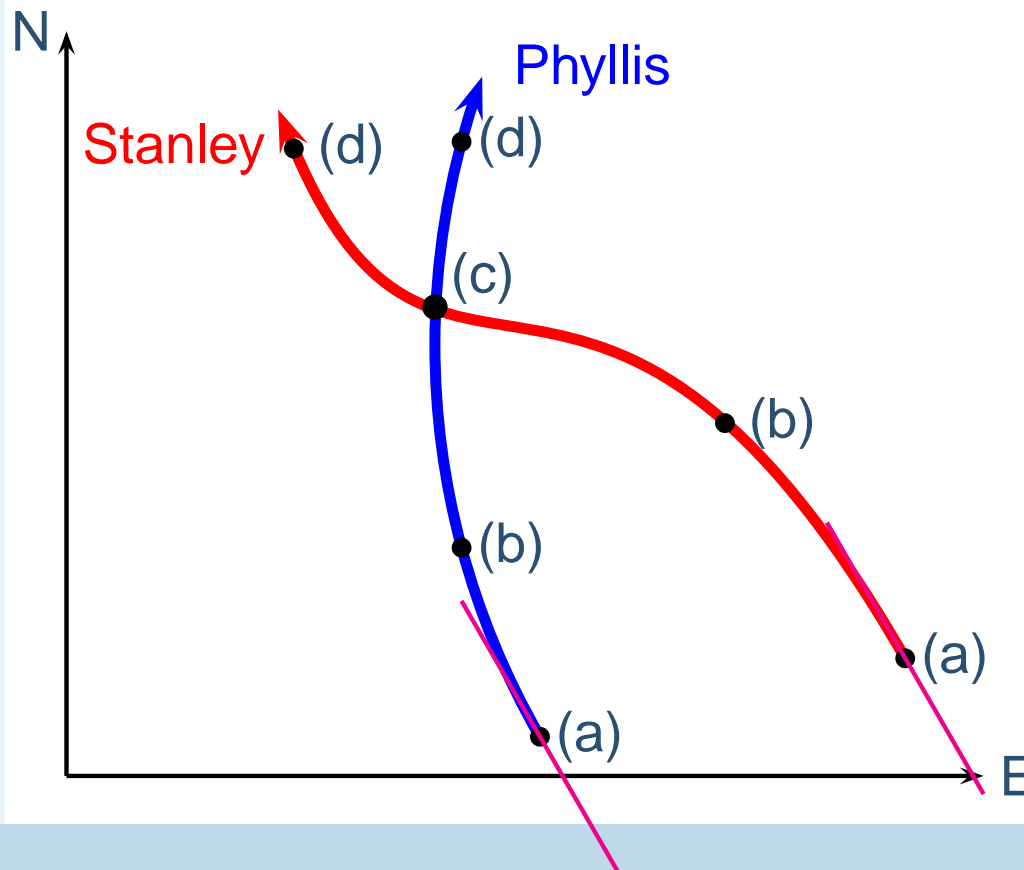
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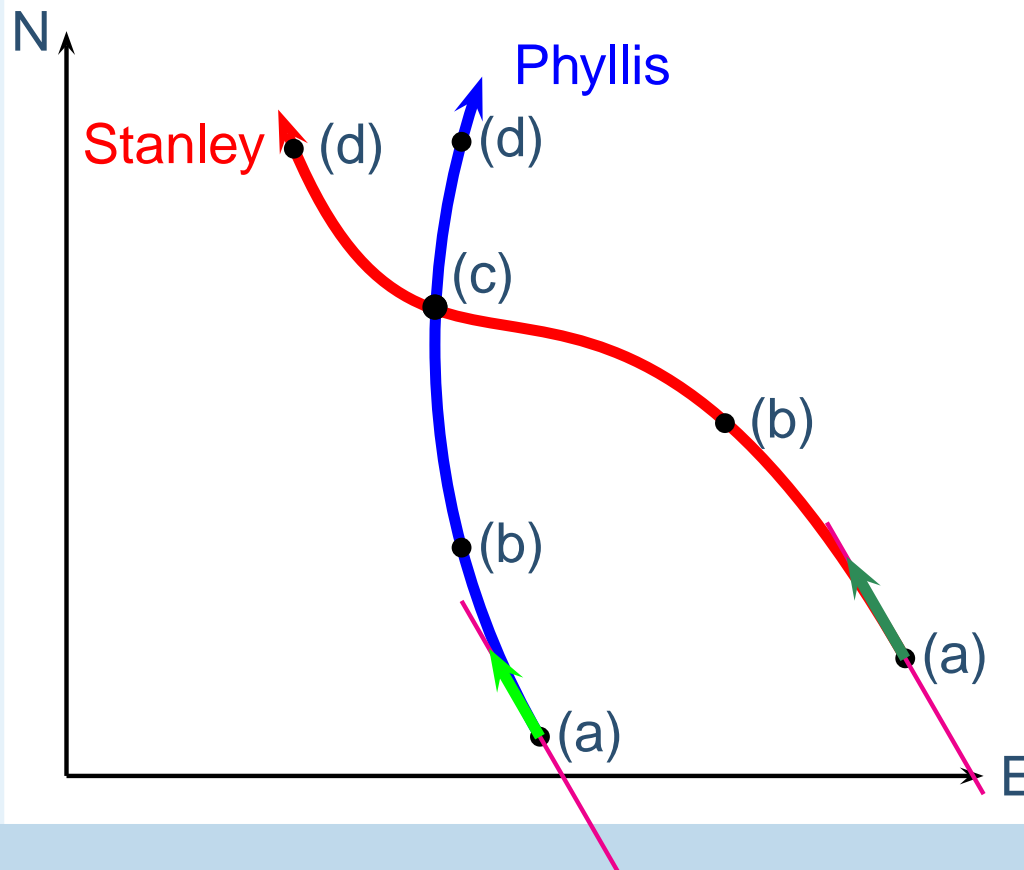
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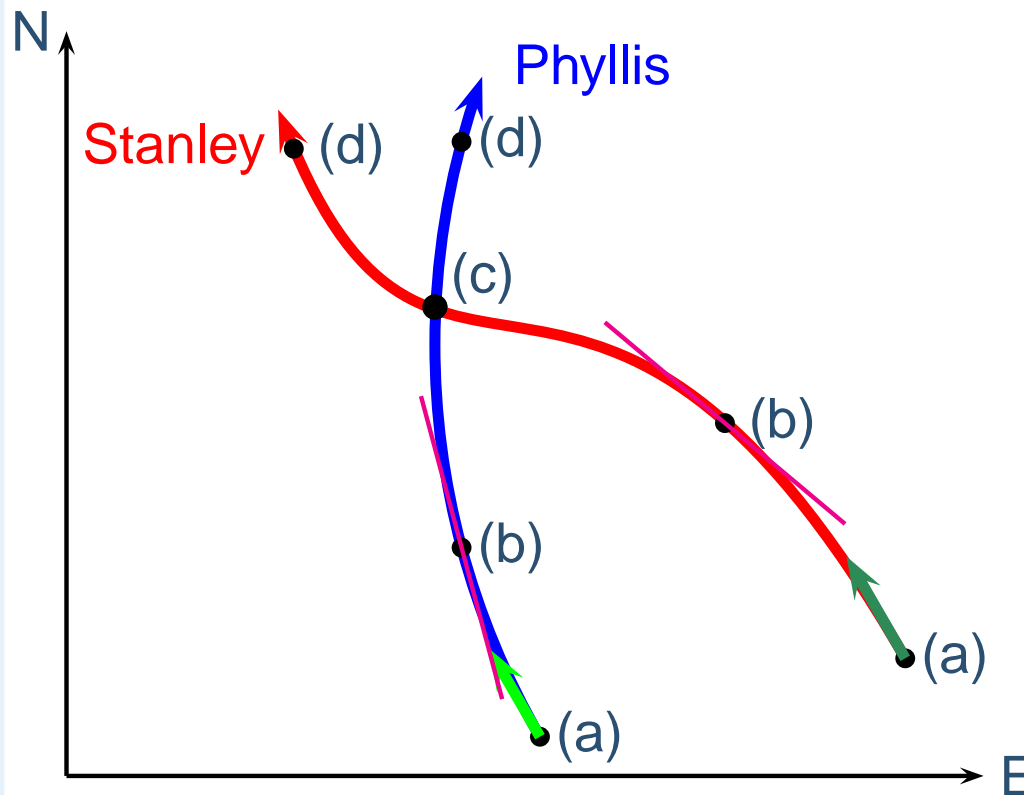
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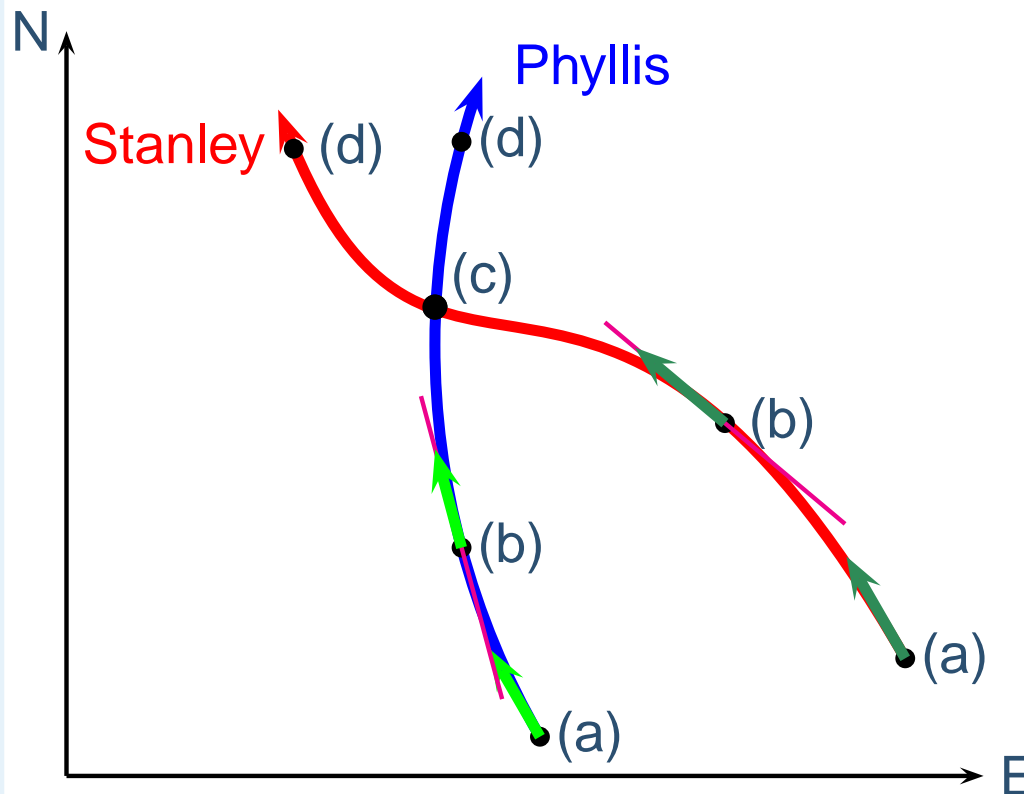
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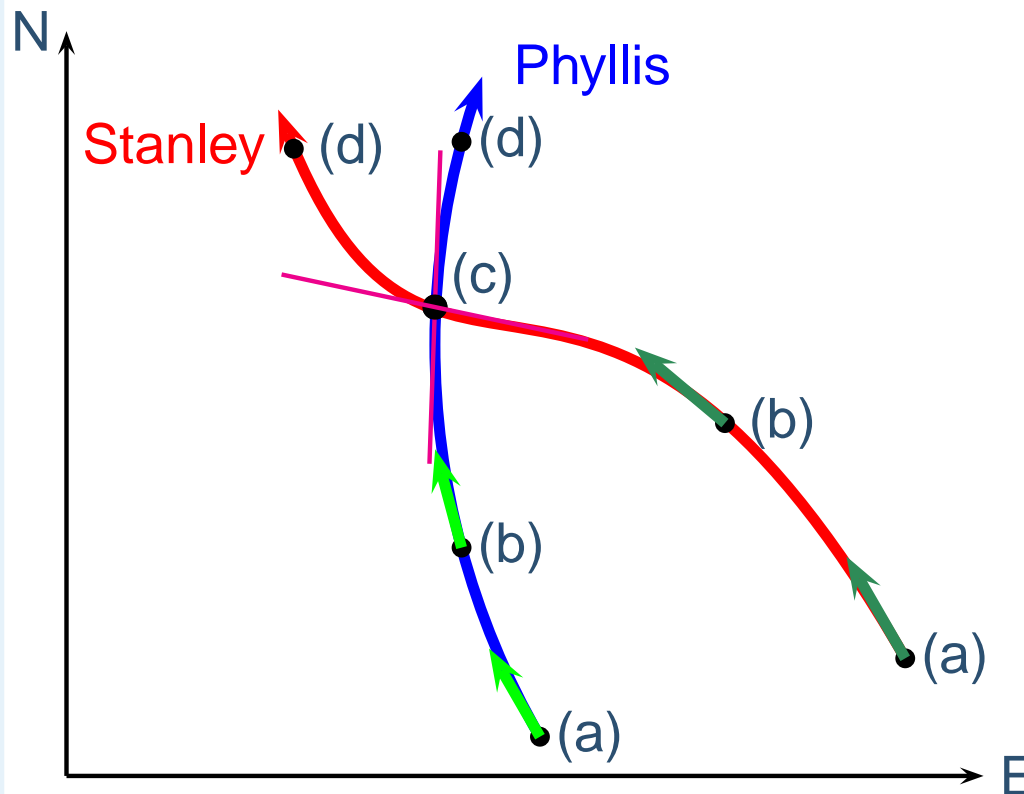
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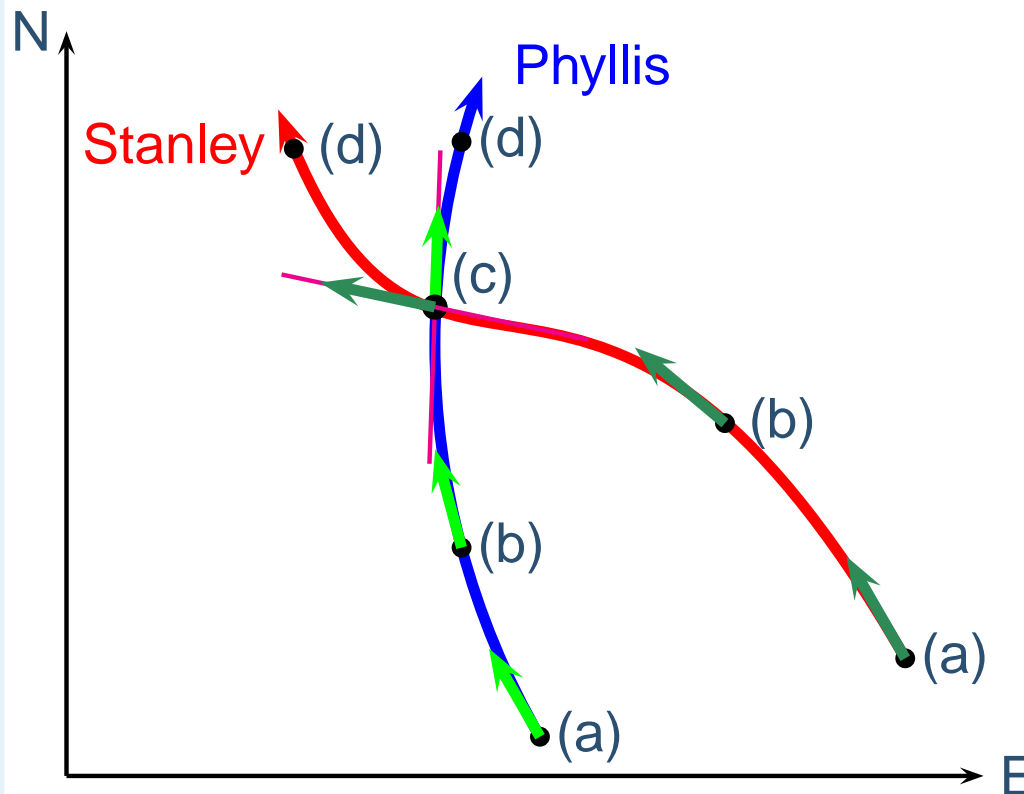
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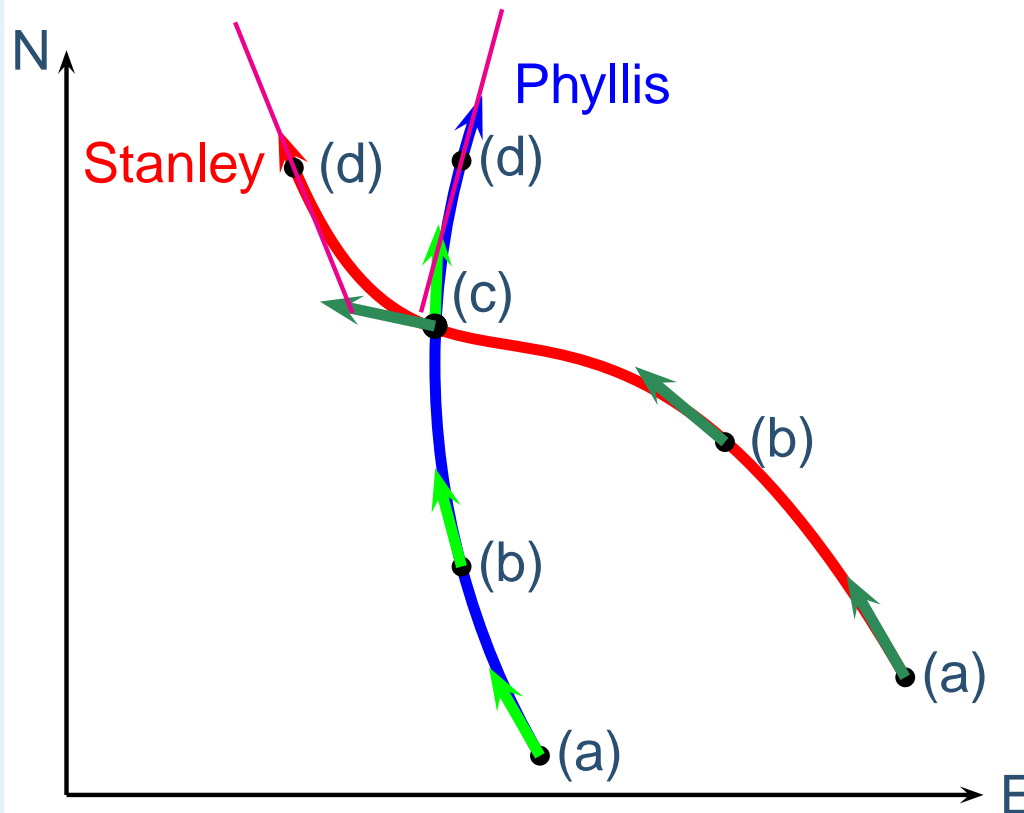
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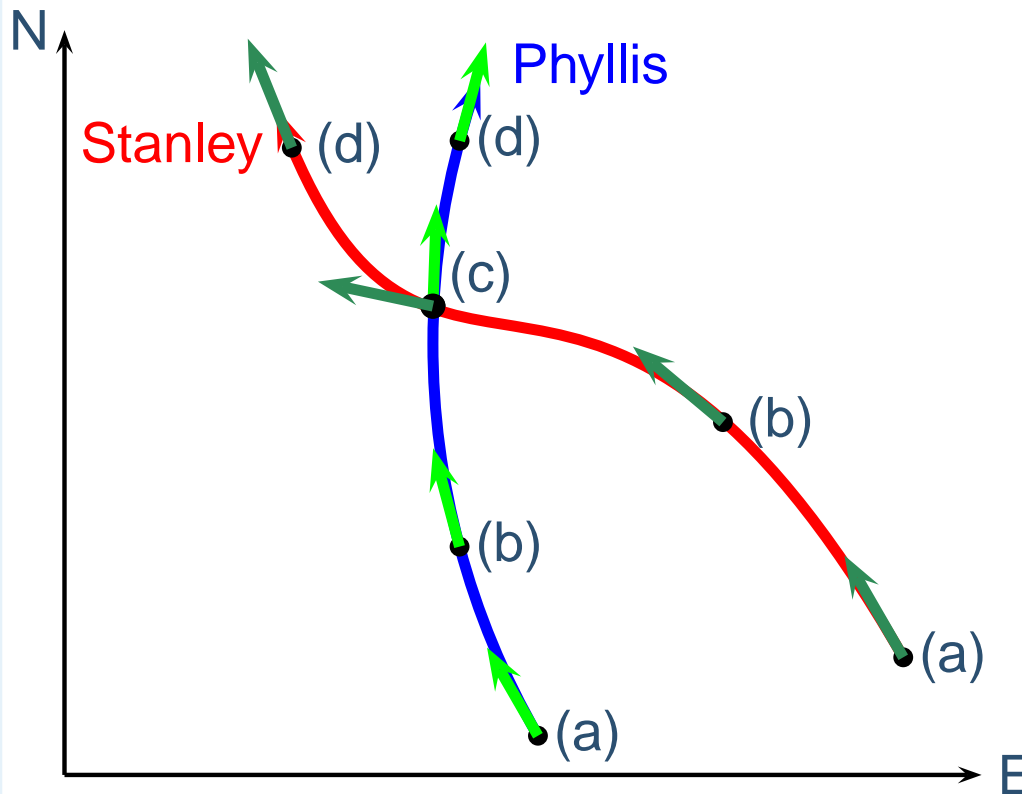
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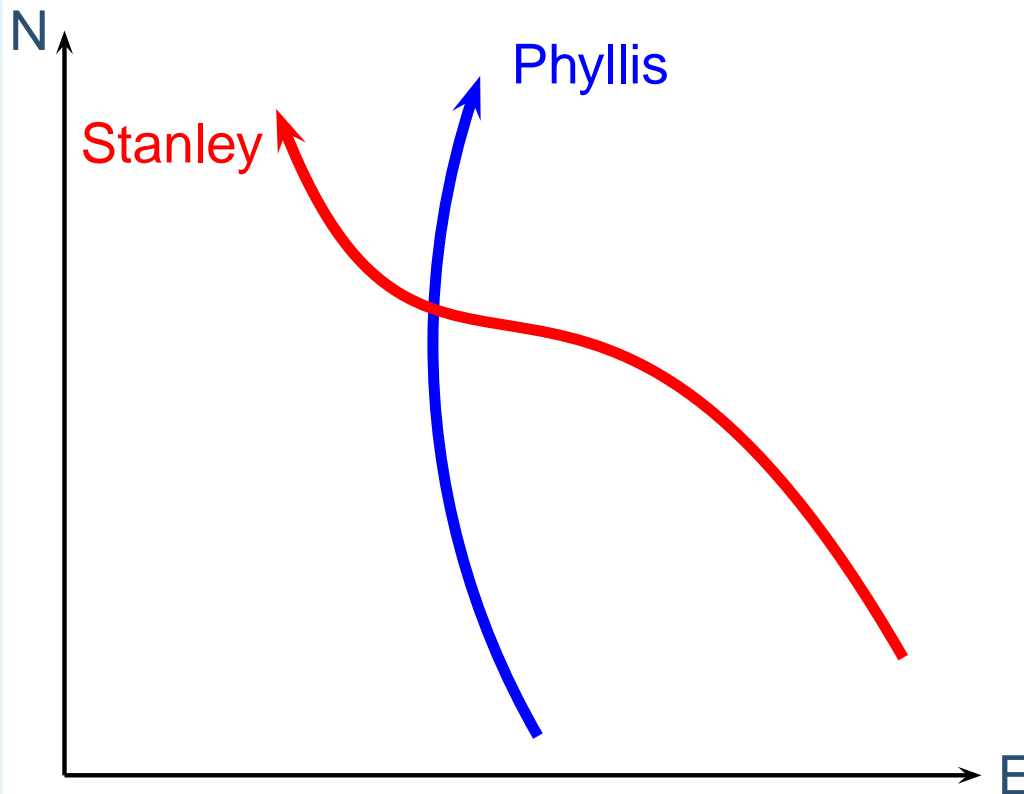
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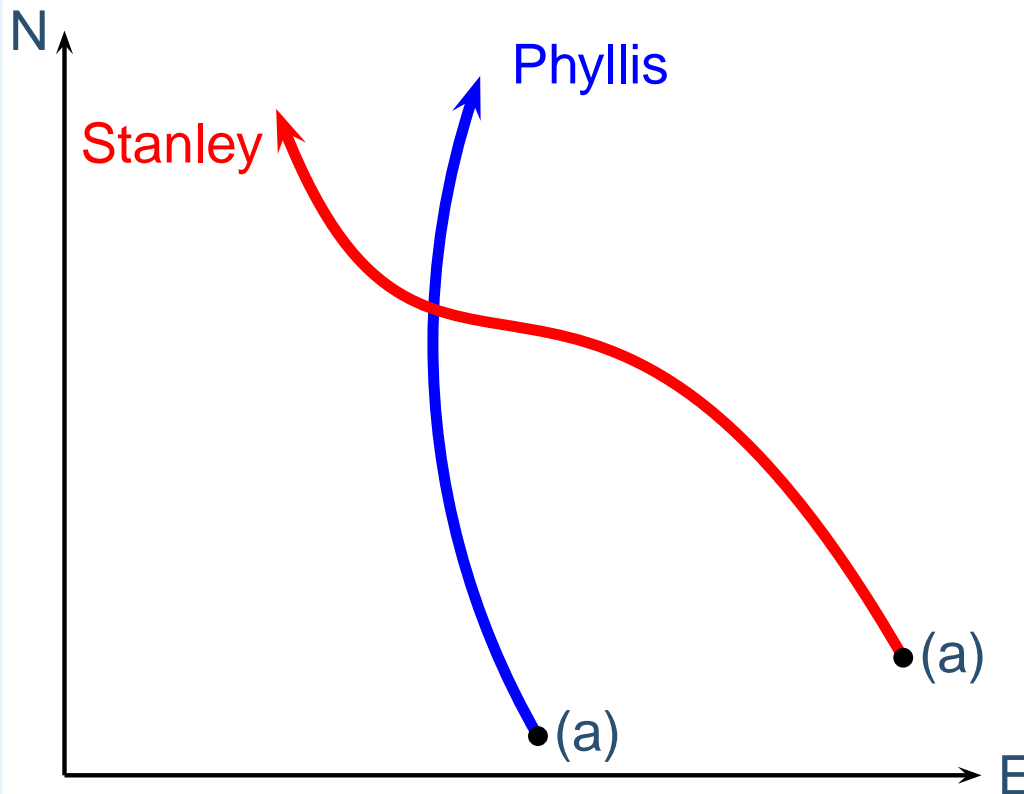
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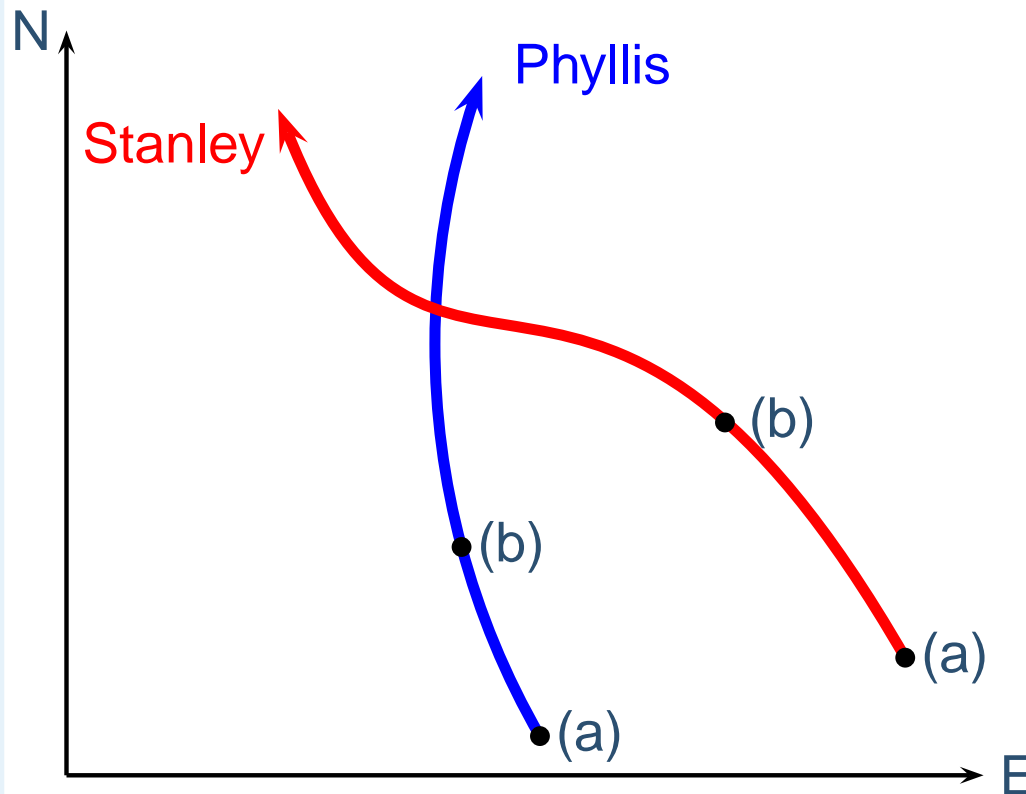
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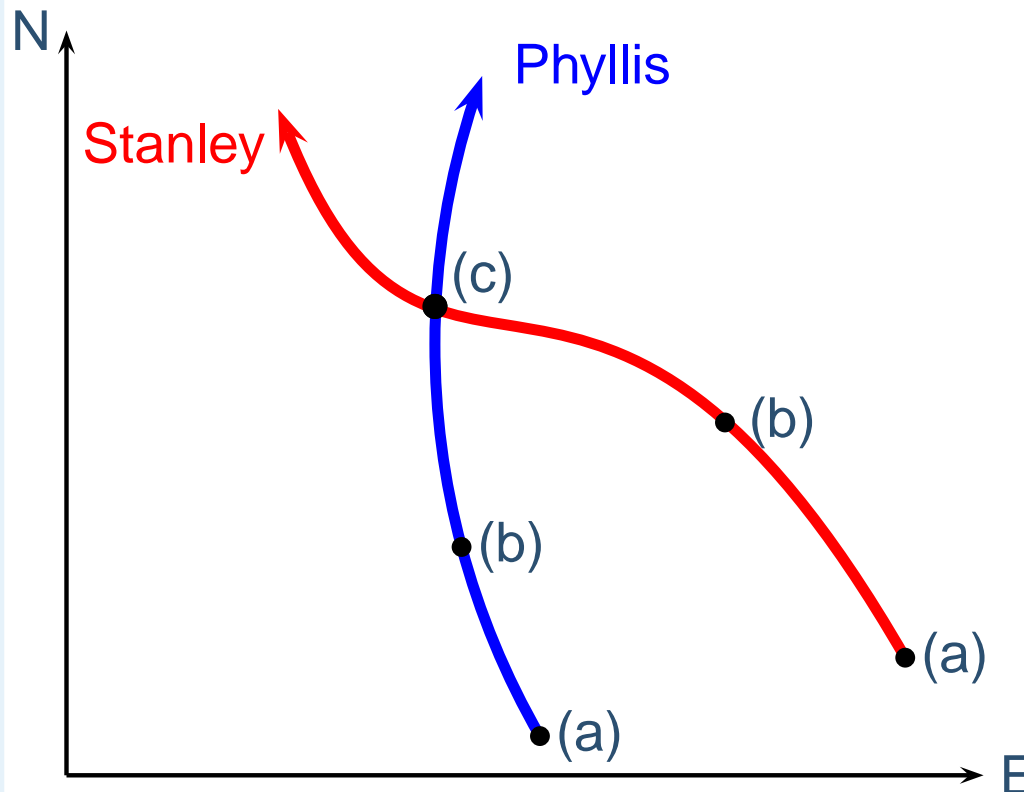
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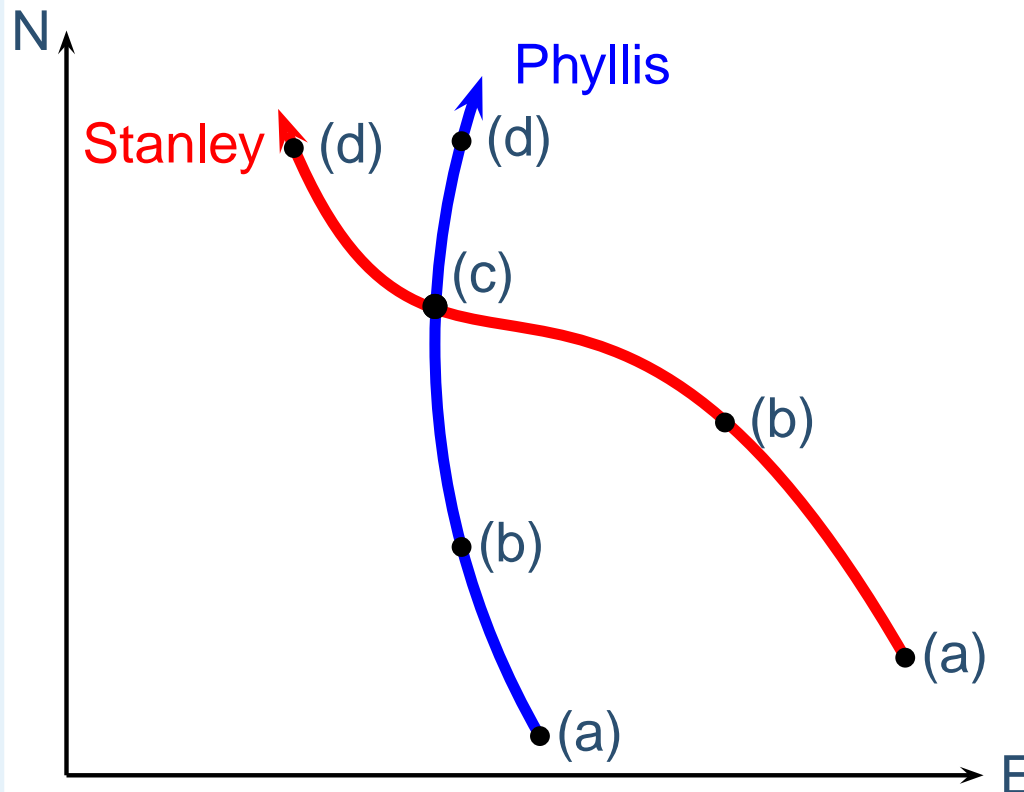
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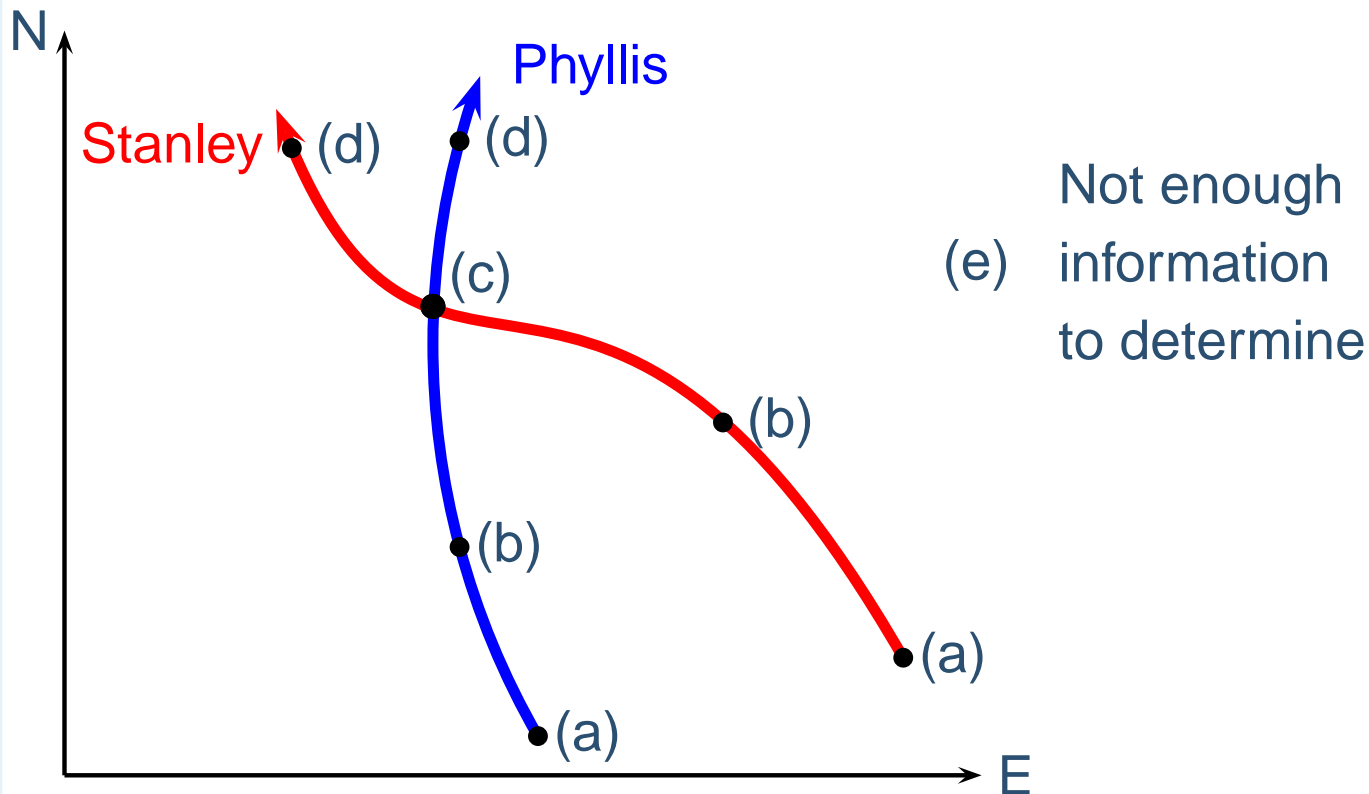
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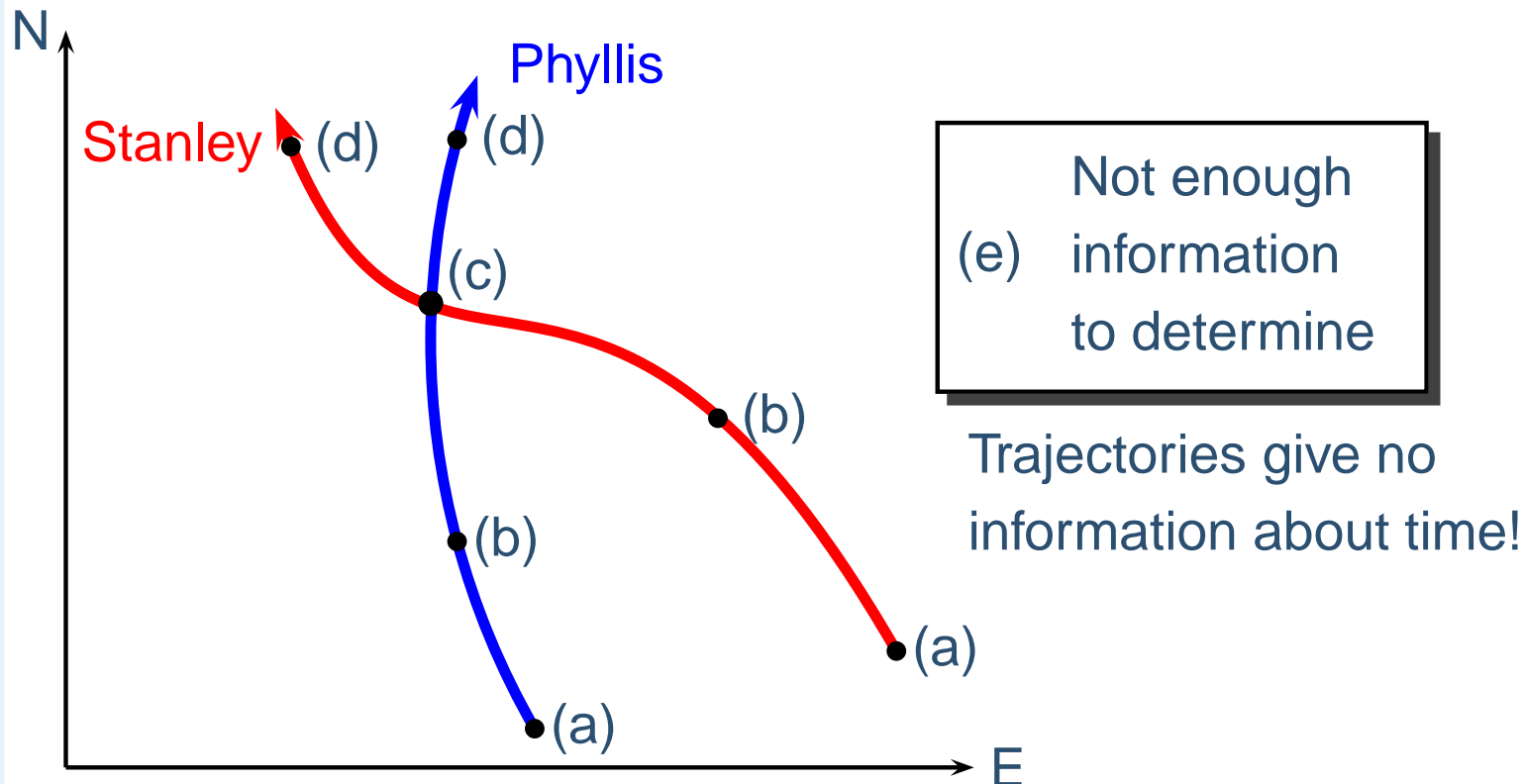
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Phyllis and Stanley both walk their dogs in the same park. The trajectories for Phyllis's and Stanley's walks are shown below. At what point were they at the same place at the same time?



# Curved Motion Exercise II

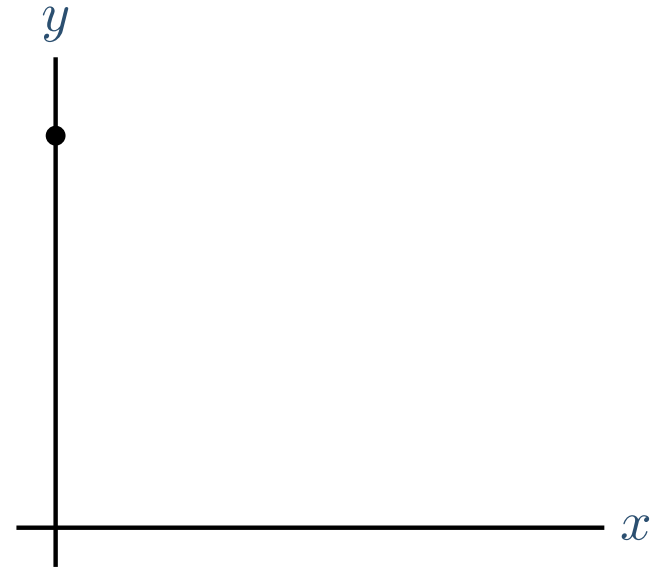
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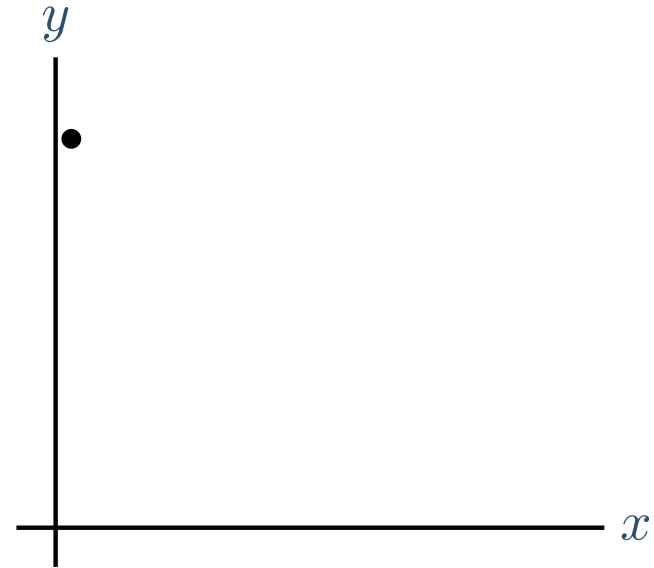
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We can find the acceleration components in the same way as velocity



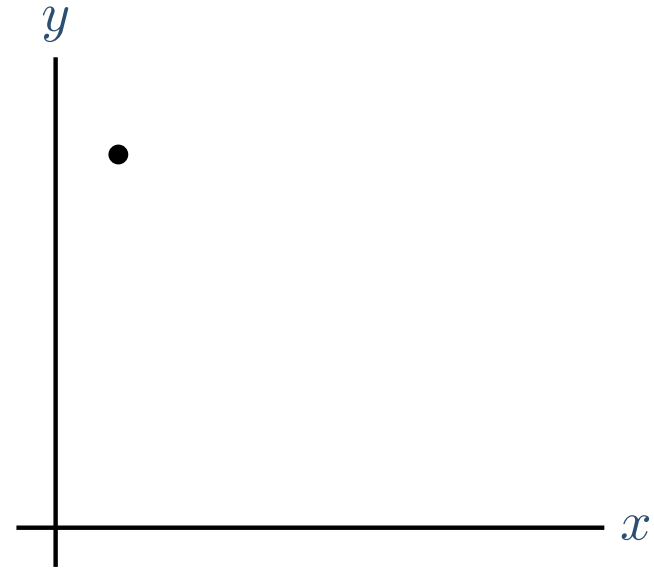
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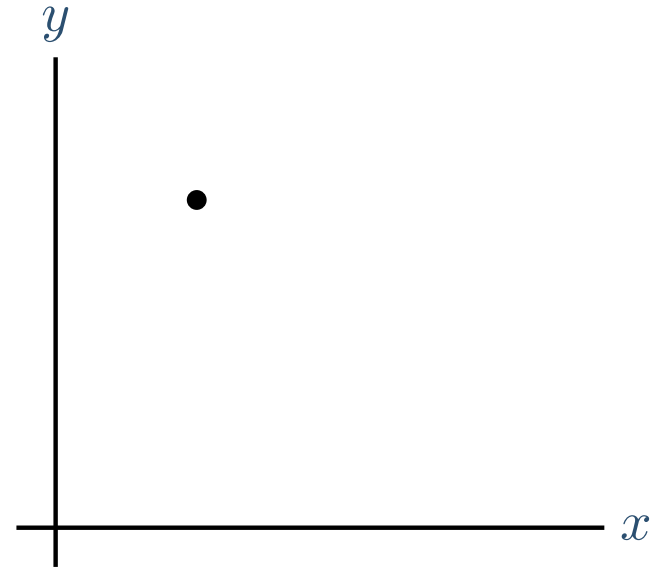
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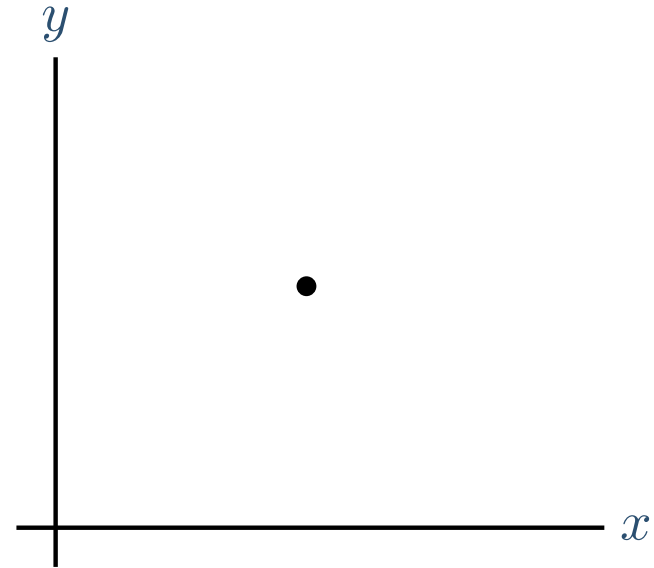
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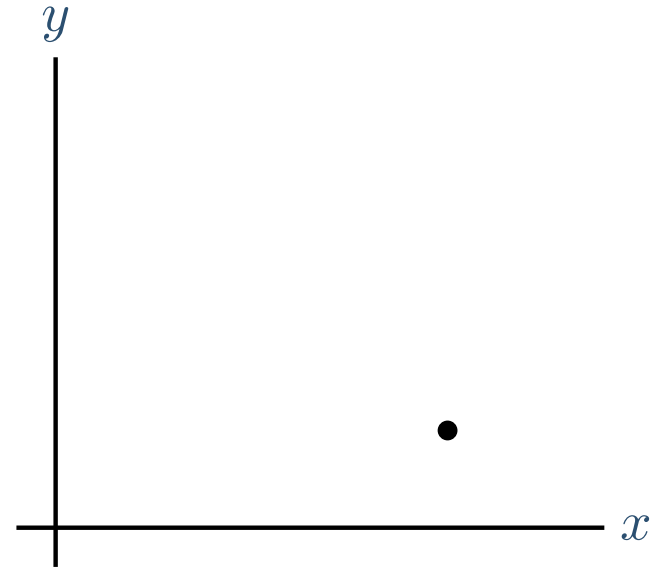
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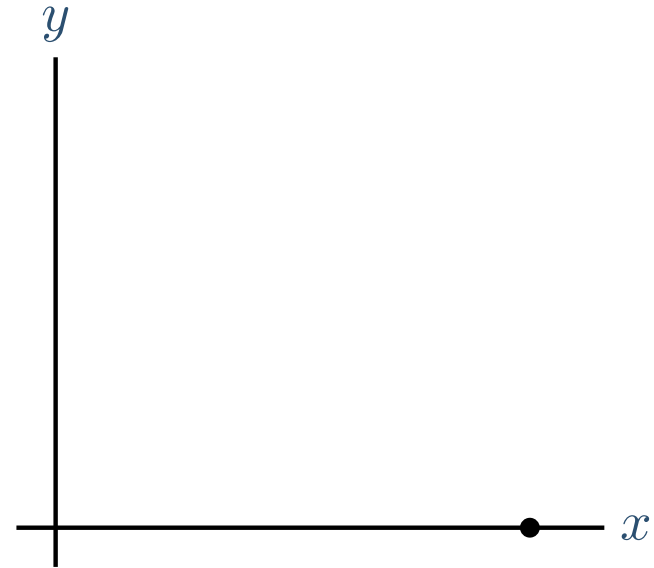
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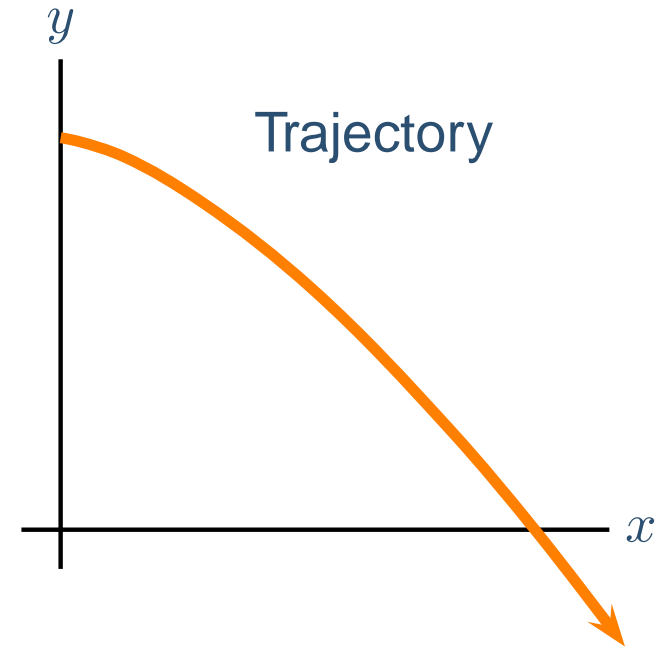
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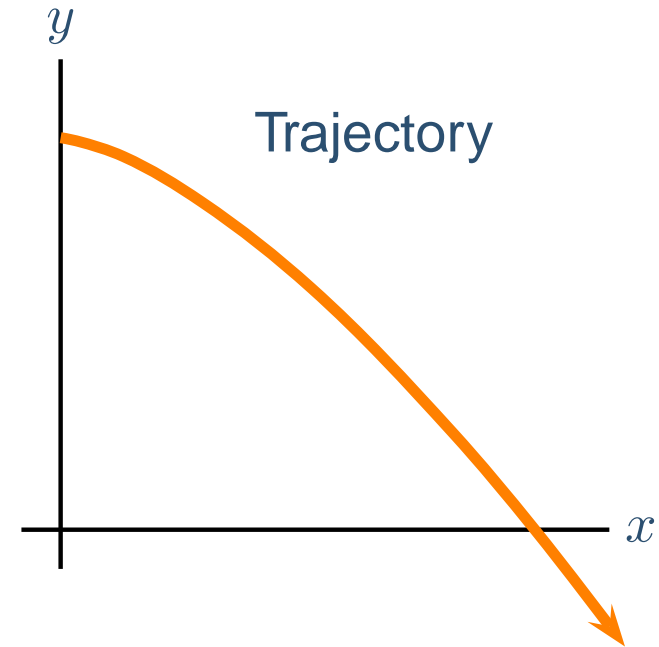




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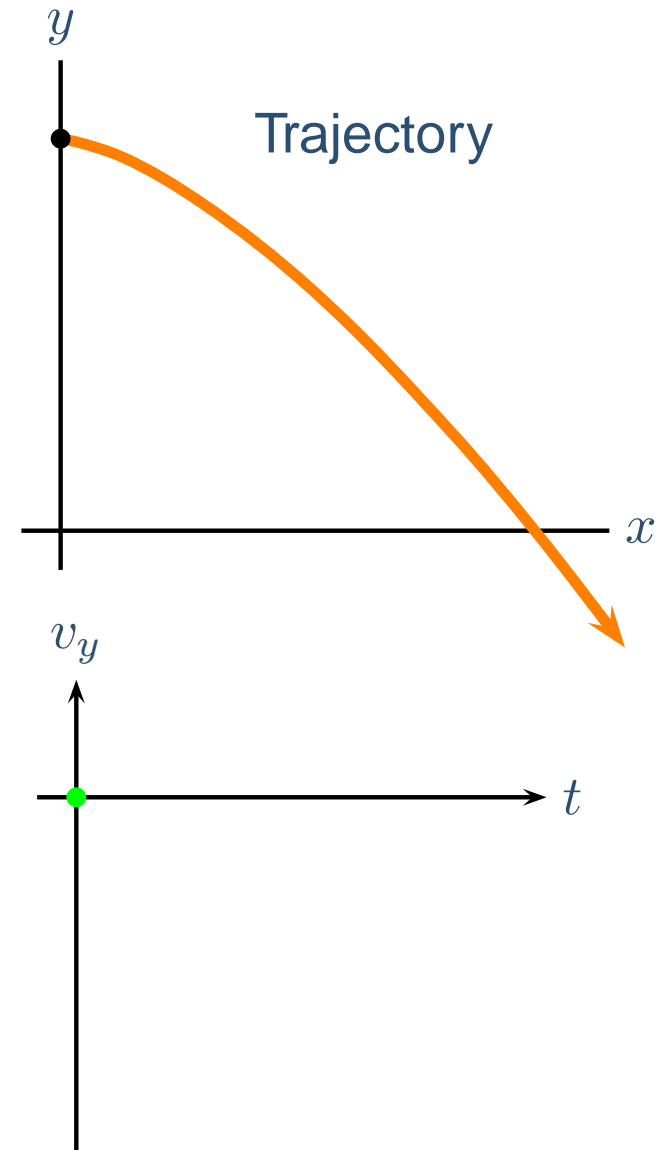
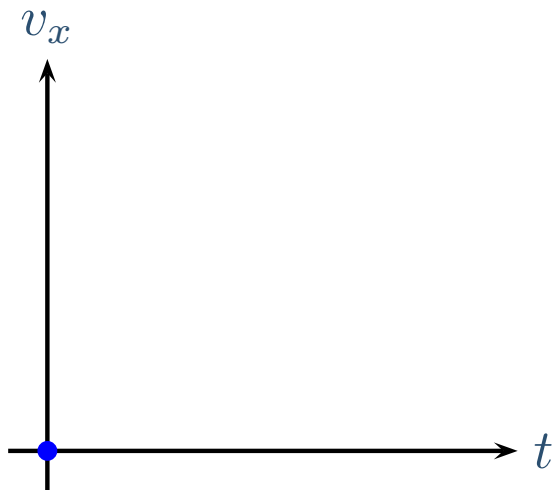
There are two separate *VELOCITY* plots which give the acceleration vector's components



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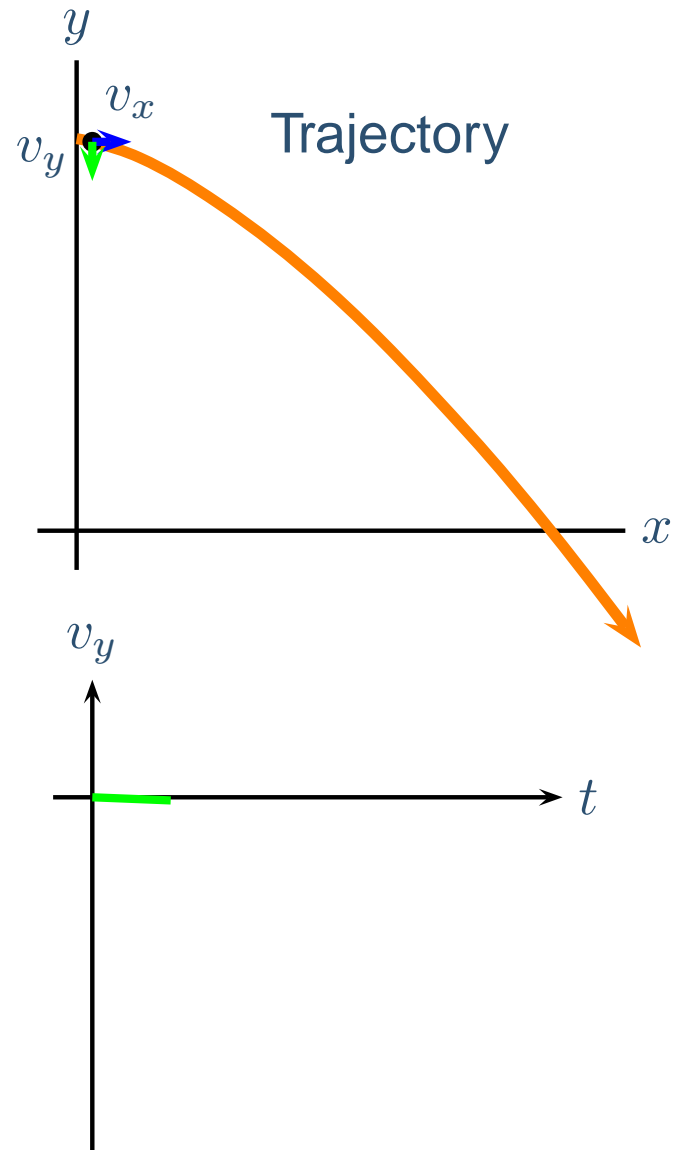
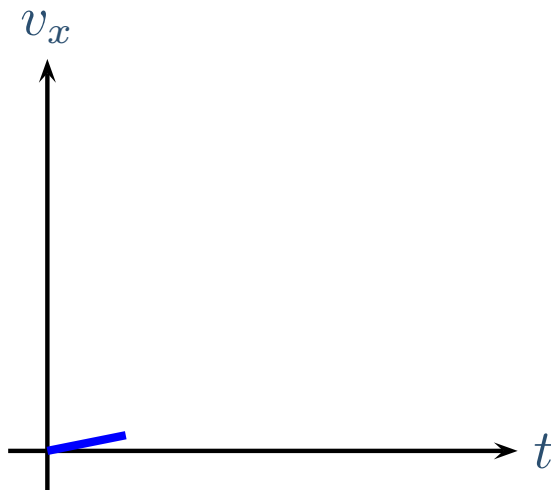
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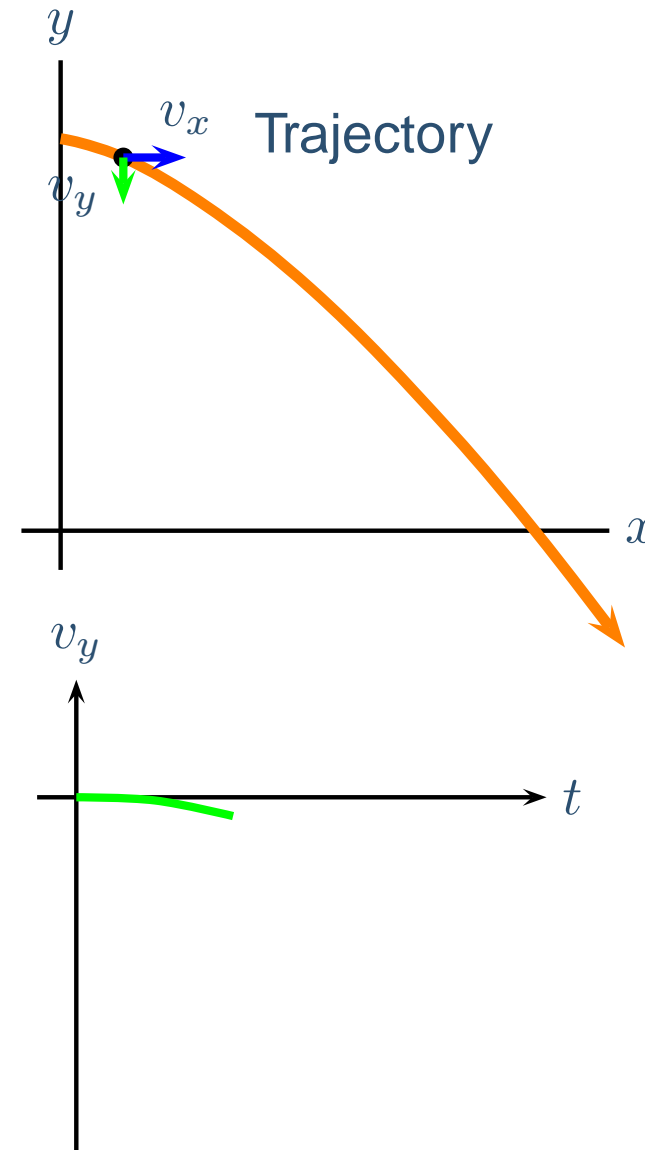
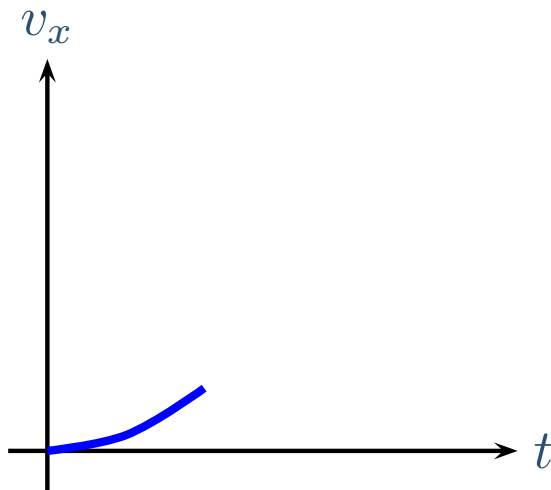
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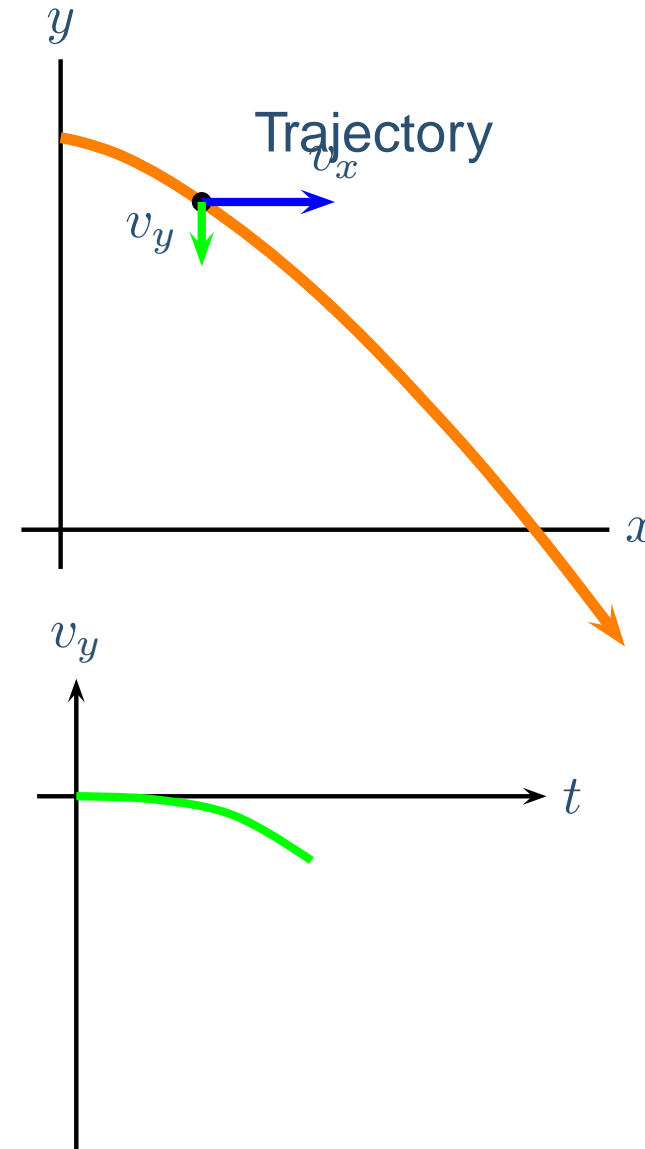
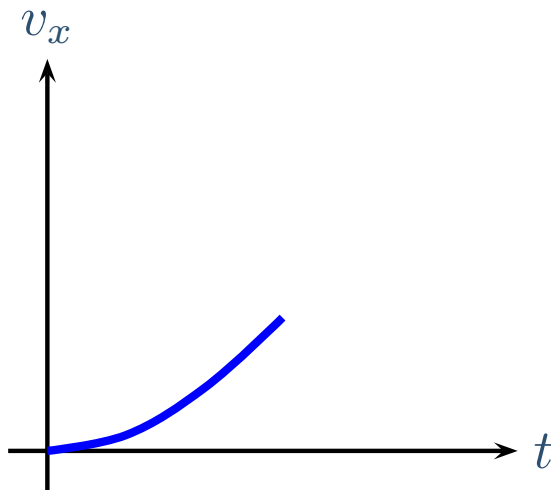
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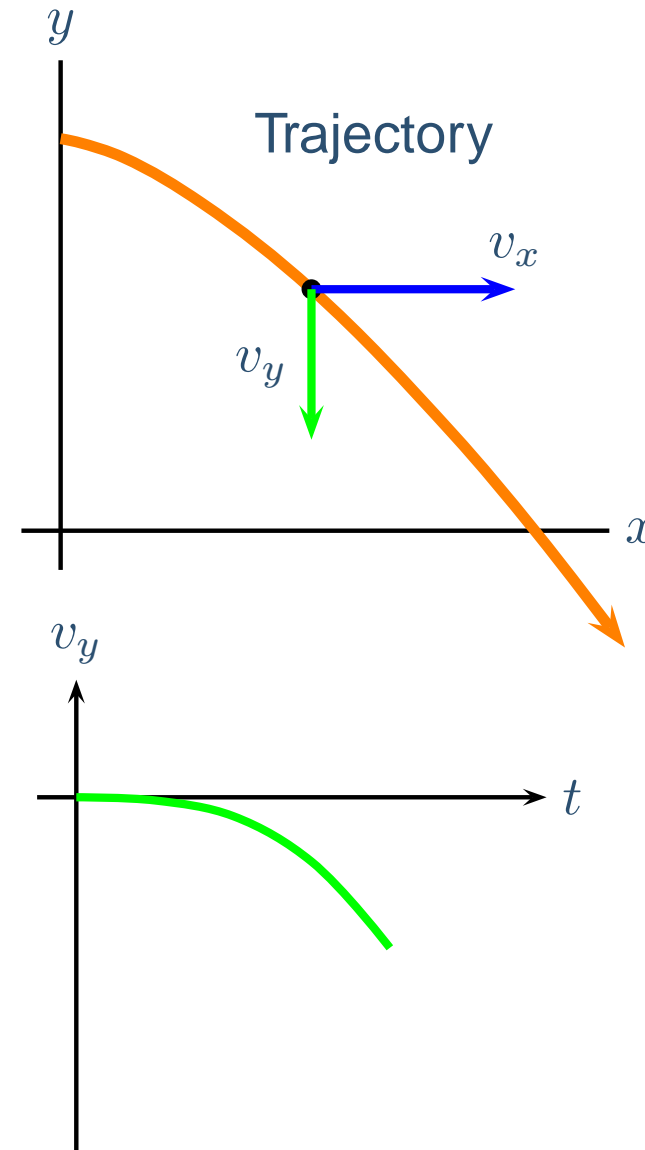
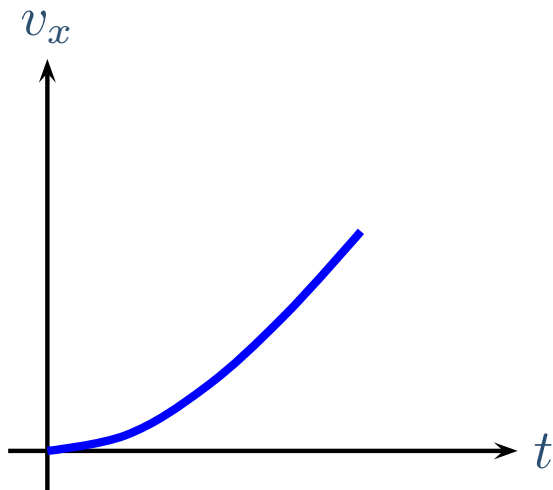
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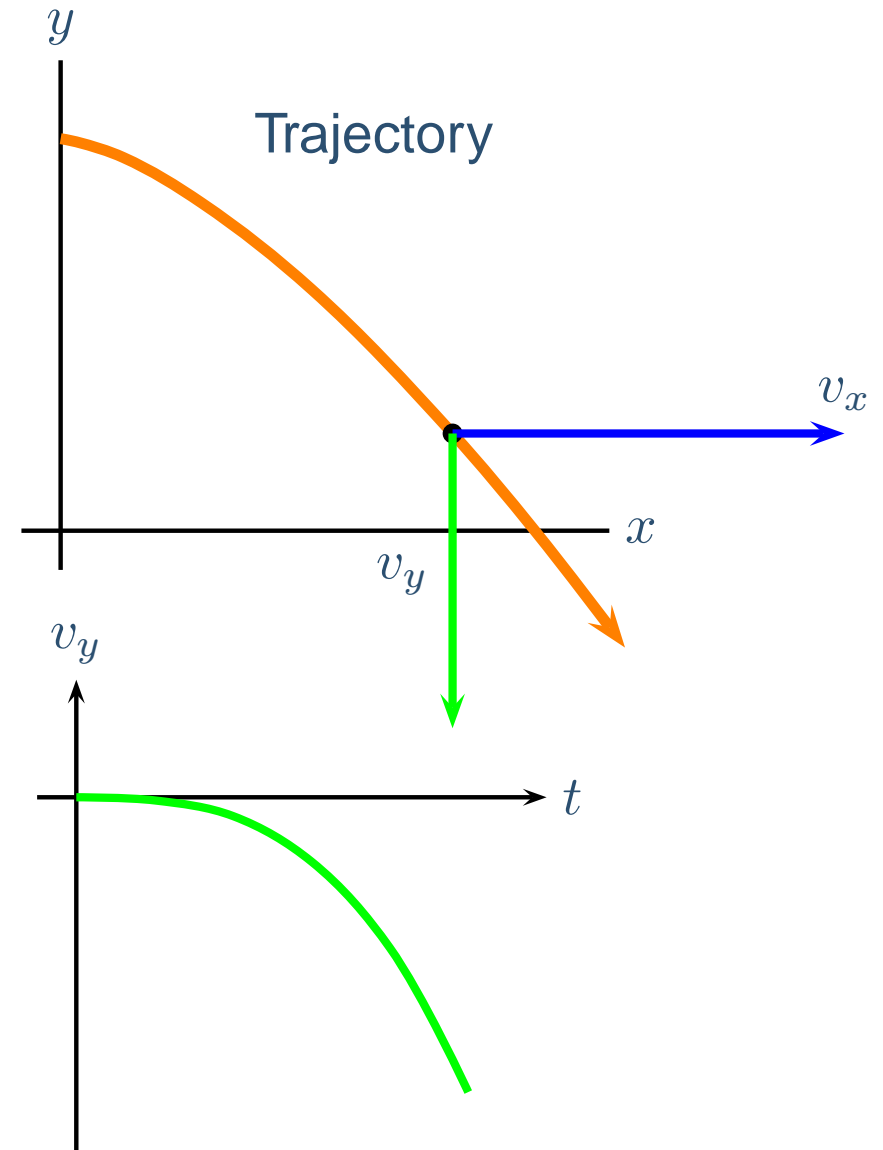
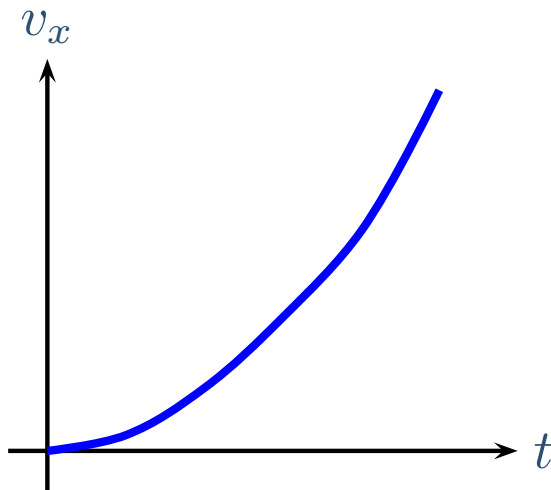
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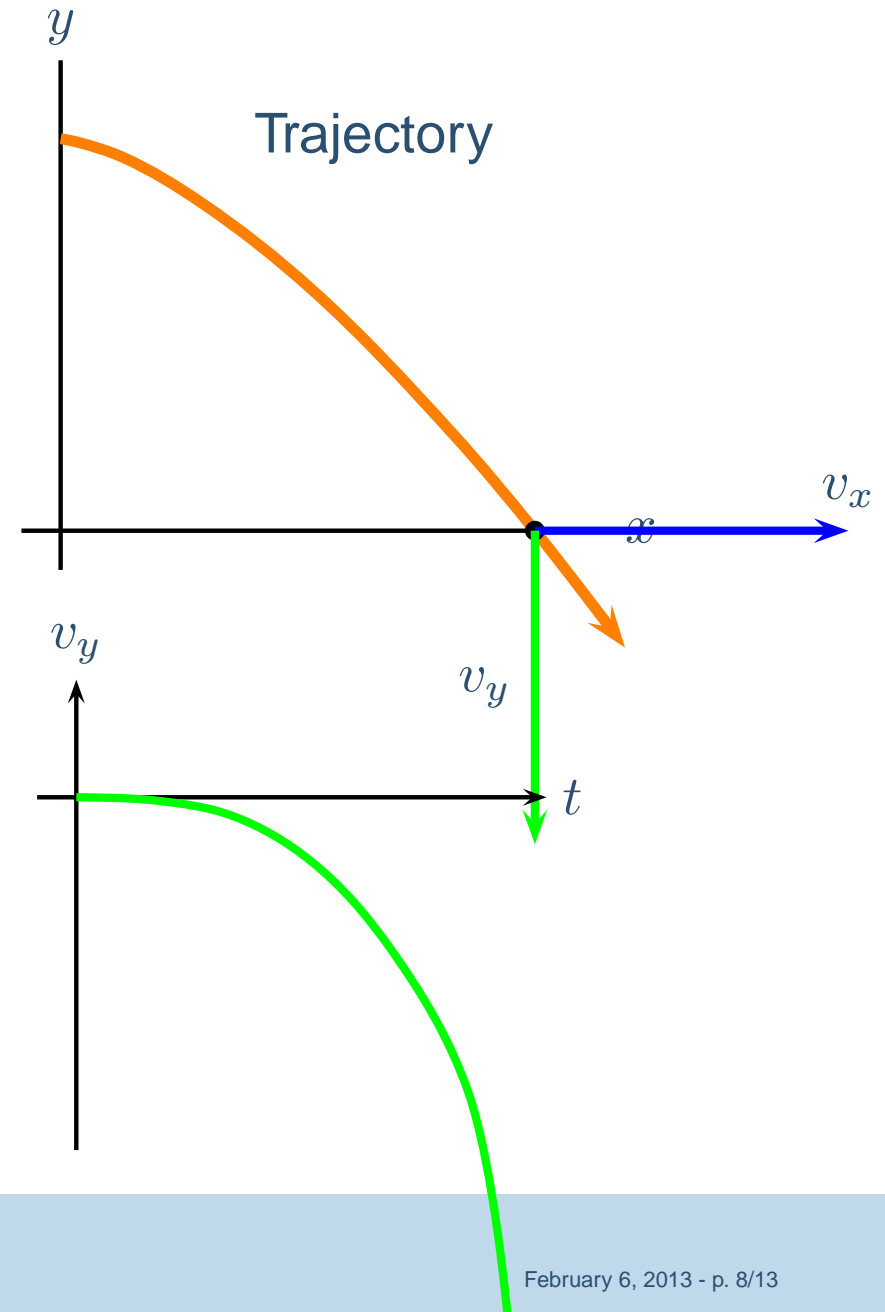
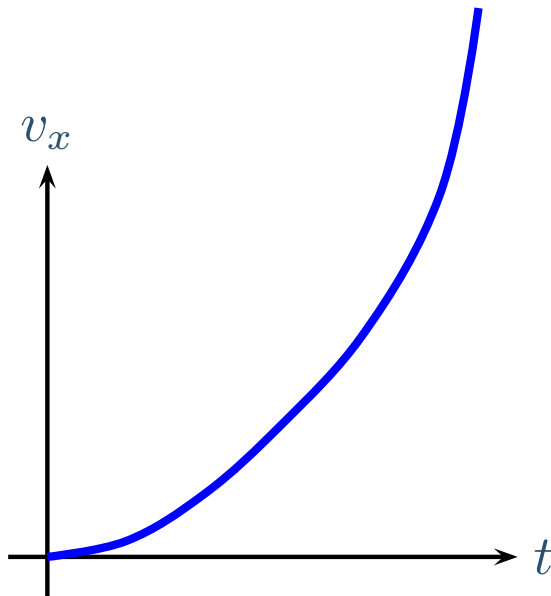
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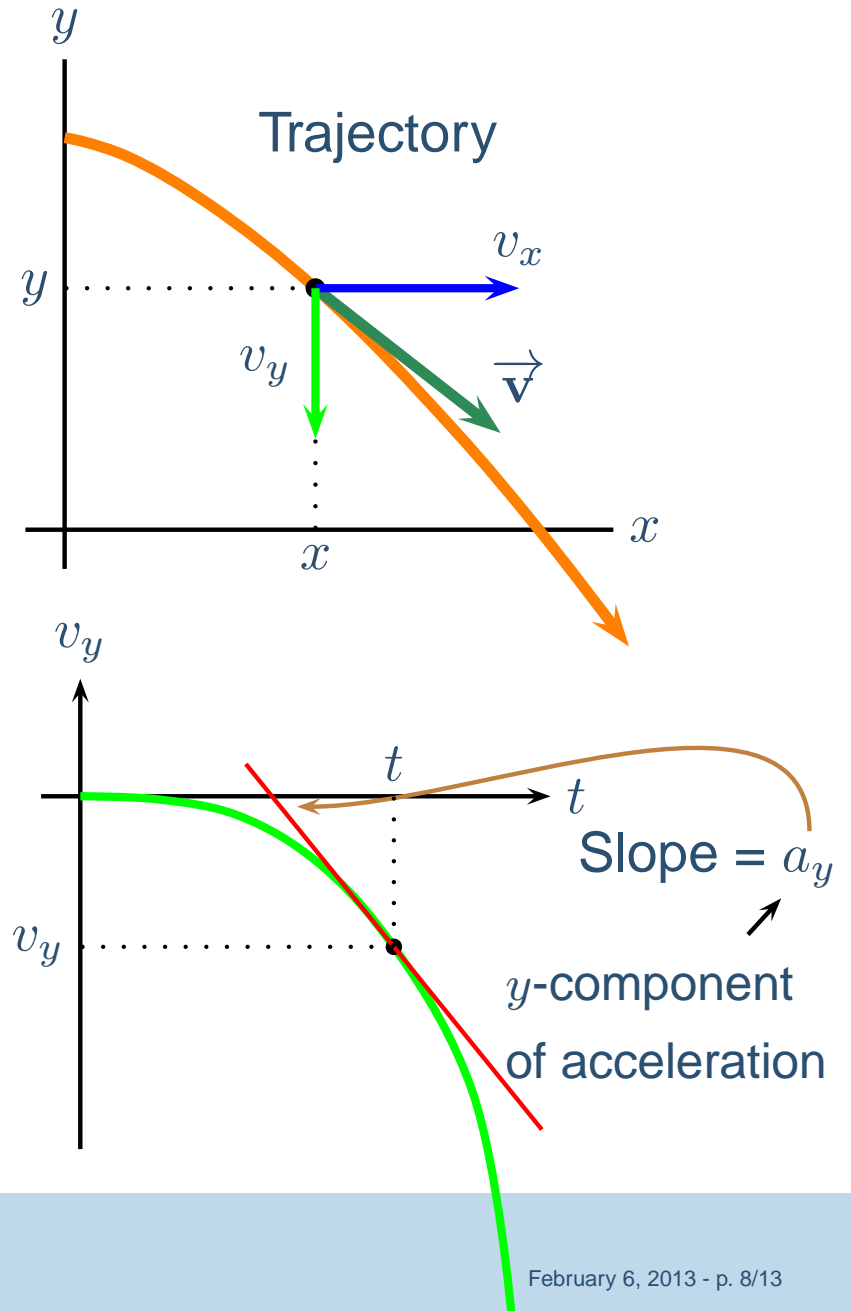
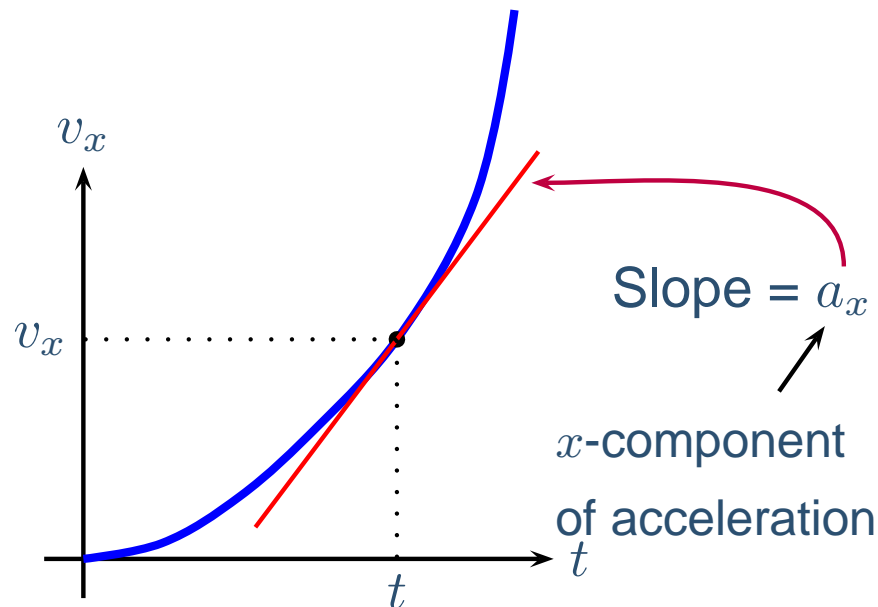




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# Projectile Motion

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Ignore air resistance again.

Gravity pulls straight down, so it causes acceleration in the  $y$ -direction only.

$$a_x = 0, a_y = -g \quad (\text{Down is negative})$$

# Projectile Equations

$a_x = 0 \Rightarrow$  uniform motion in  $x$ .

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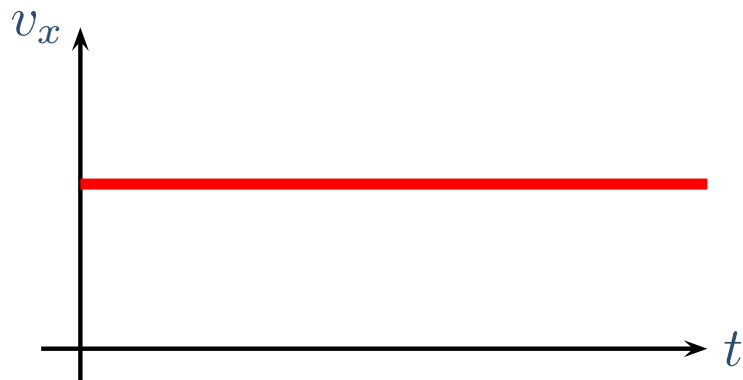
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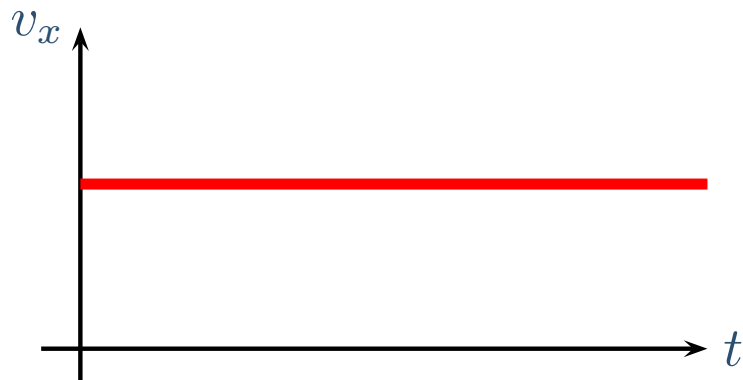


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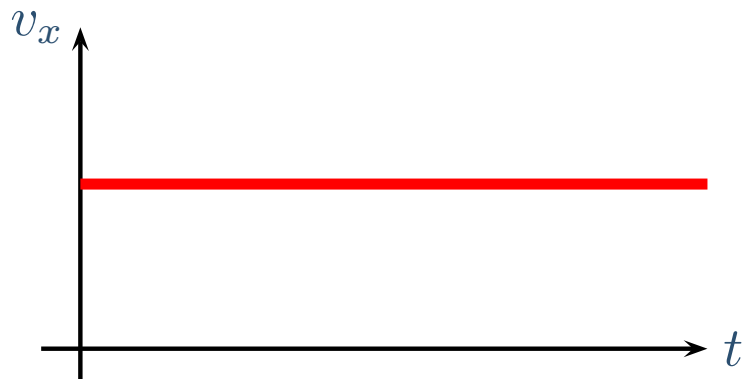
$$x = x_0 + v_{0x}t$$



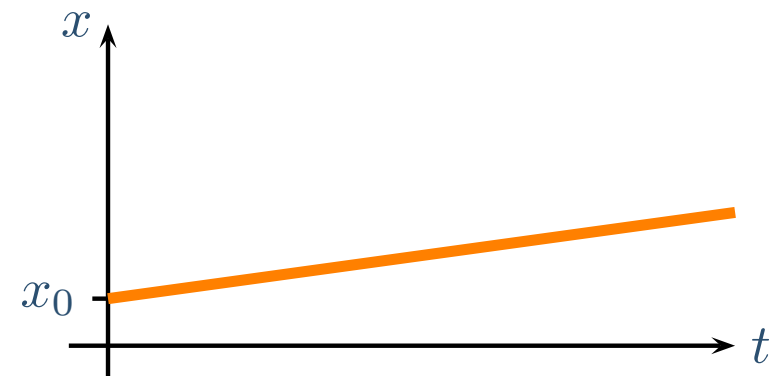
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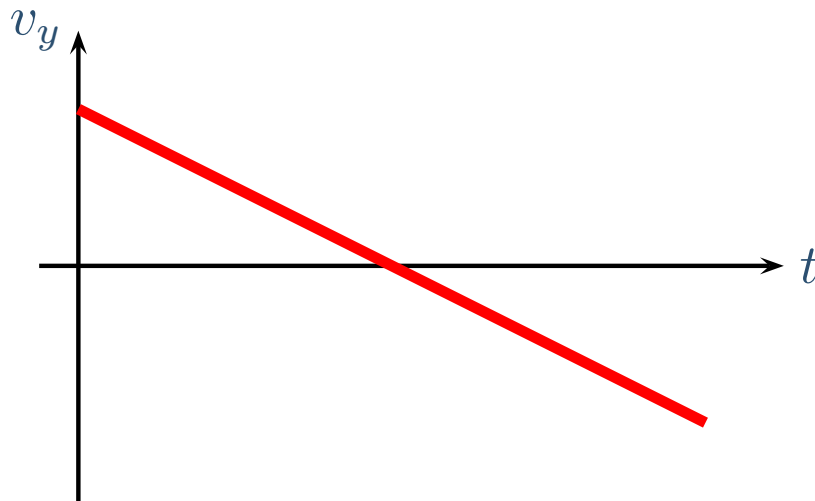
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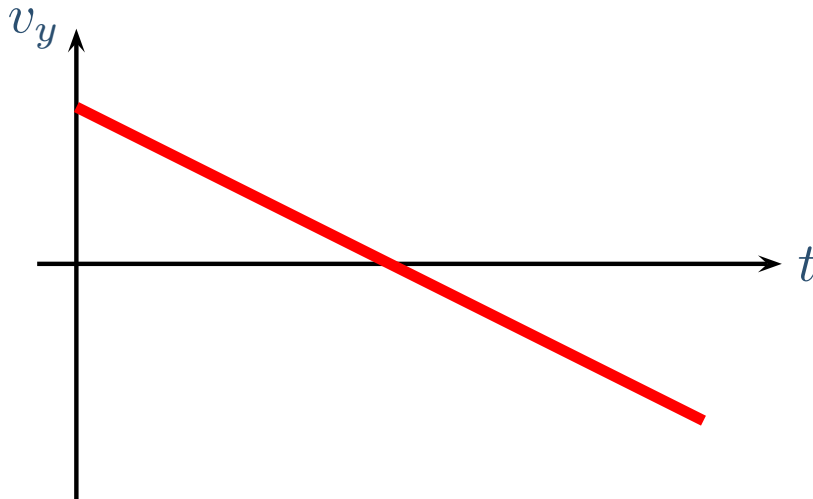


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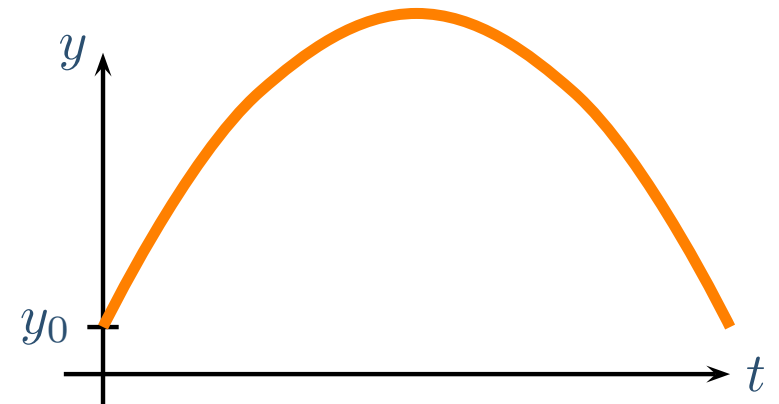
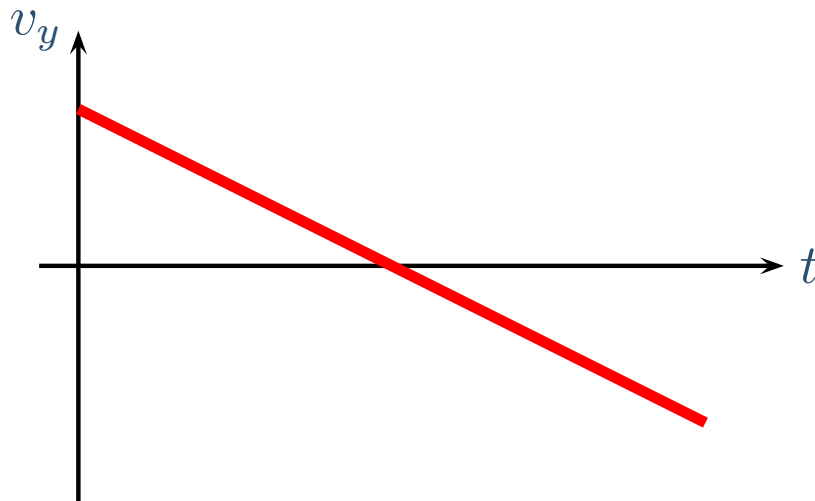


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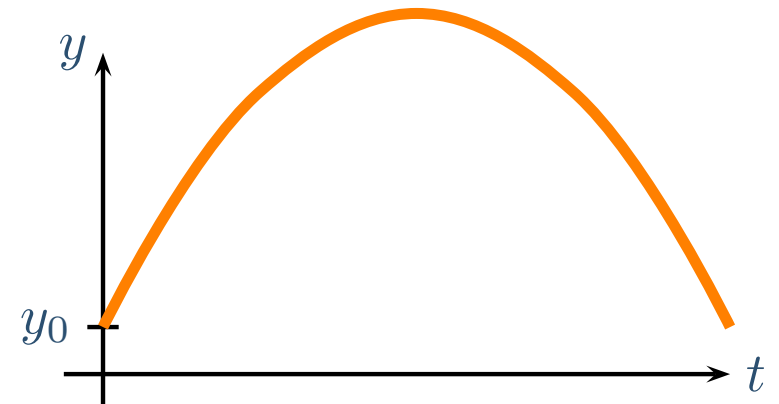
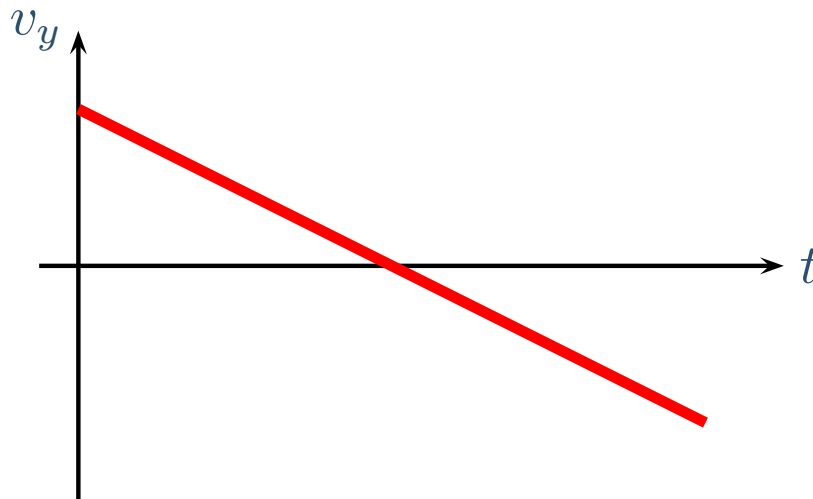


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In both of these equations  $g = +9.8 \text{ m/s}^2$

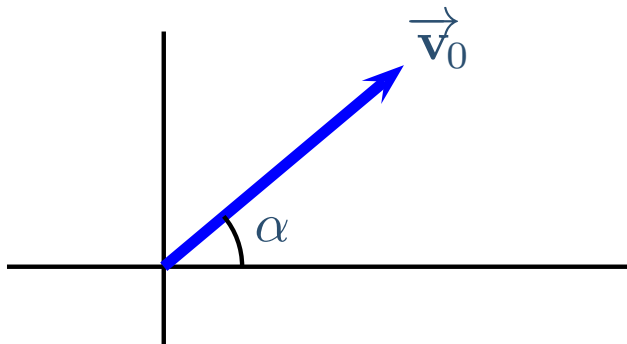


# Launch Angle

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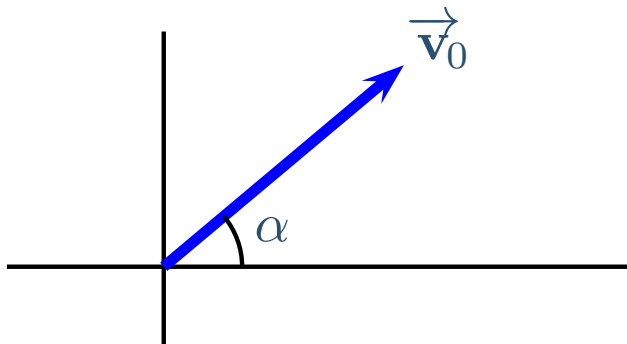


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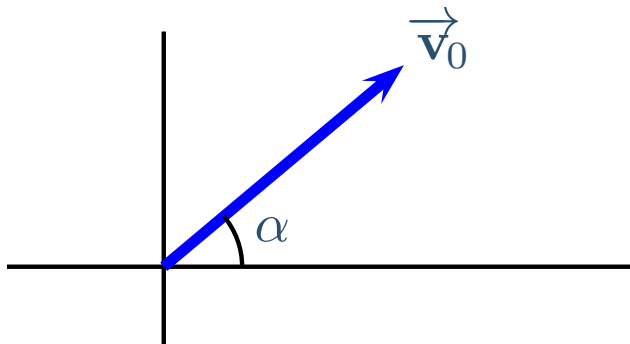
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# Summary

## Projectile Equations

$a_x = 0$	$a_y = -g$
$v_x = v_{0x}$	$v_y = v_{0y} - gt$
$x = x_0 + v_{0x}t$	$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$
$v_{0x} = v_0 \cos \theta$	$v_{0y} = v_0 \sin \theta$