Today

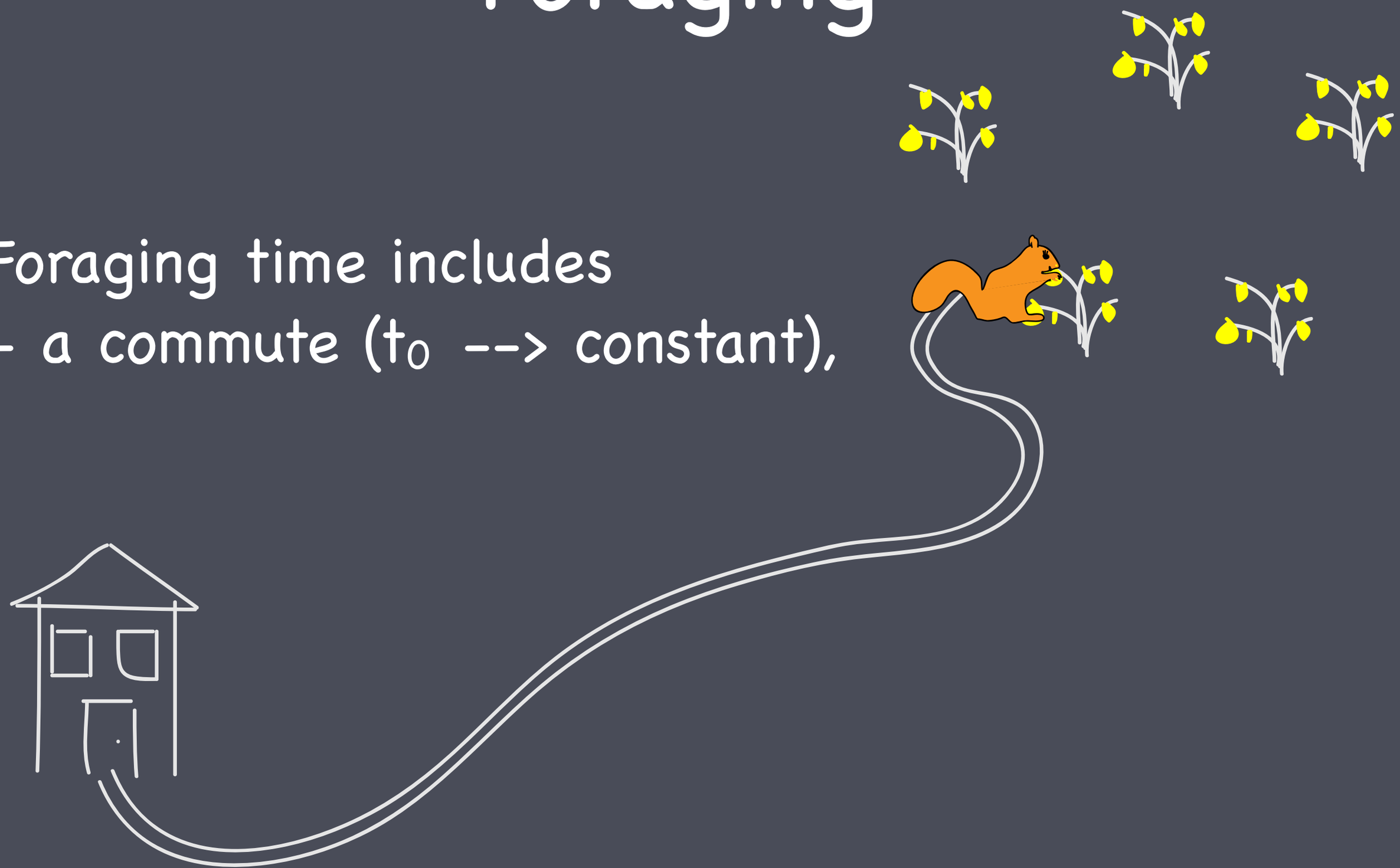
- Optimal foraging
- Intro to least squares

Foraging

Foraging

Foraging time includes

Foraging



Foraging time includes
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Foraging

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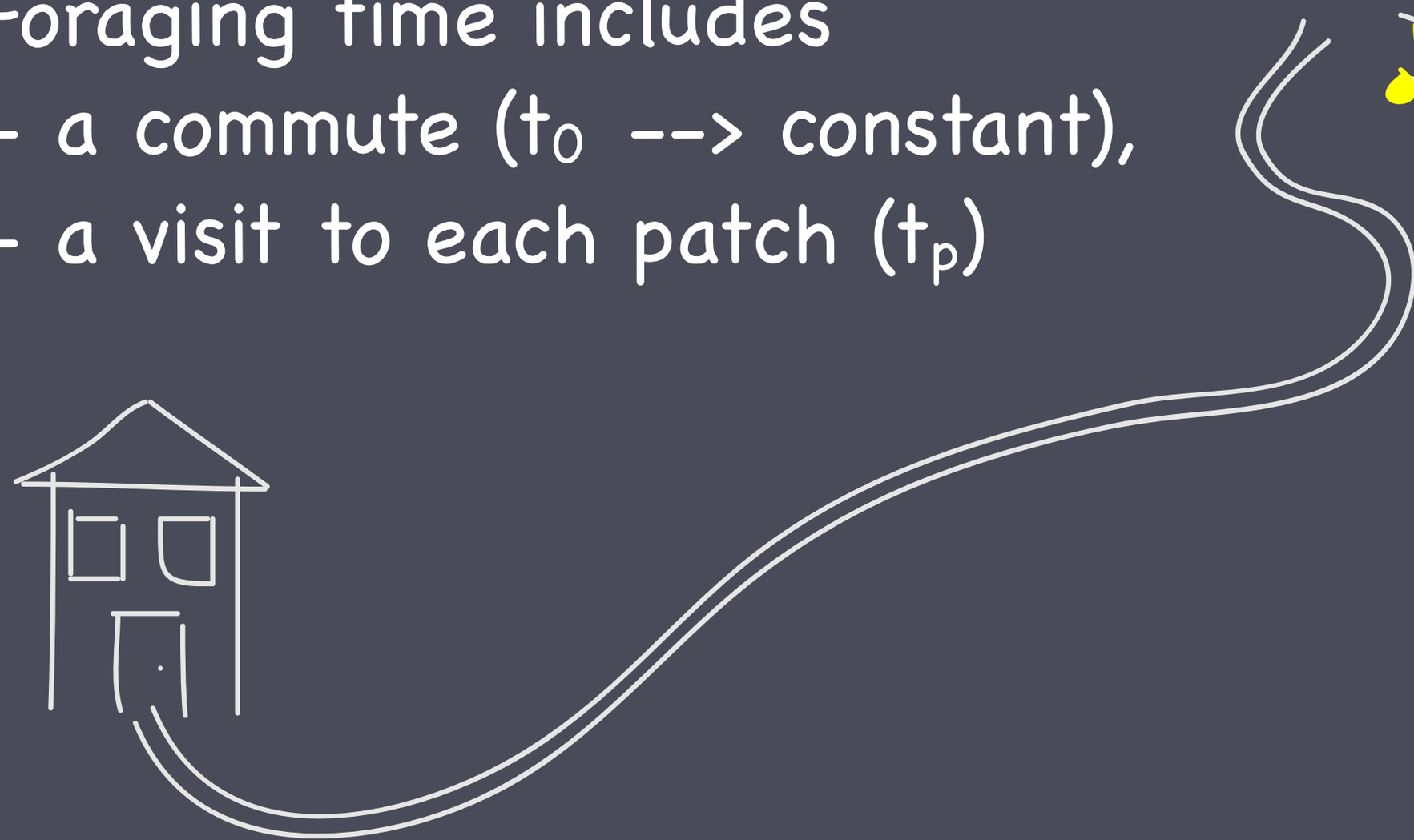
- a commute (t_0 --> constant),
- a visit to each patch (t_p)



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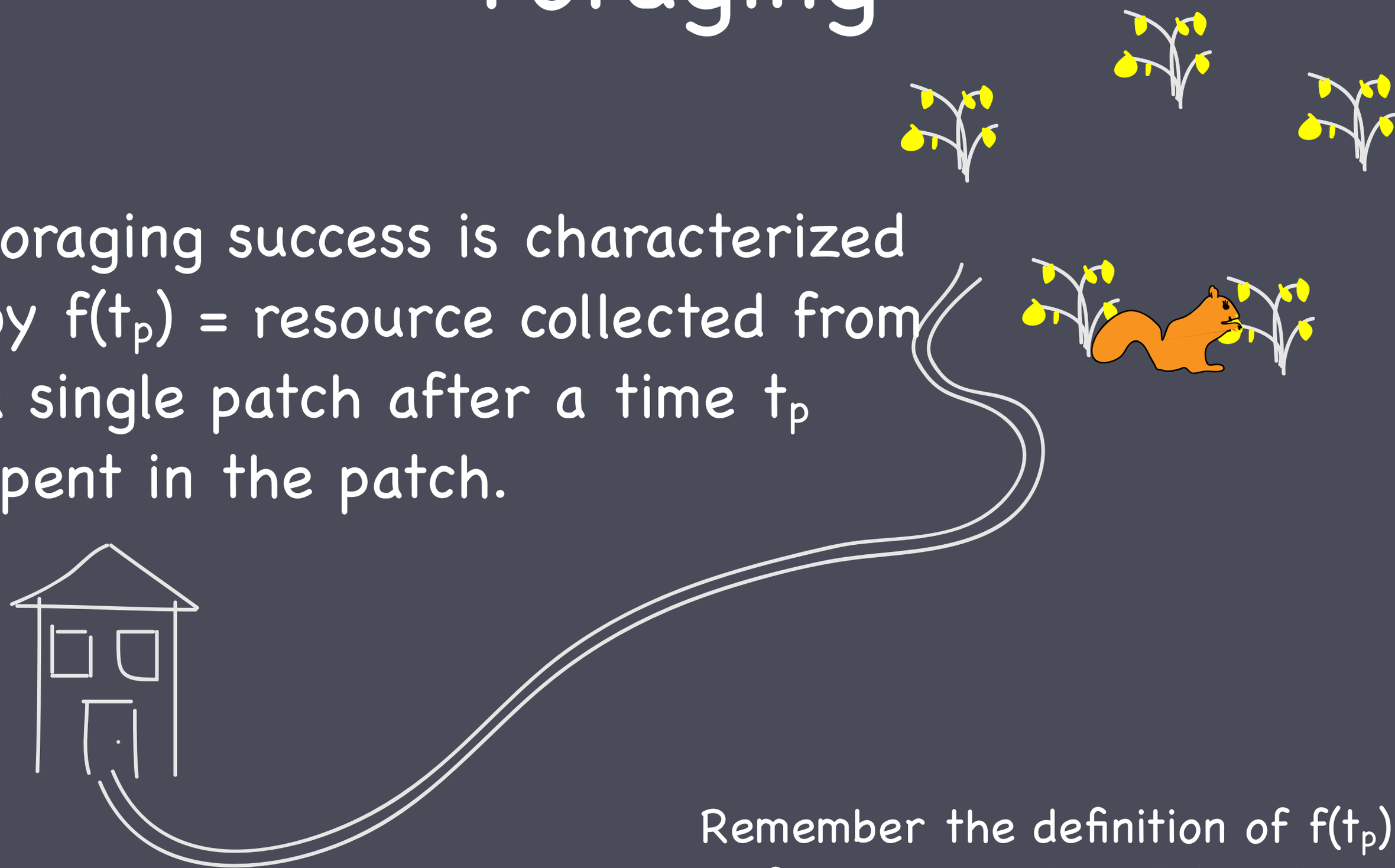
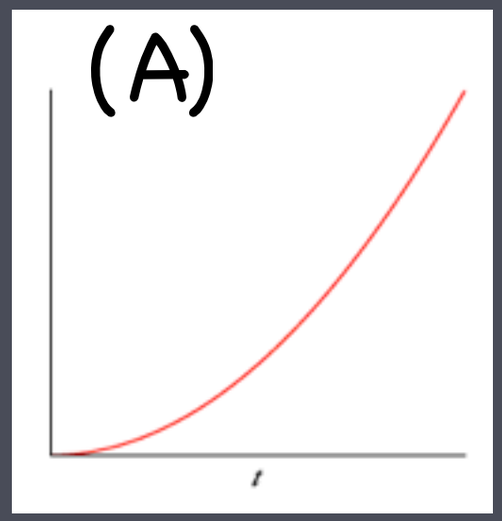


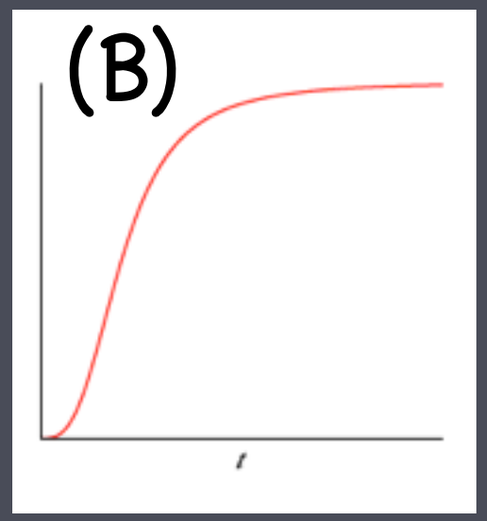
Foraging success is characterized by $f(t_p)$ = resource collected from a single patch after a time t_p spent in the patch.

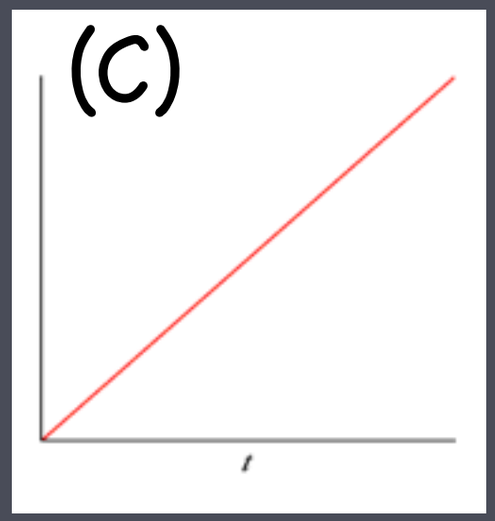
Remember the definition of $f(t_p)$ for an upcoming clicker Q.

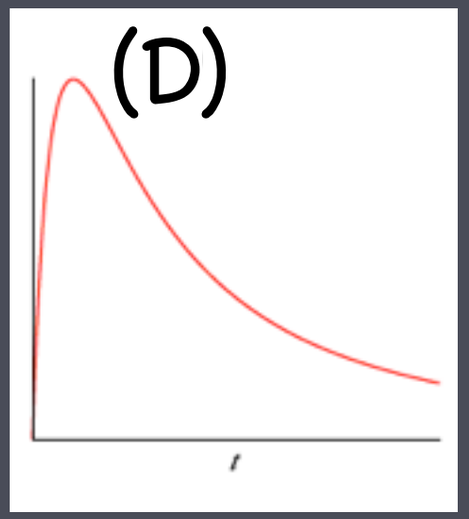
Which of the following graphs matches the given description of f(t)?

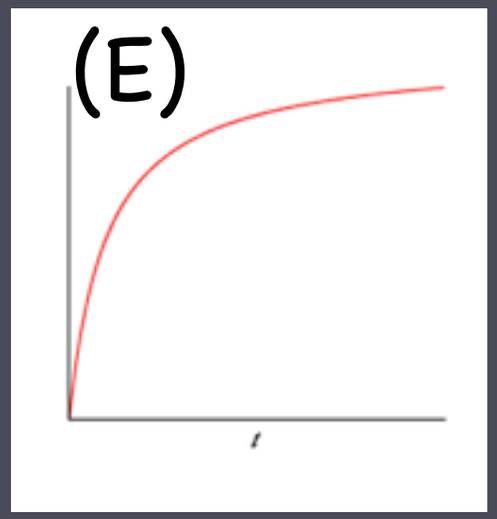
Collection goes well at first but gradually slows down as the resource is depleted.











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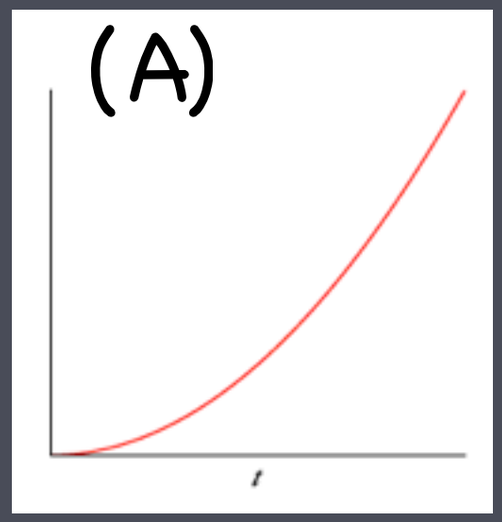

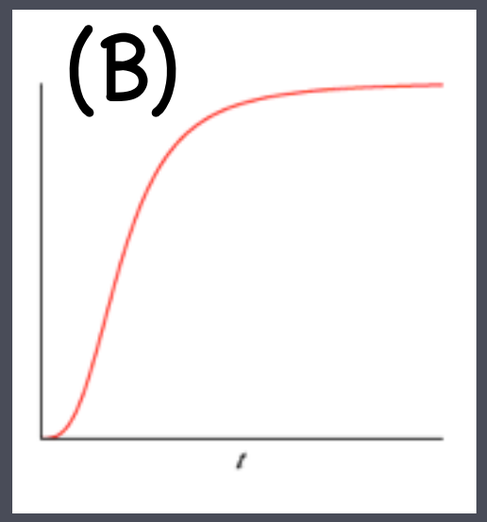

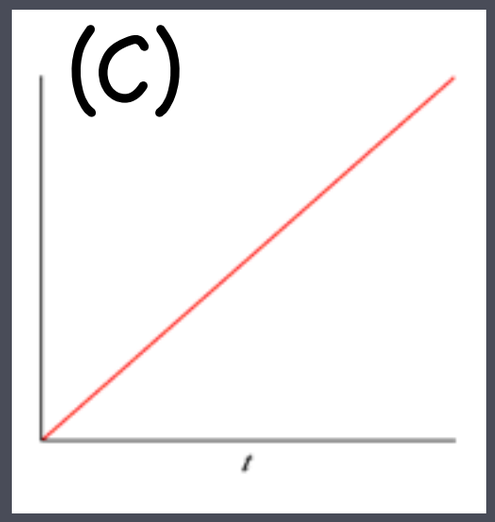

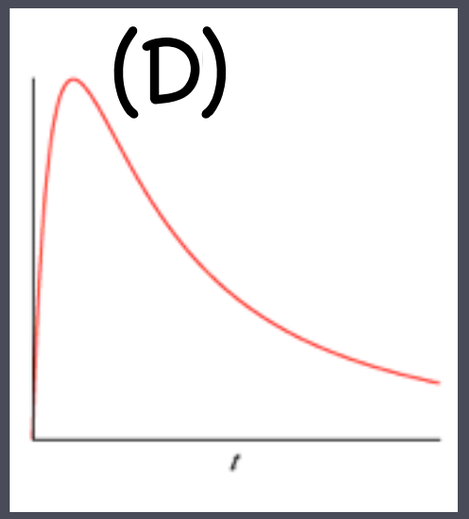

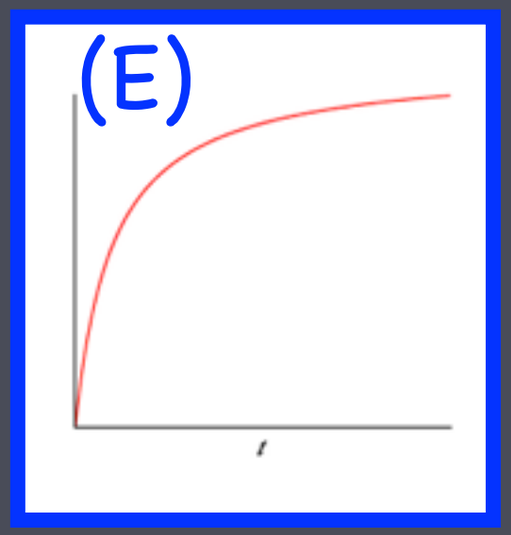

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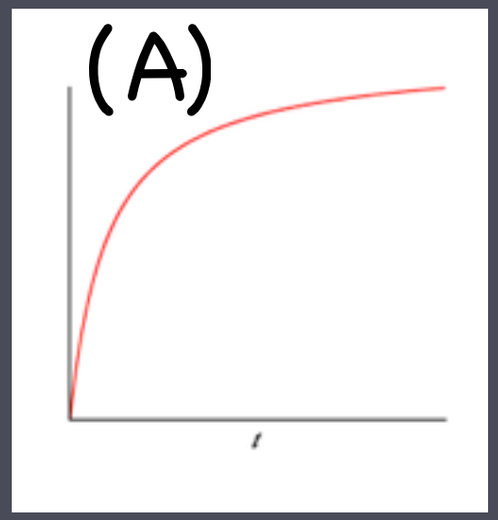

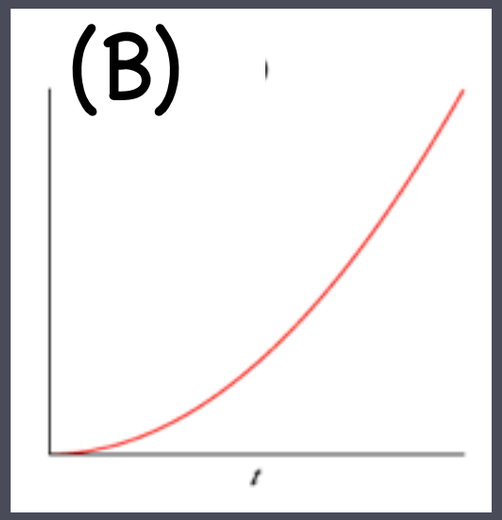

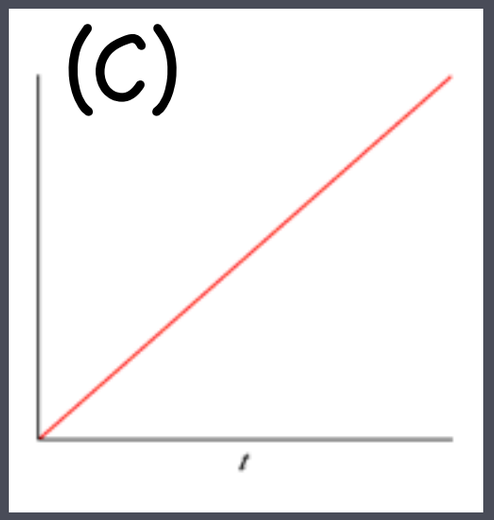

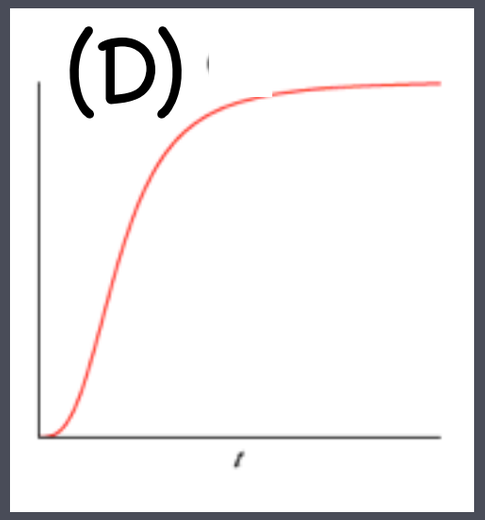

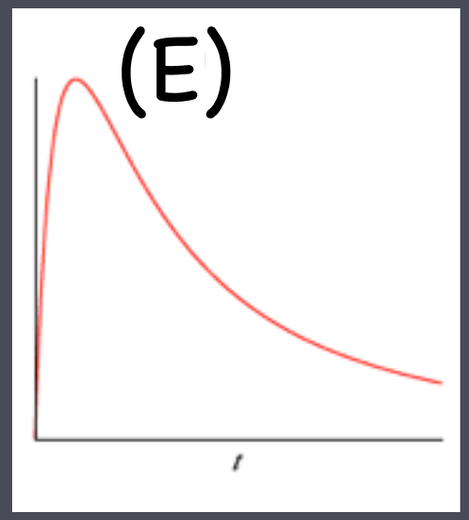

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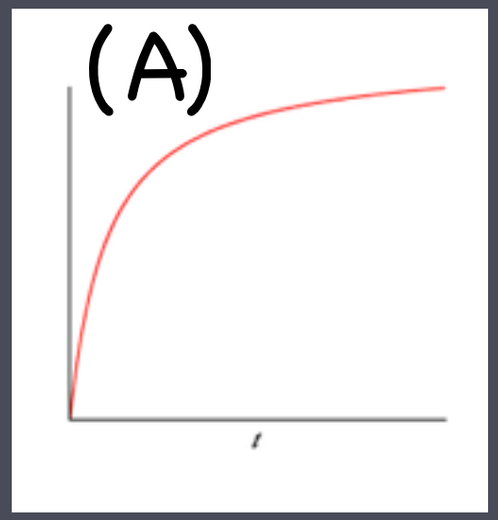

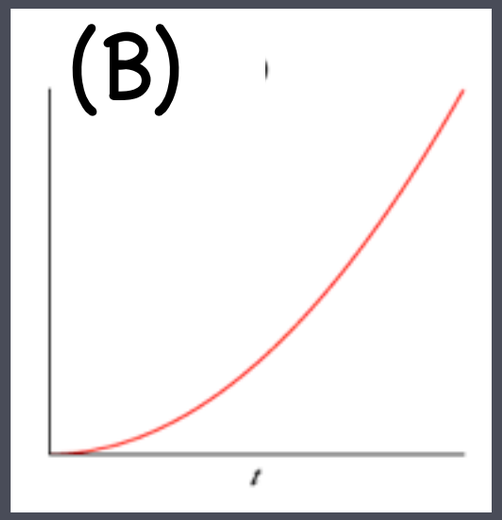

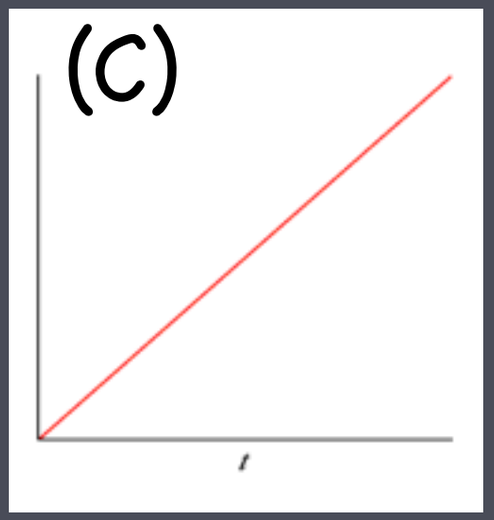

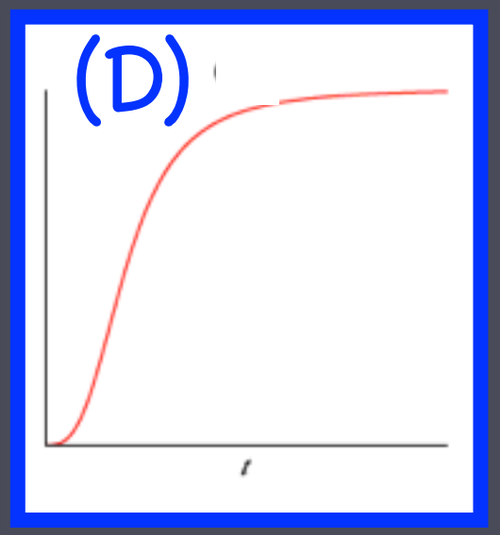

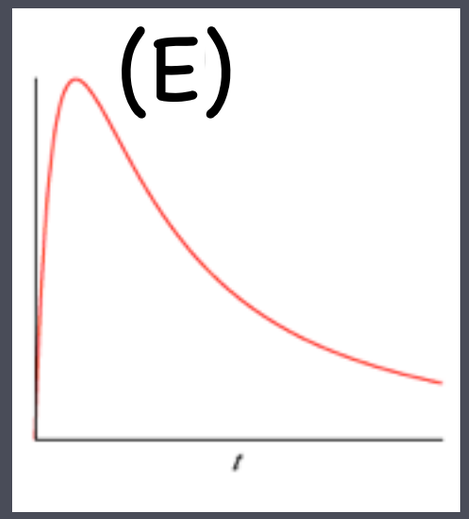

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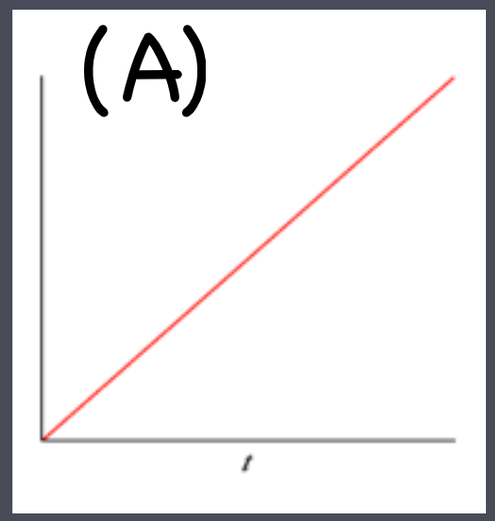

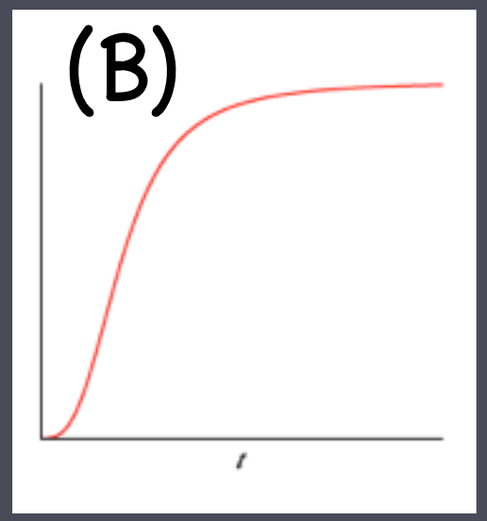

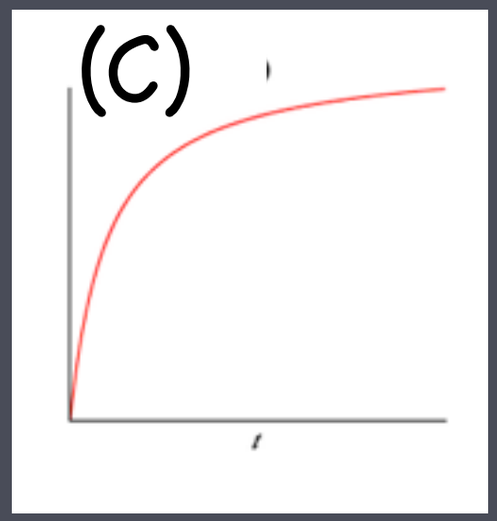

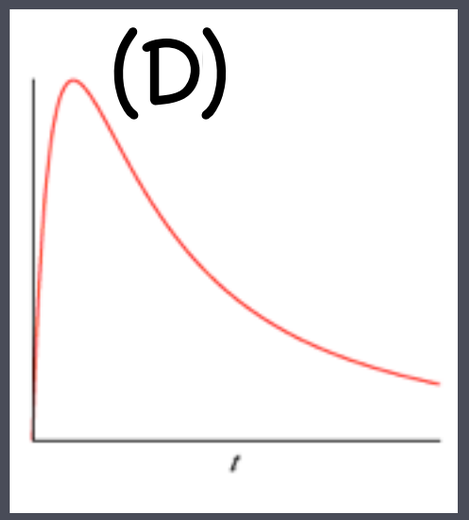

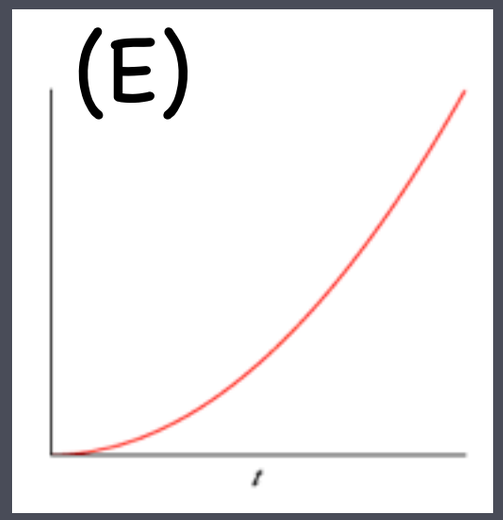

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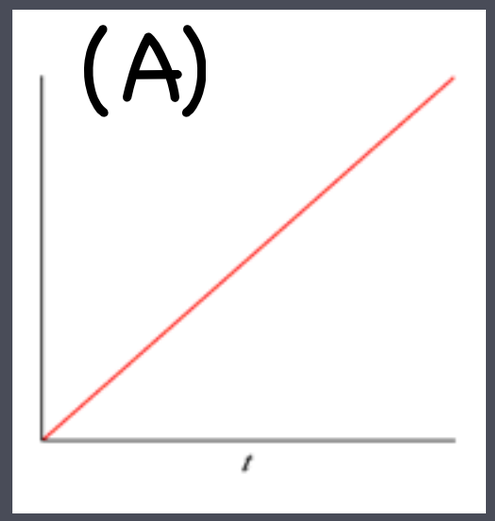
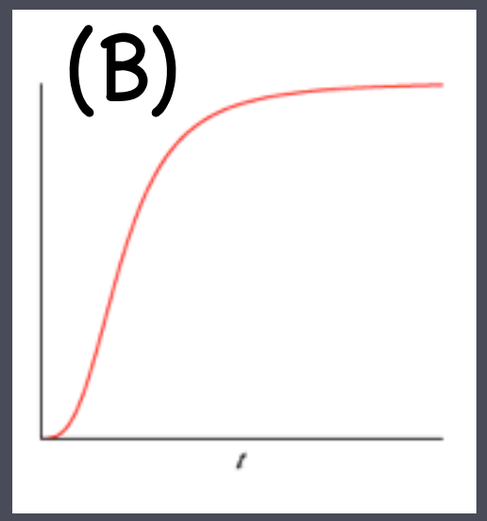
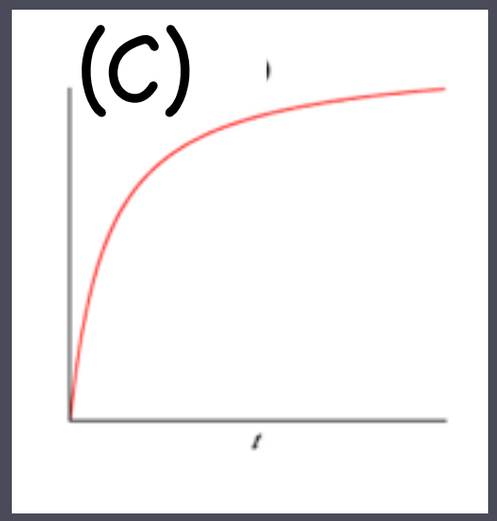
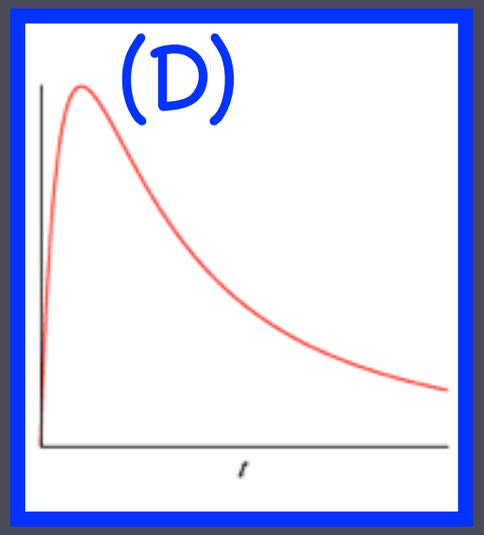
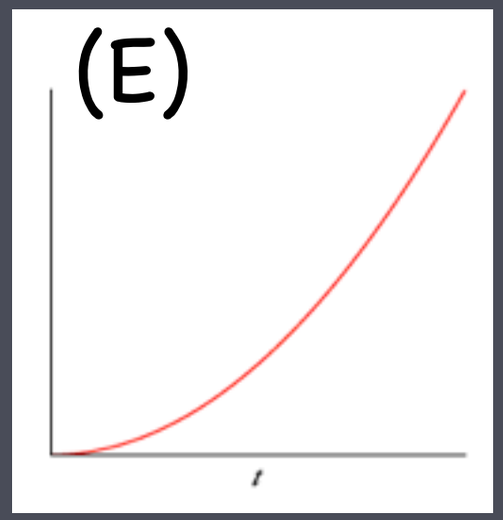




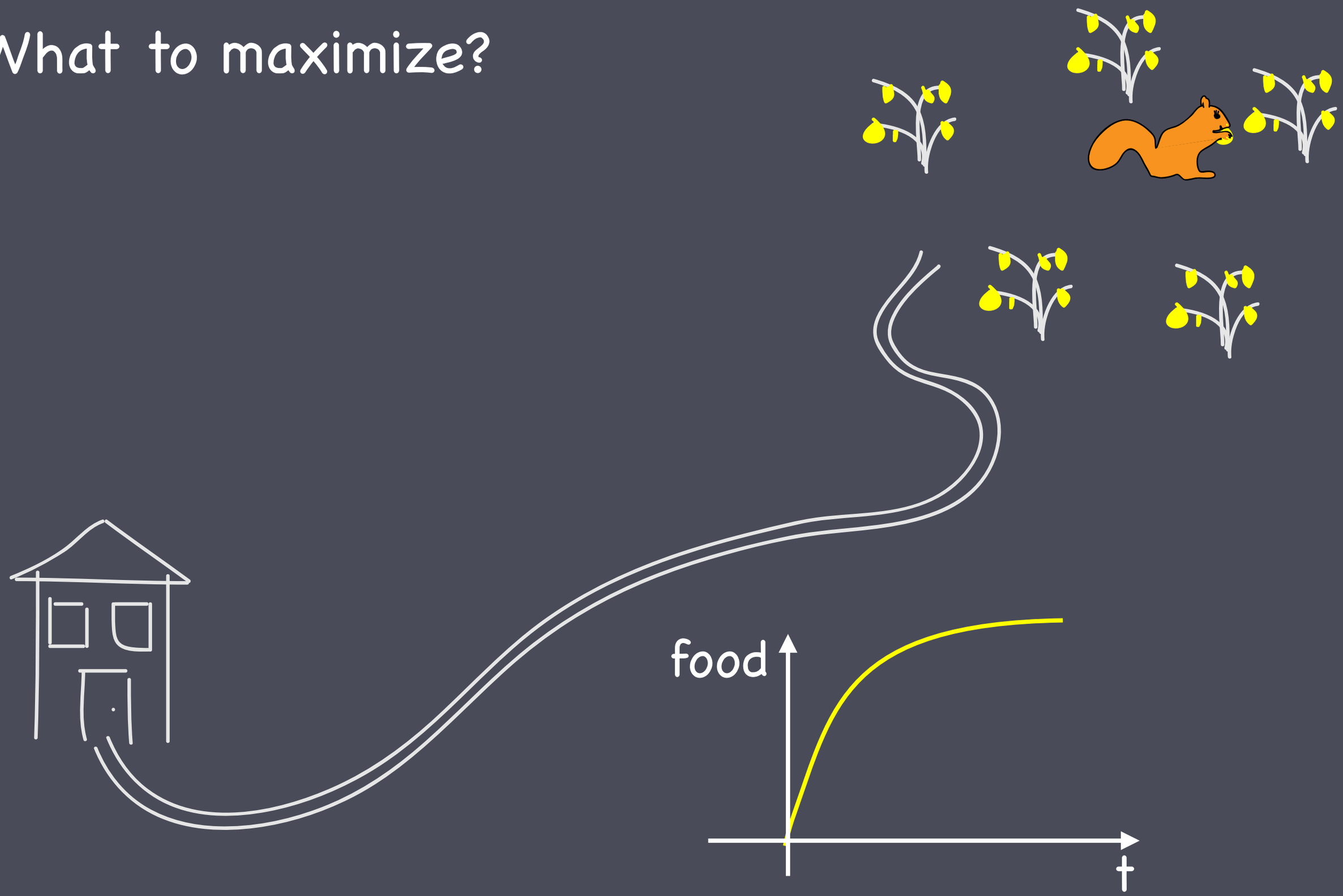






Foraging

What to maximize?



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What to maximize?

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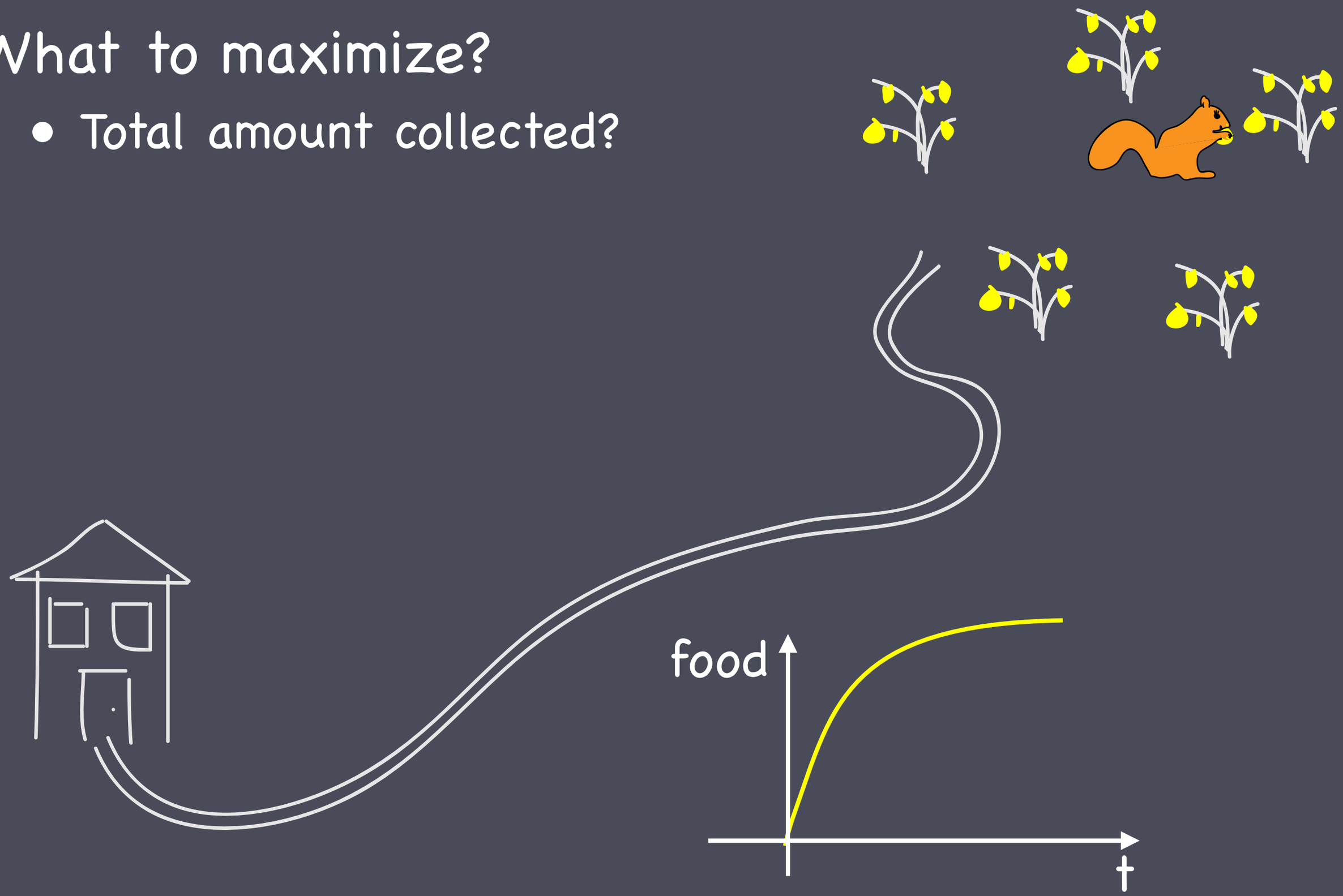

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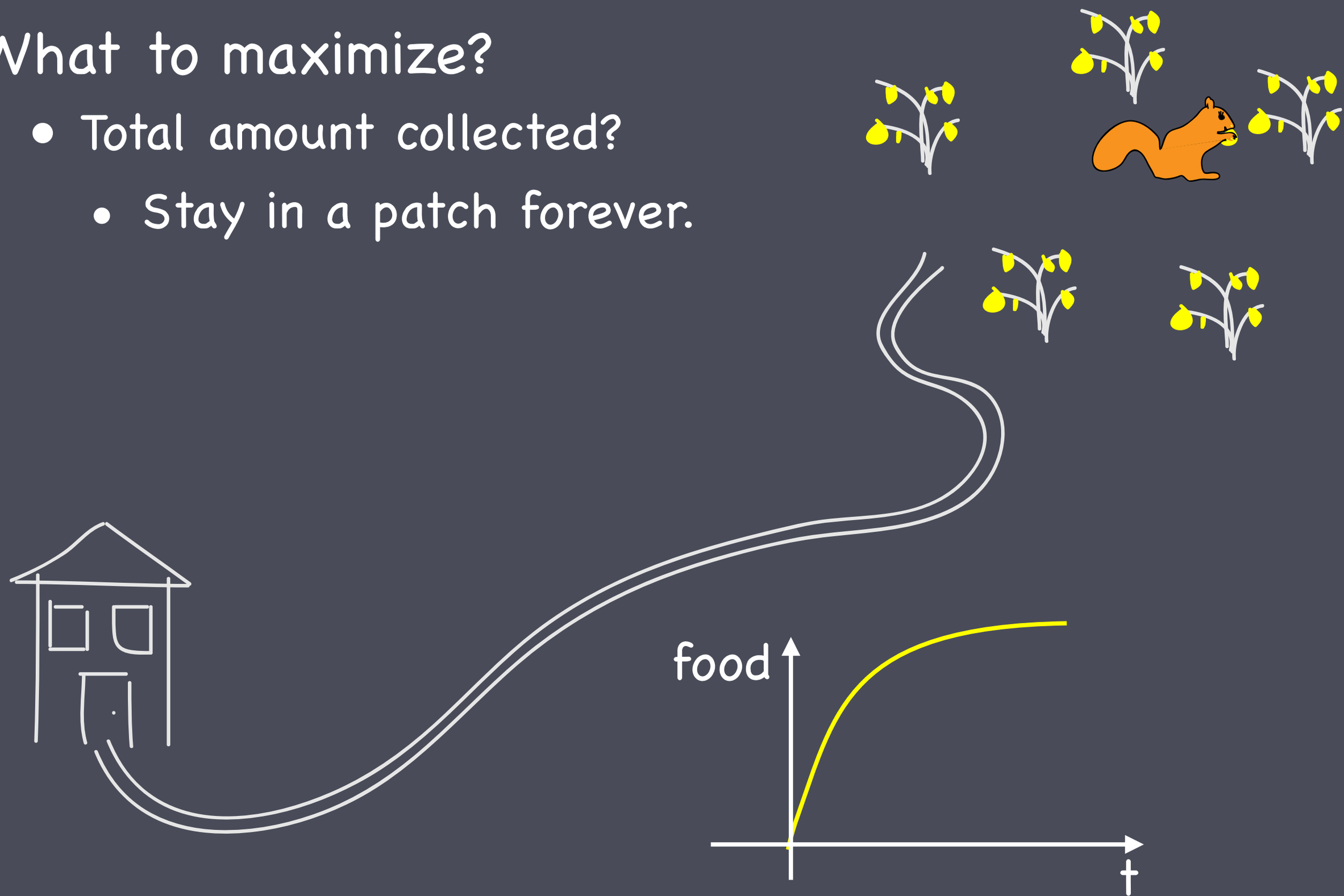

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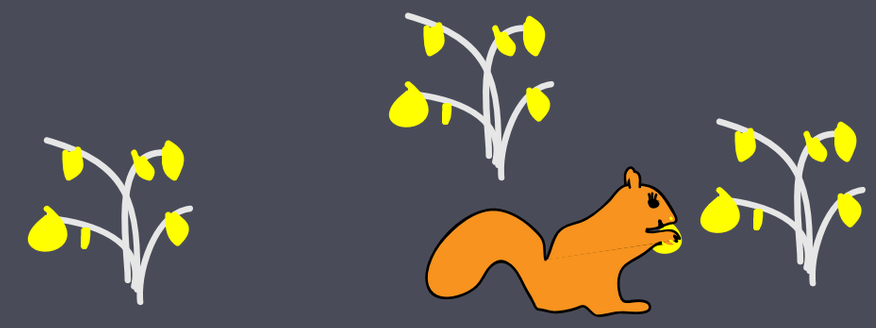

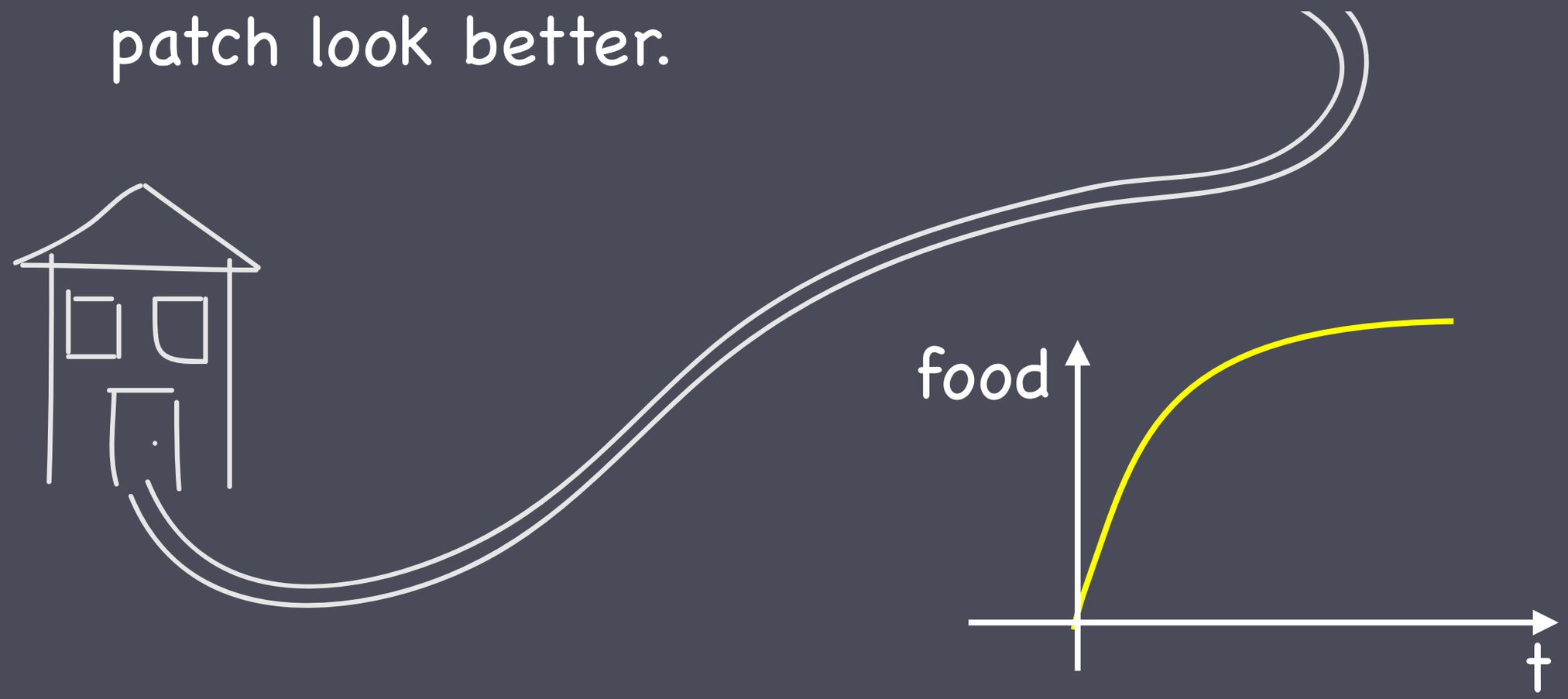

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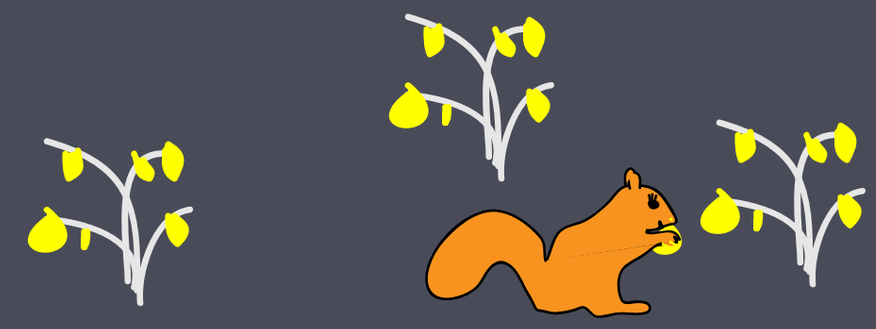

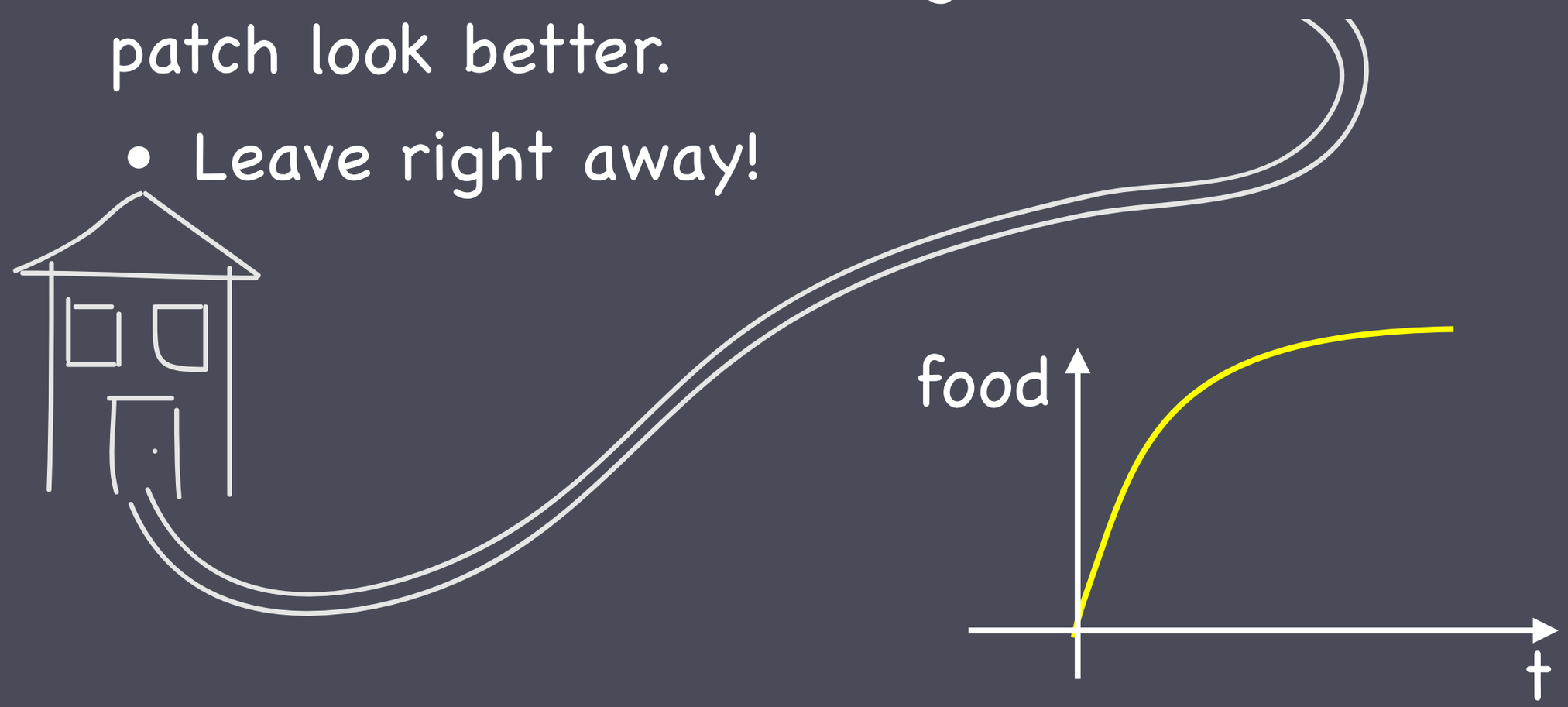

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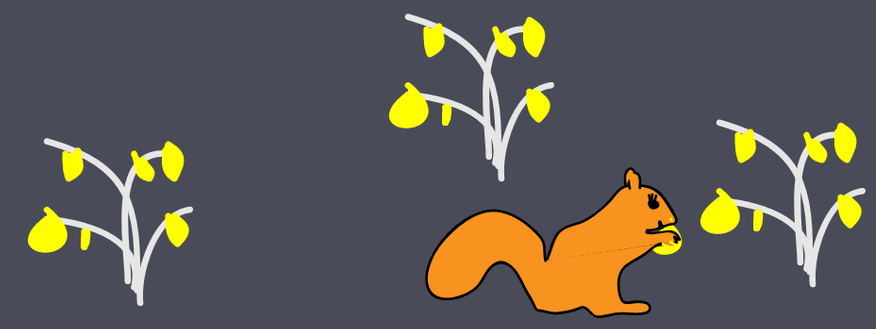

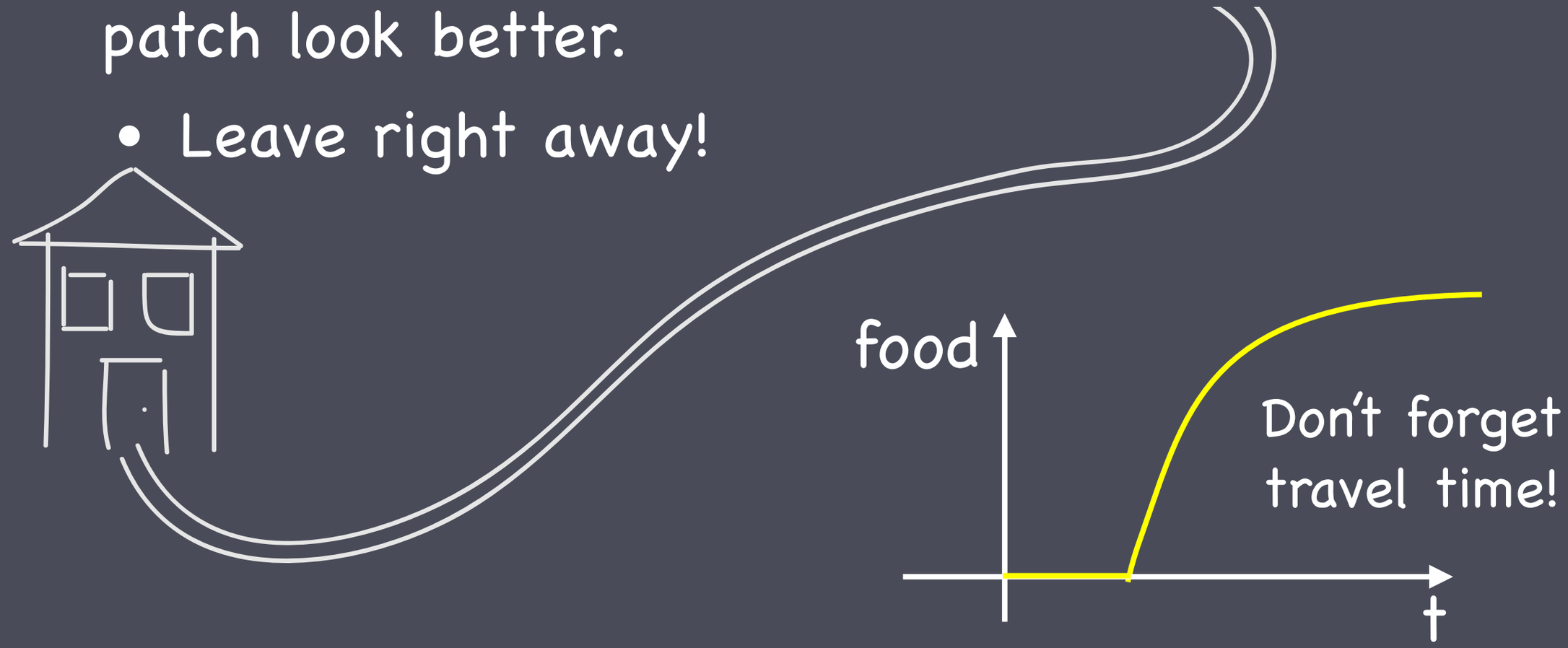

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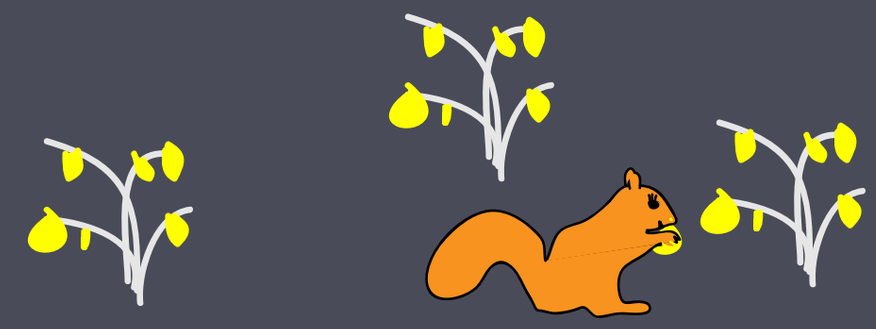

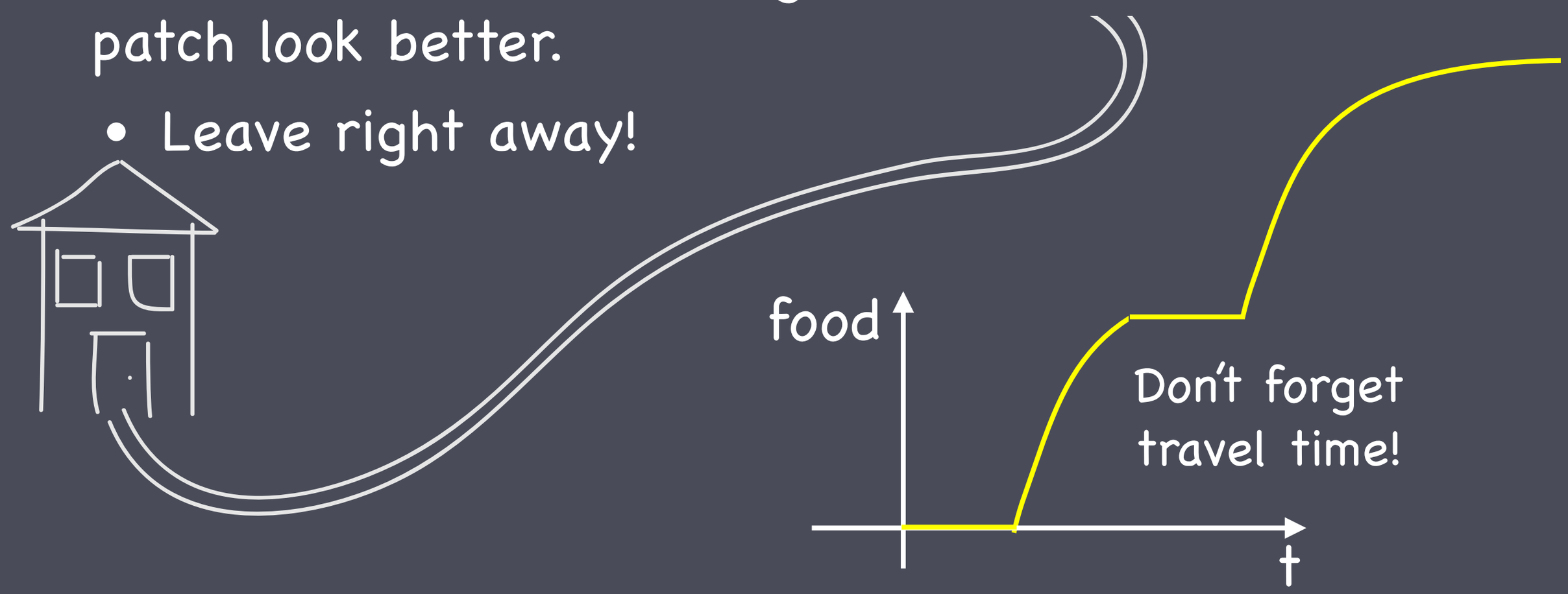

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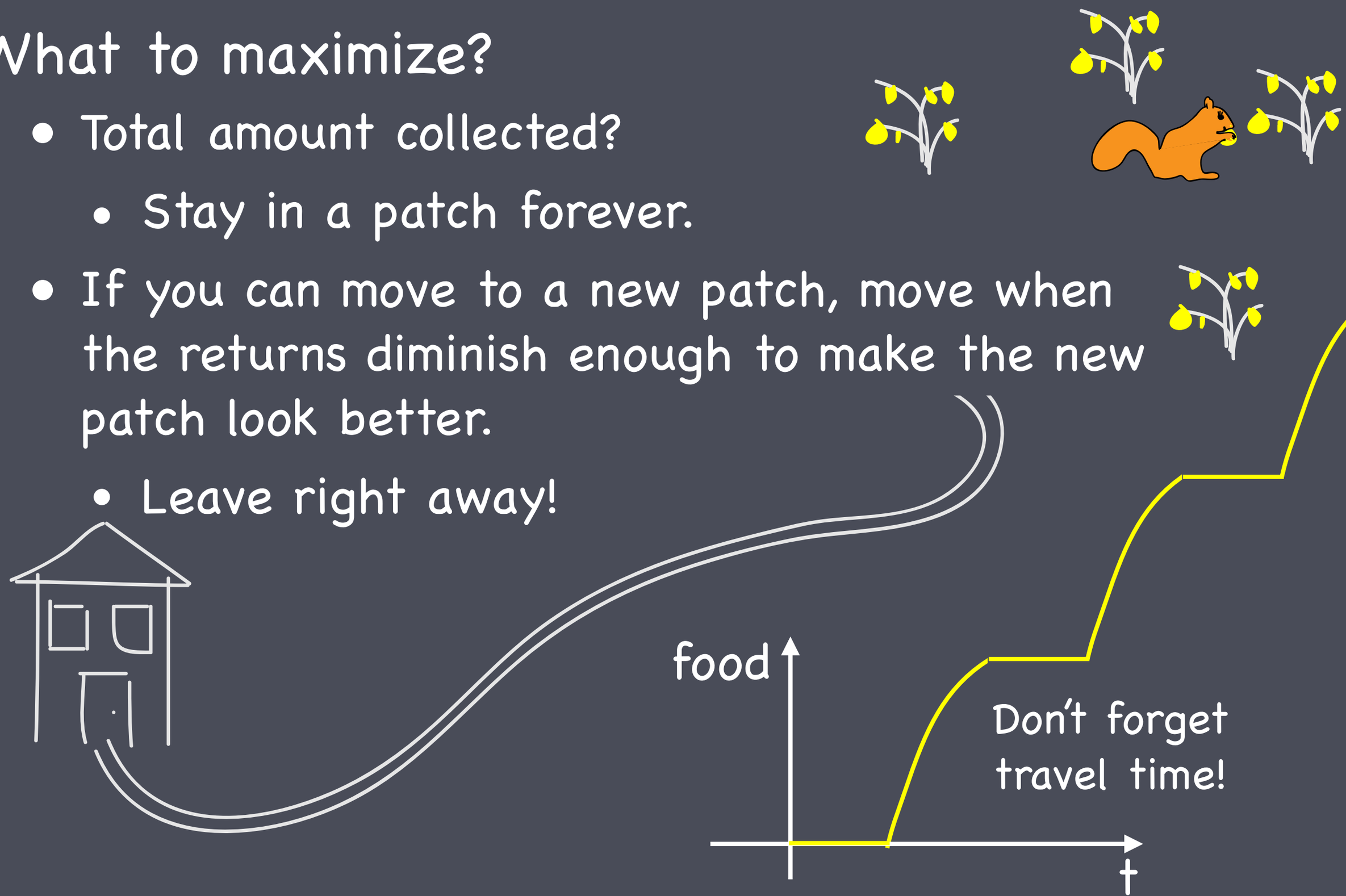

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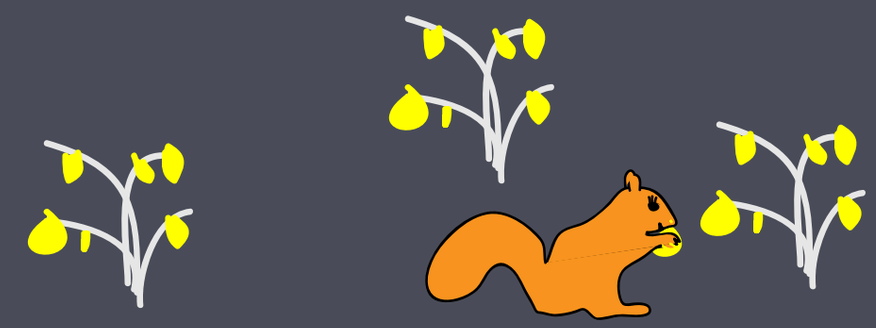
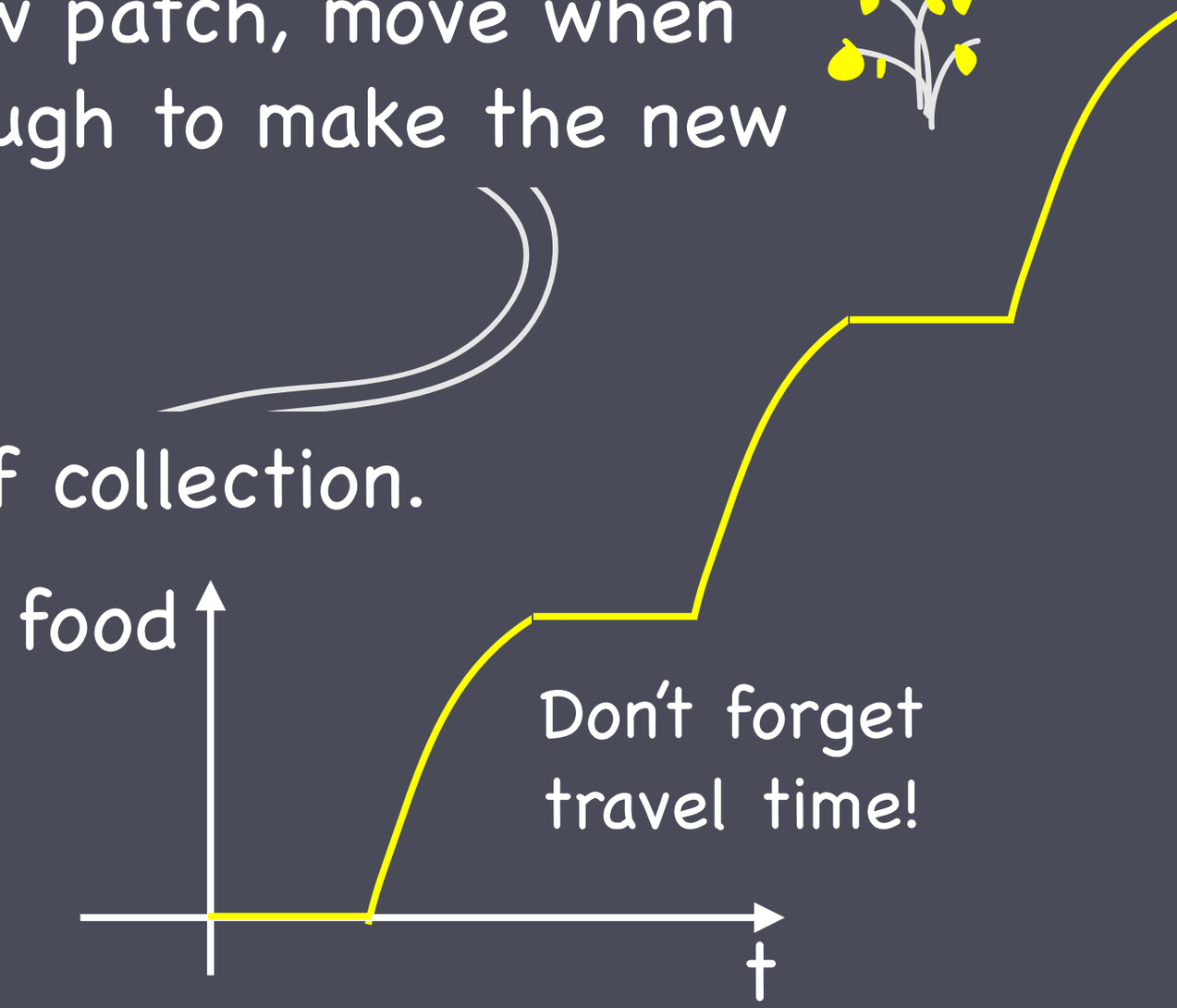
- Maximize average rate of collection.





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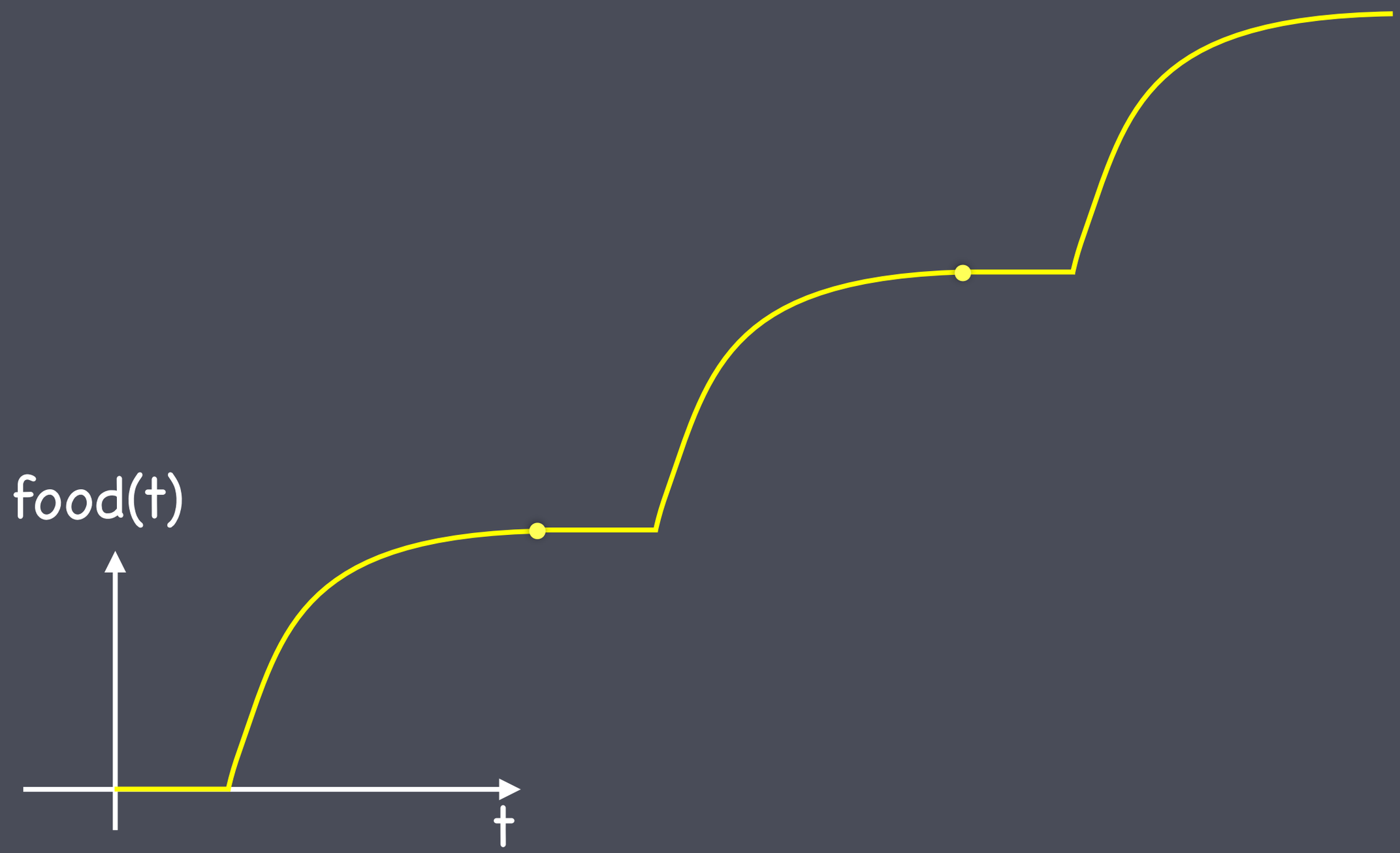


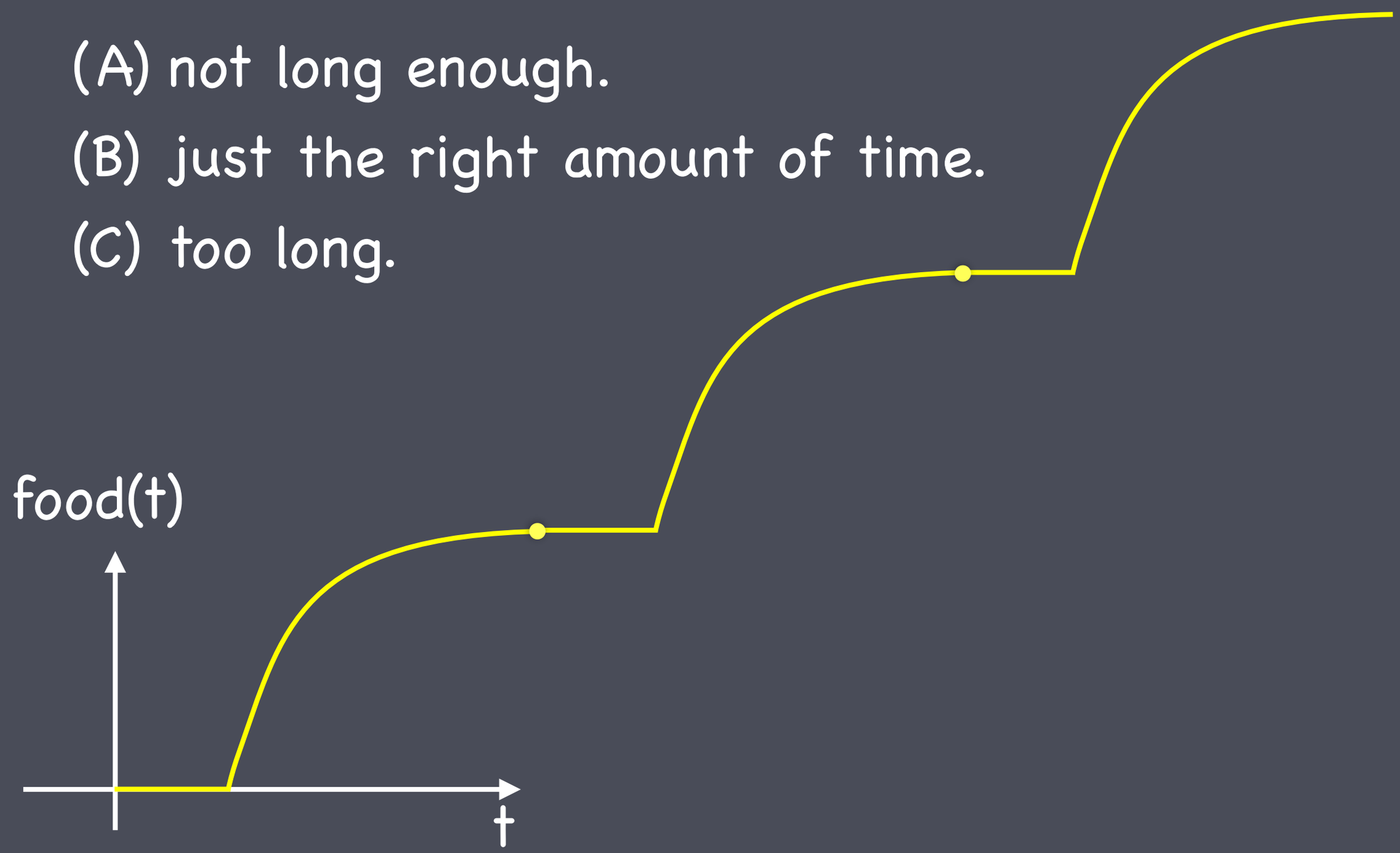
Foraging

I waited

(A) not long enough.

(B) just the right amount of time.

(C) too long.



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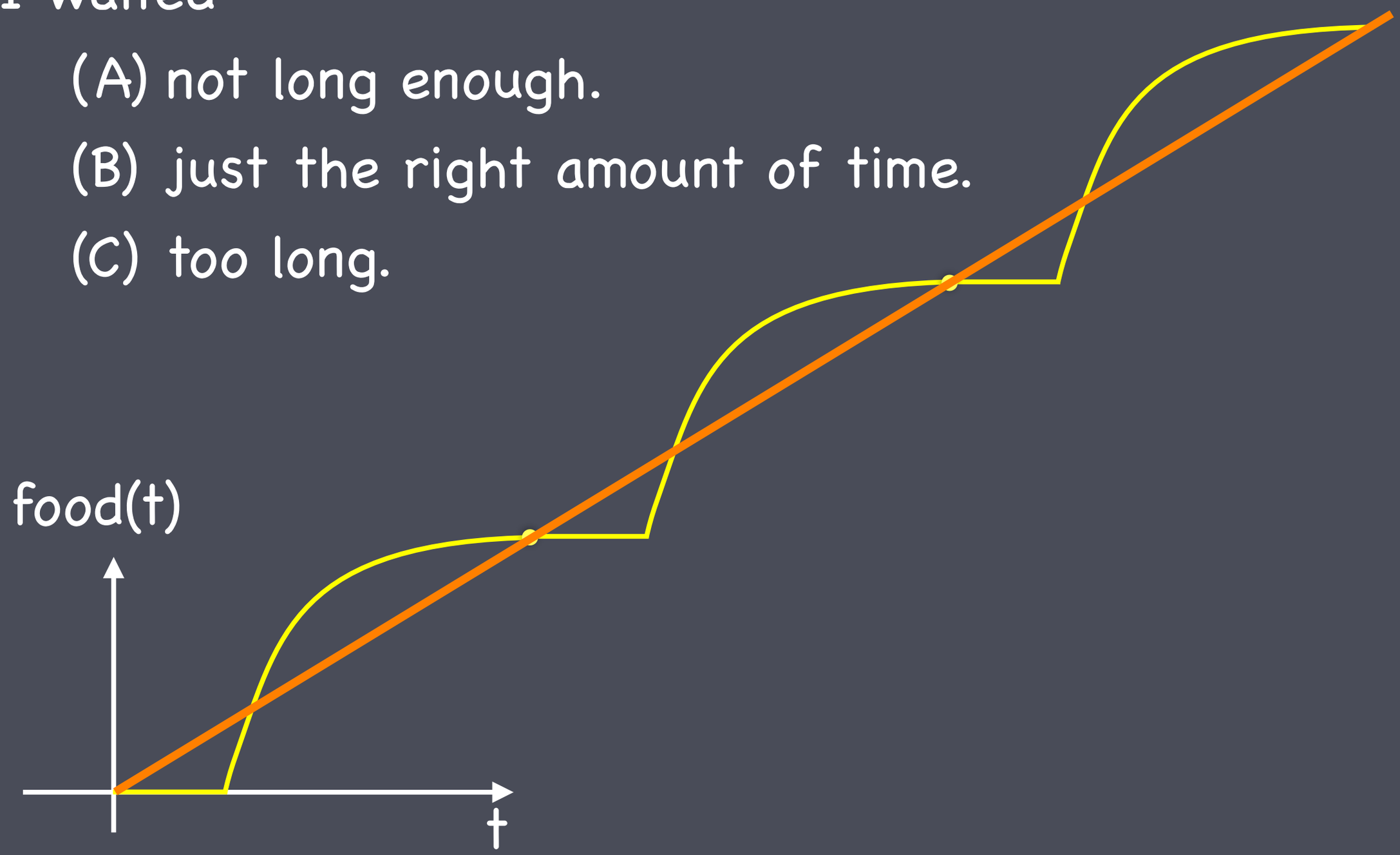

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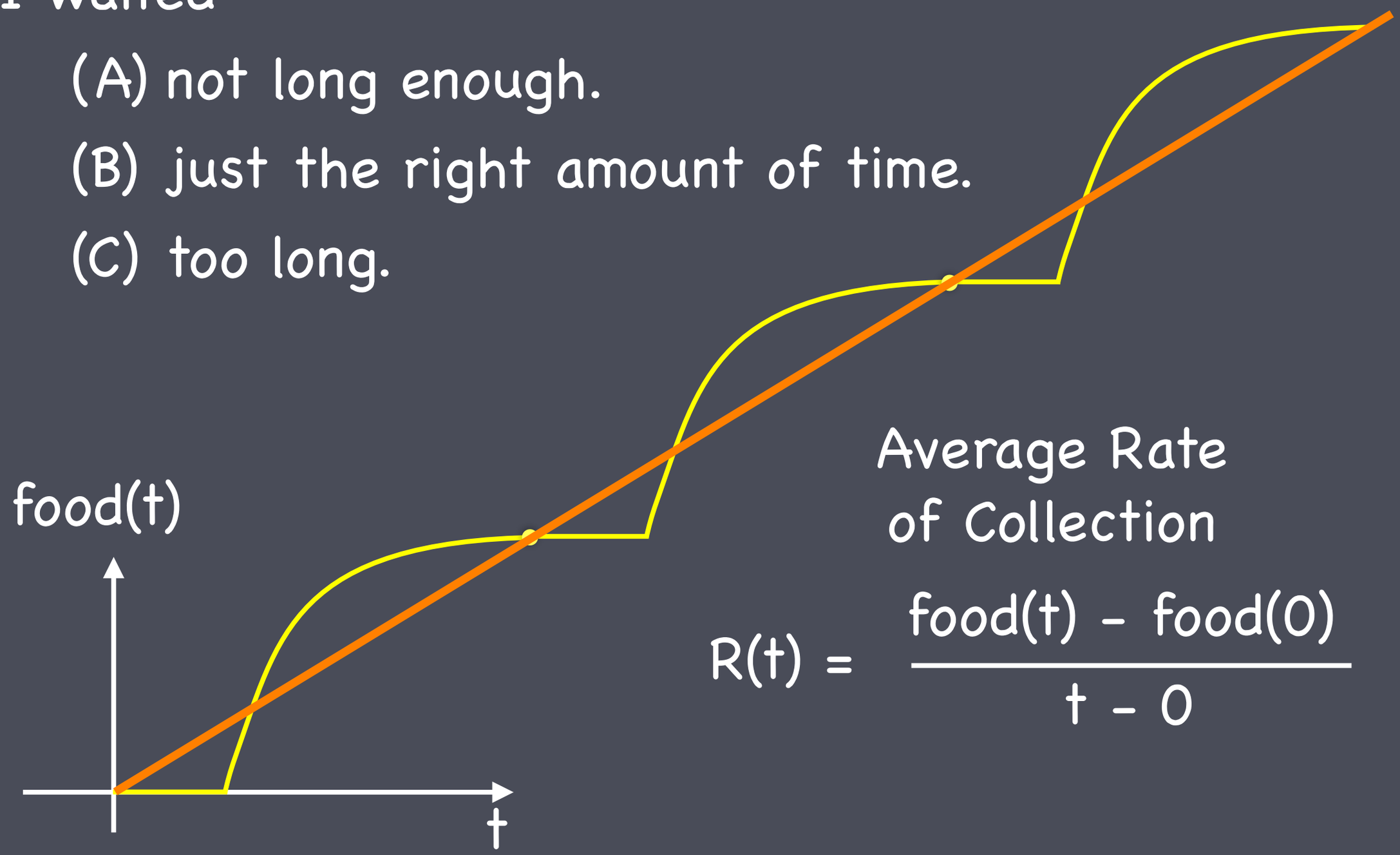

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$$R(t) = \frac{food(t) - food(0)}{t - 0}$$

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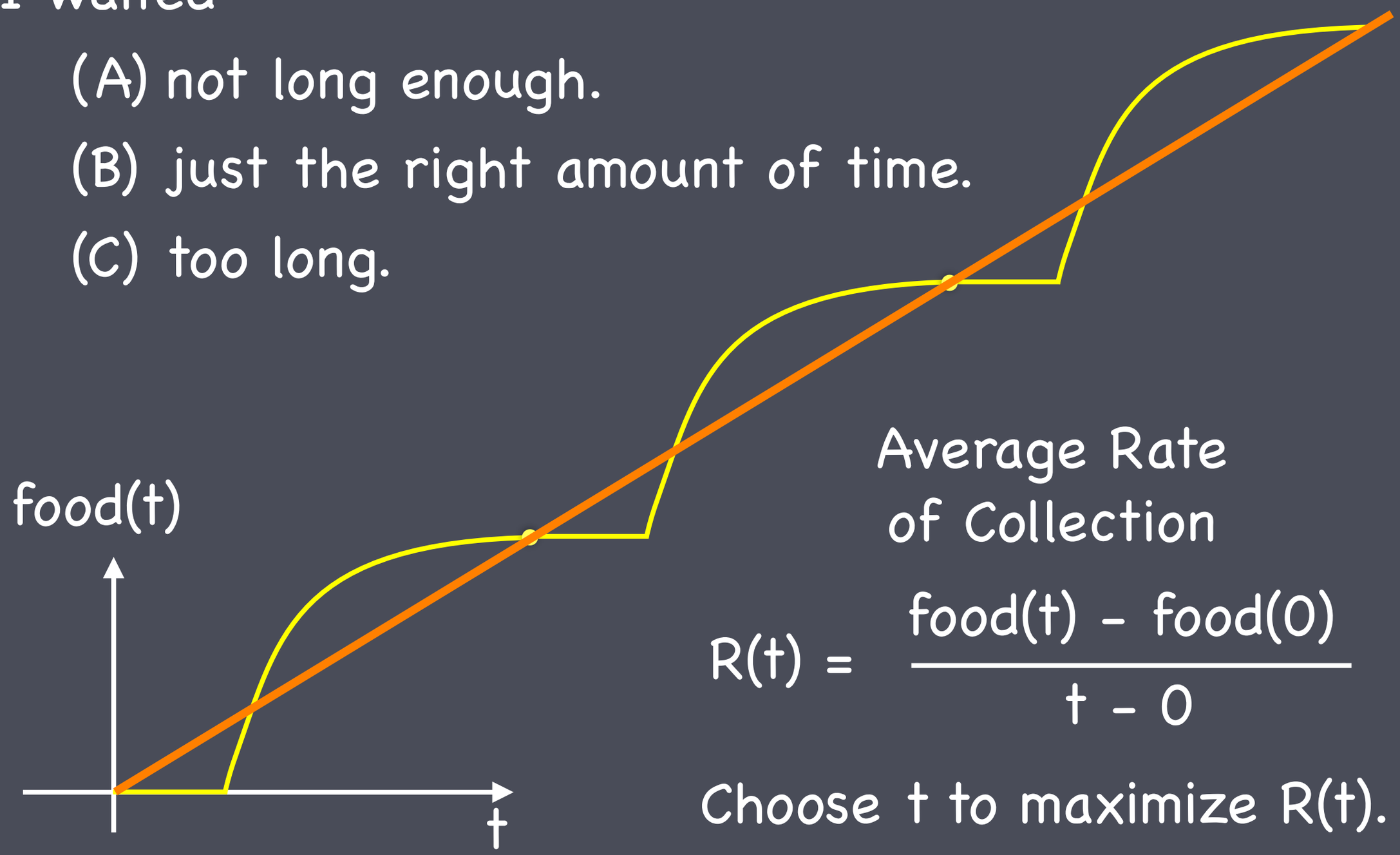

Average Rate of Collection

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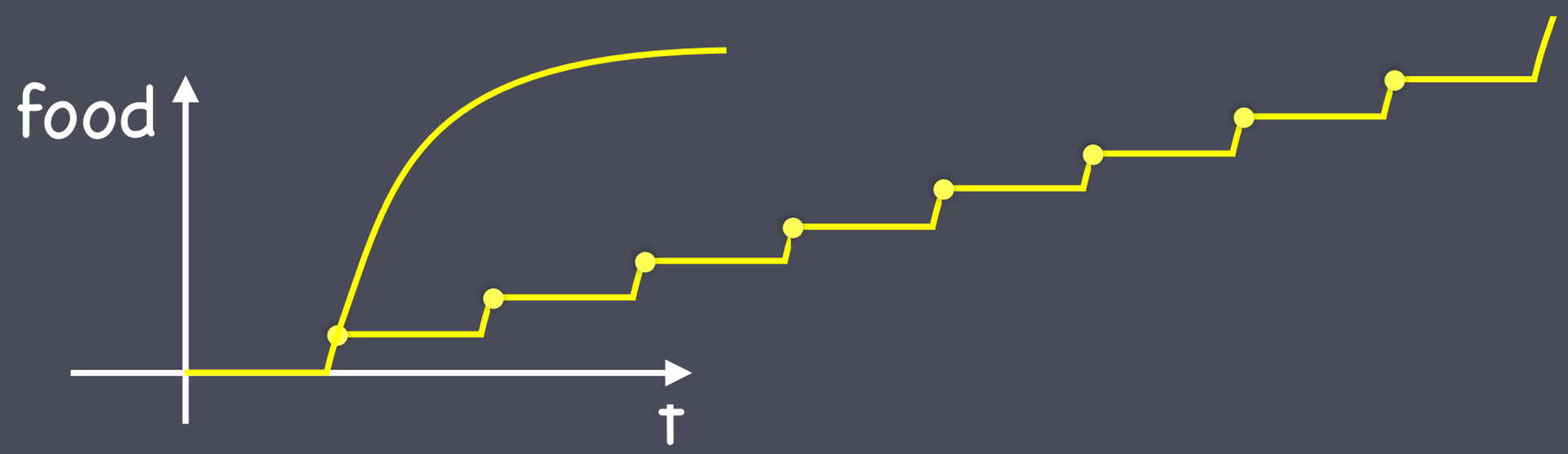
Choose t to maximize R(t).

Foraging



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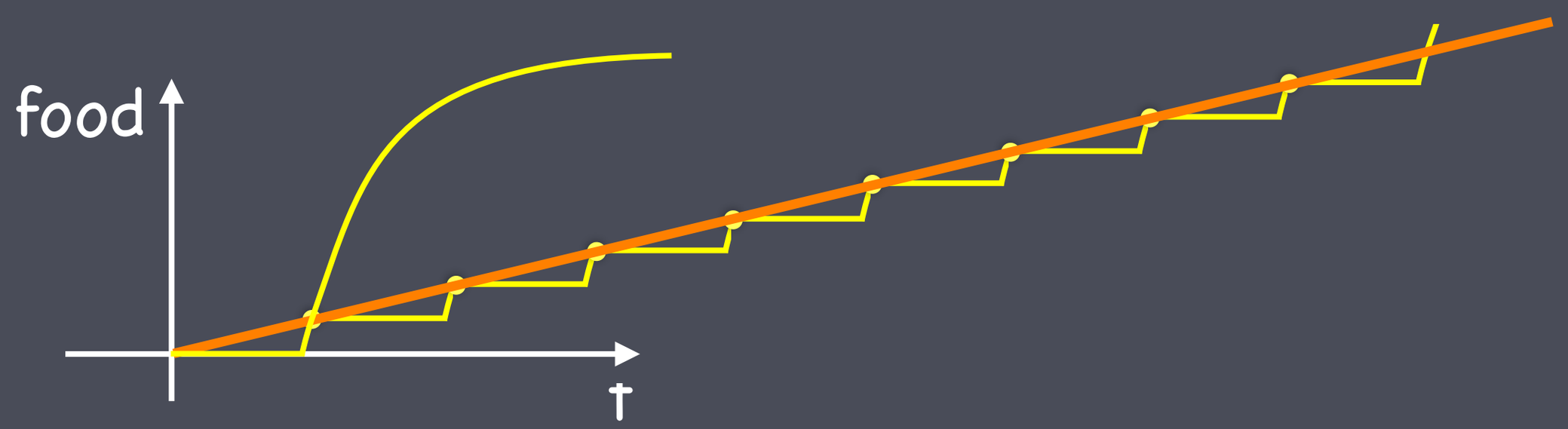

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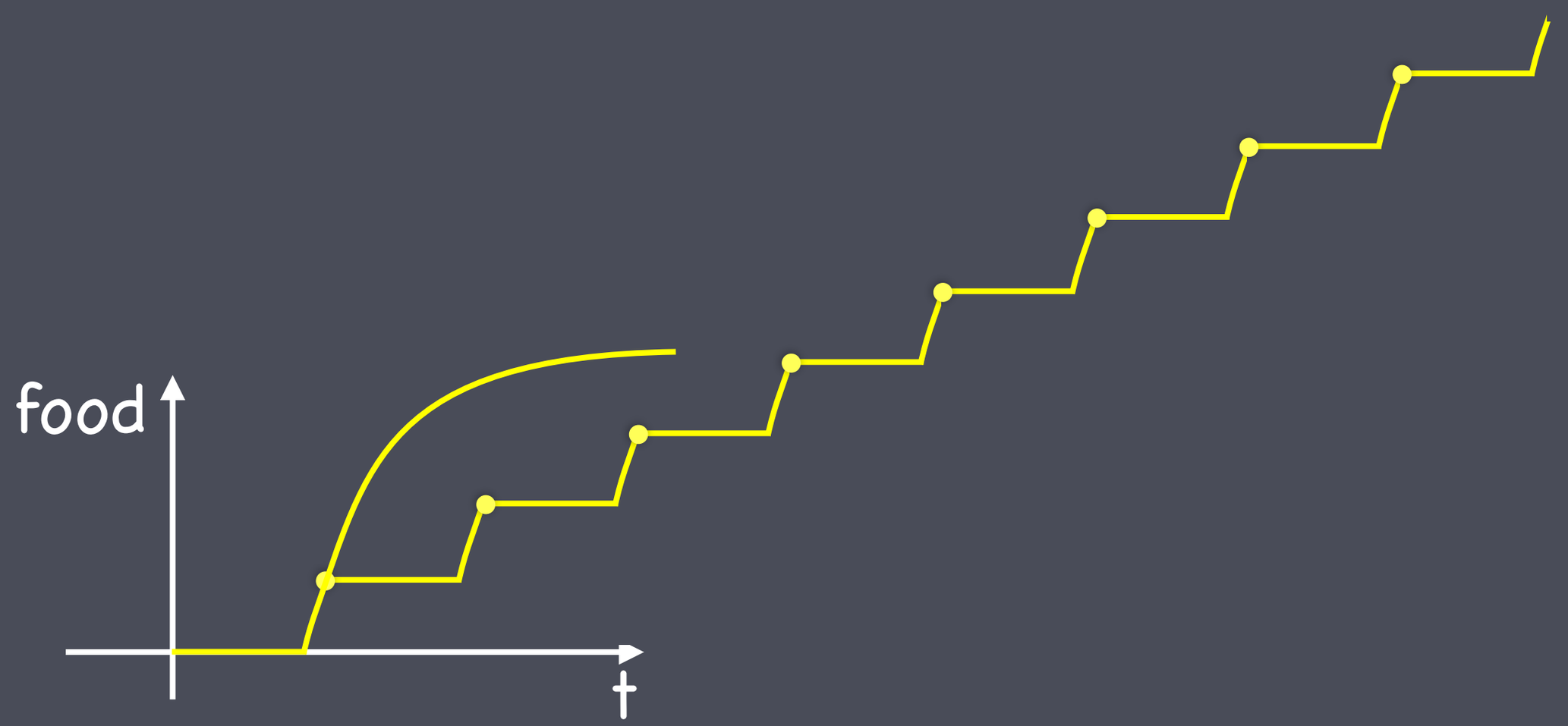
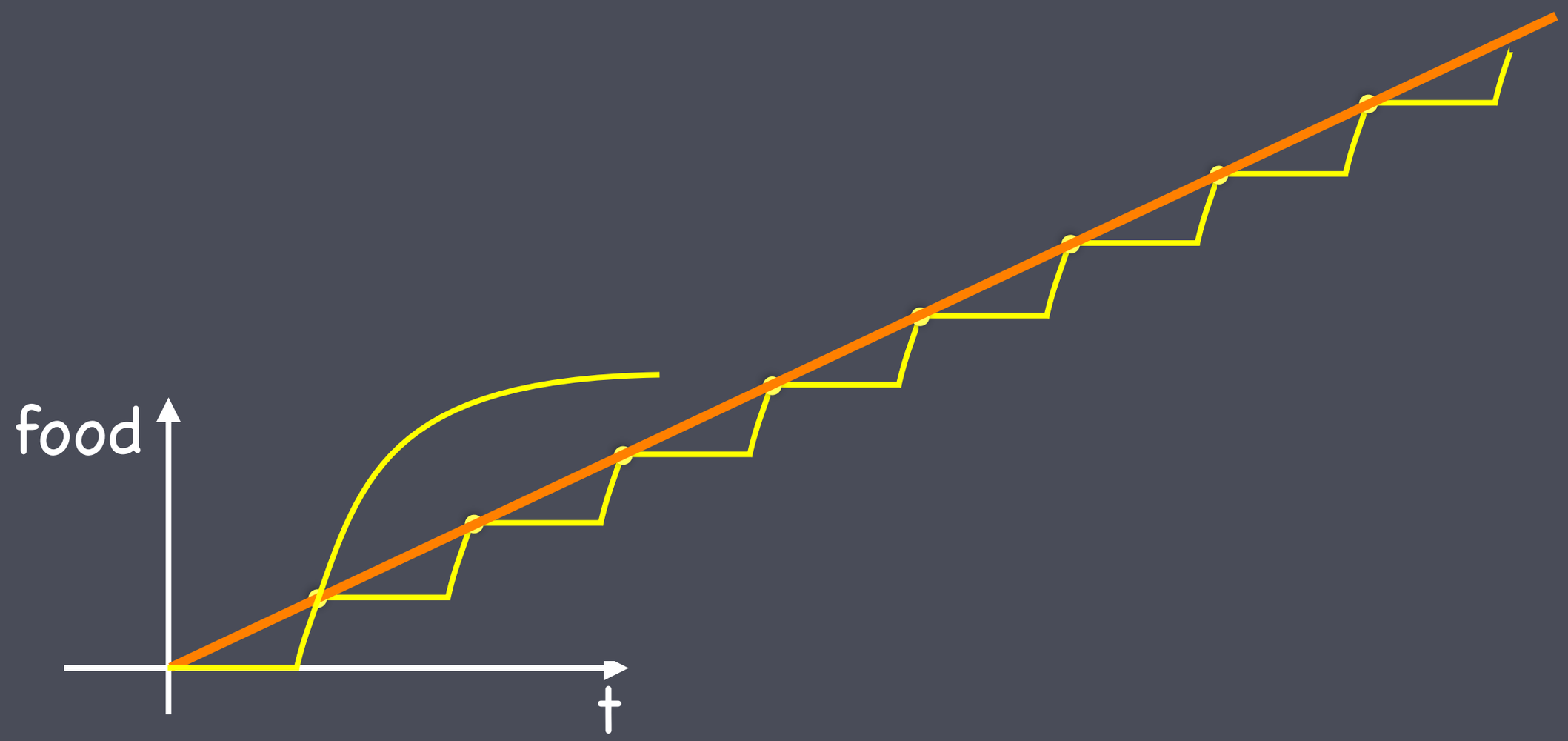


Foraging



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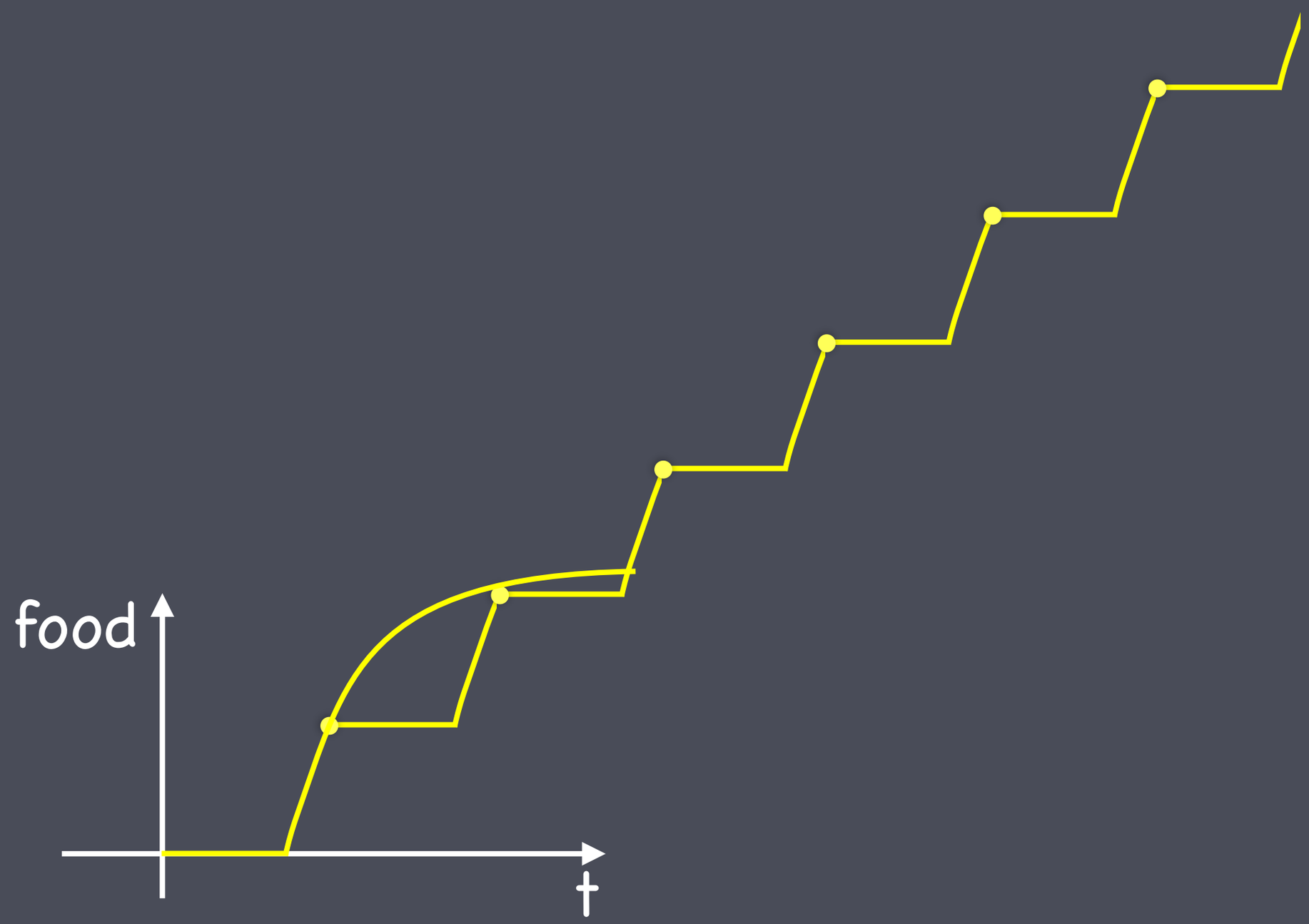

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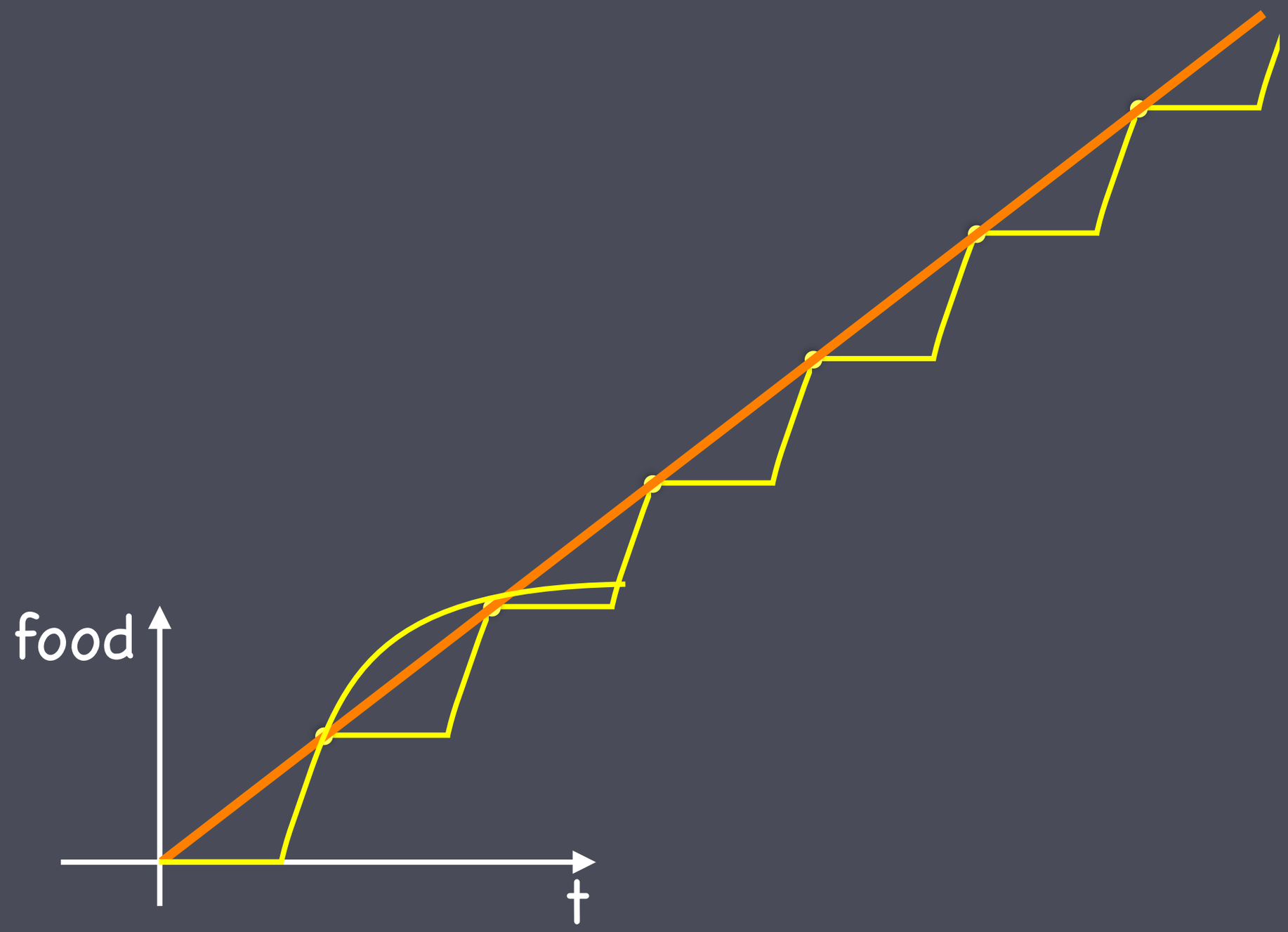

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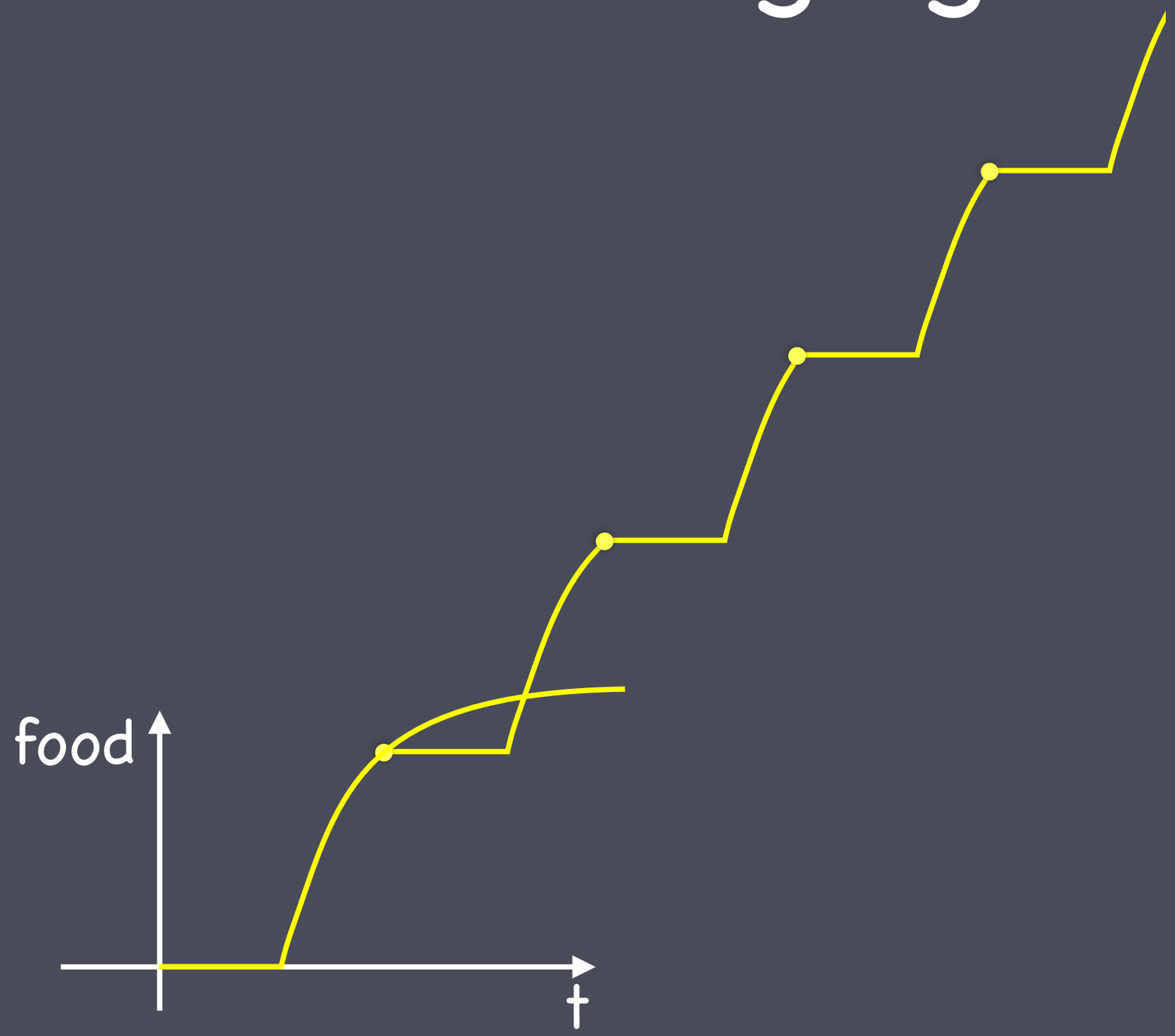

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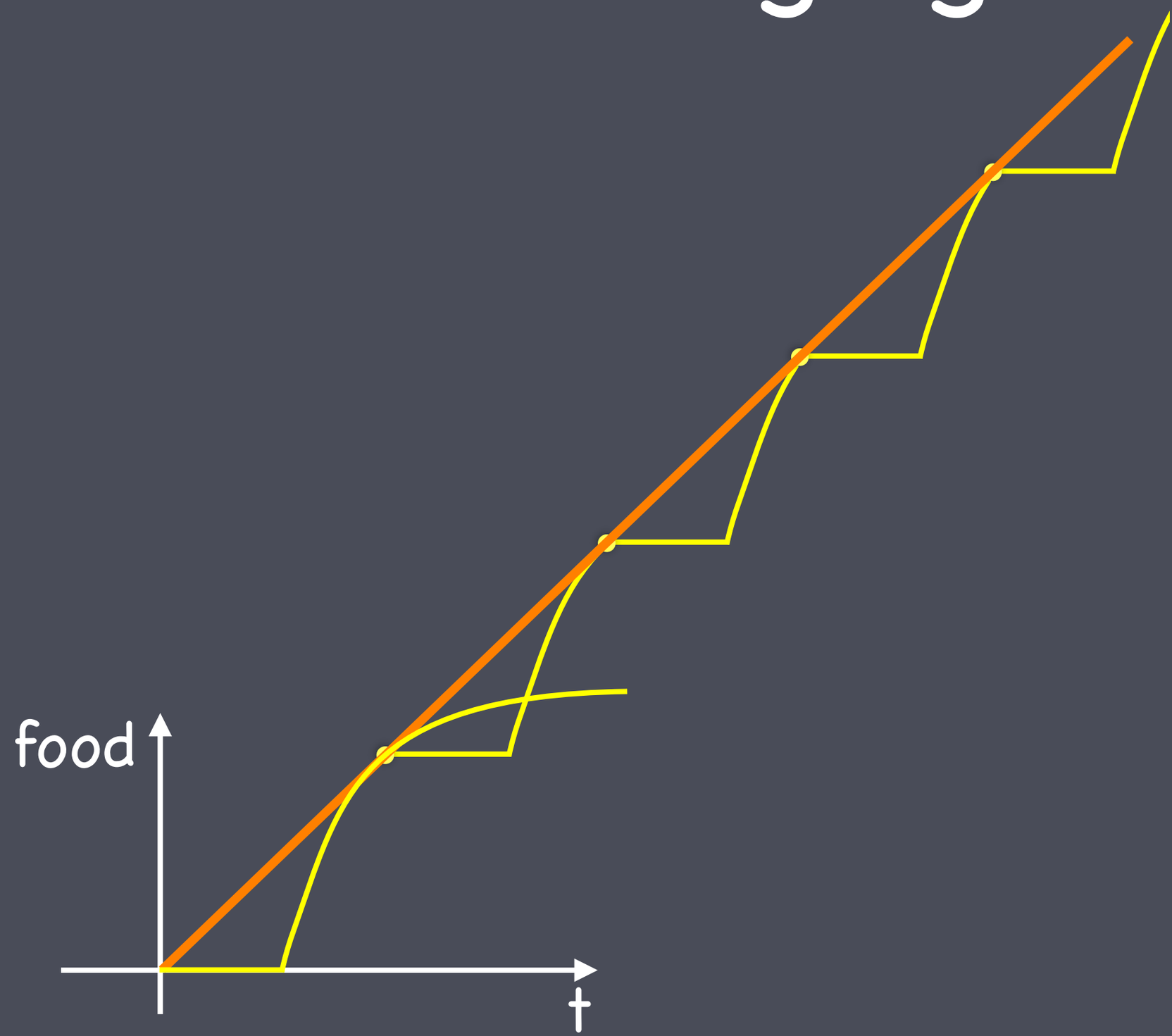

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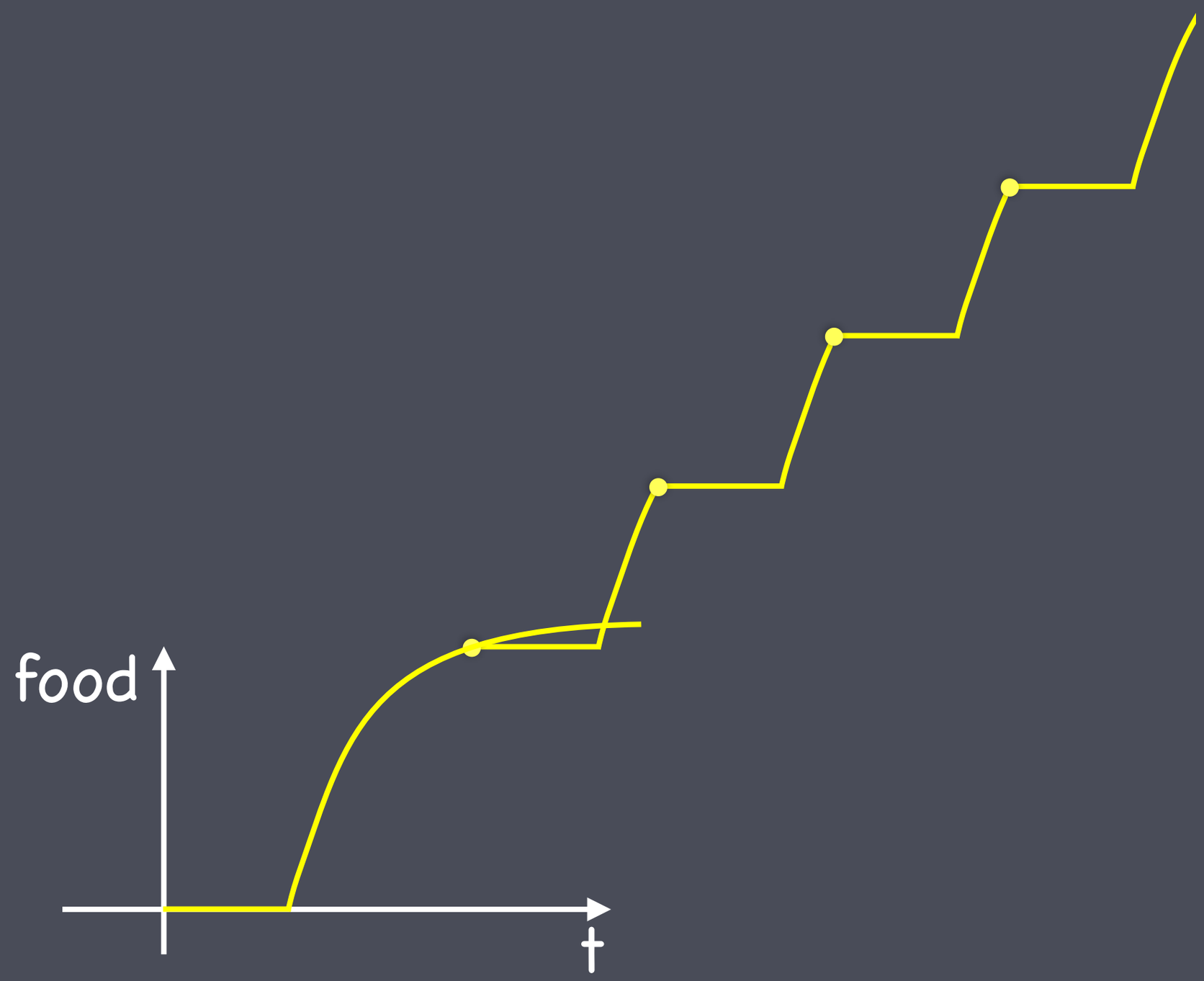

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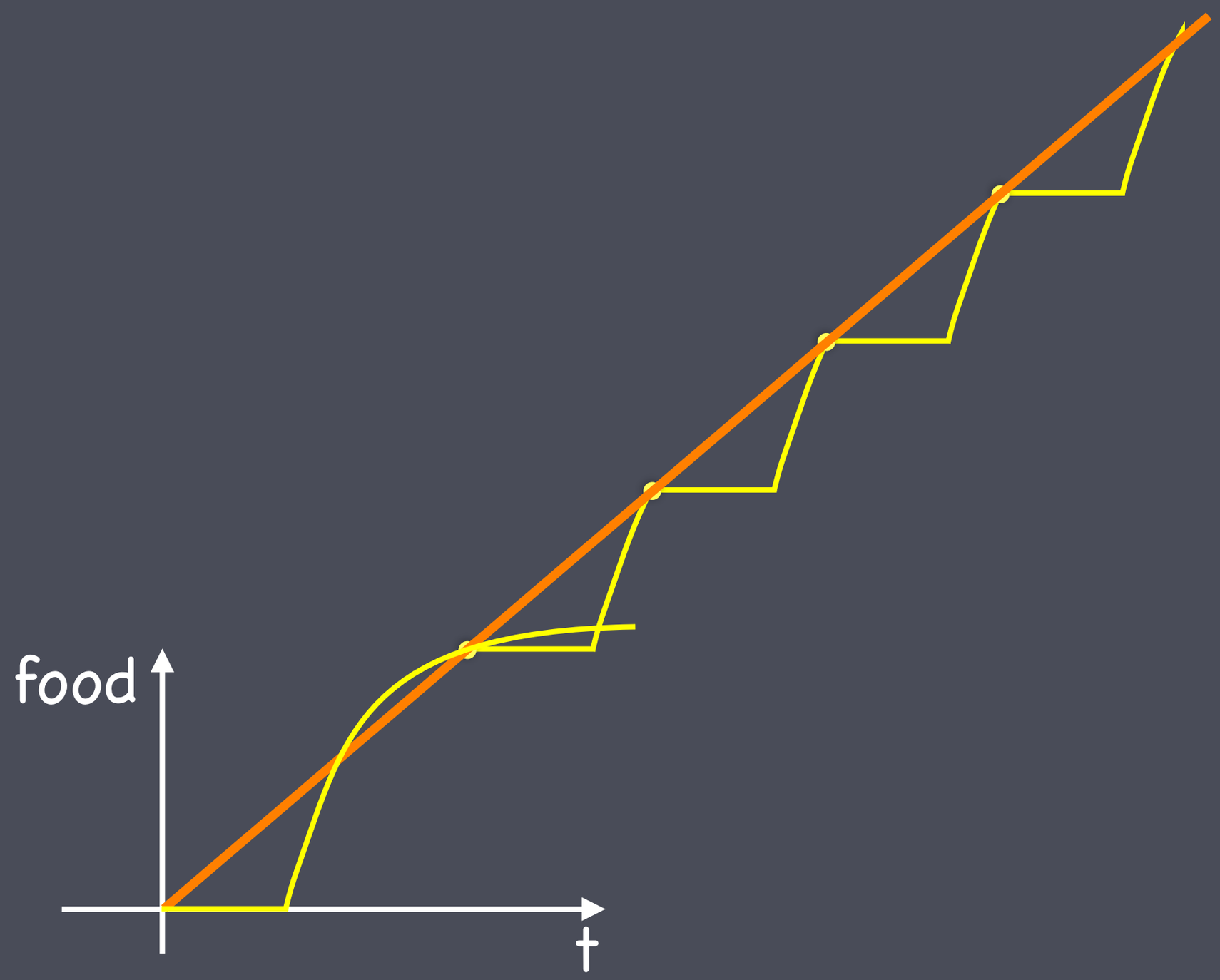

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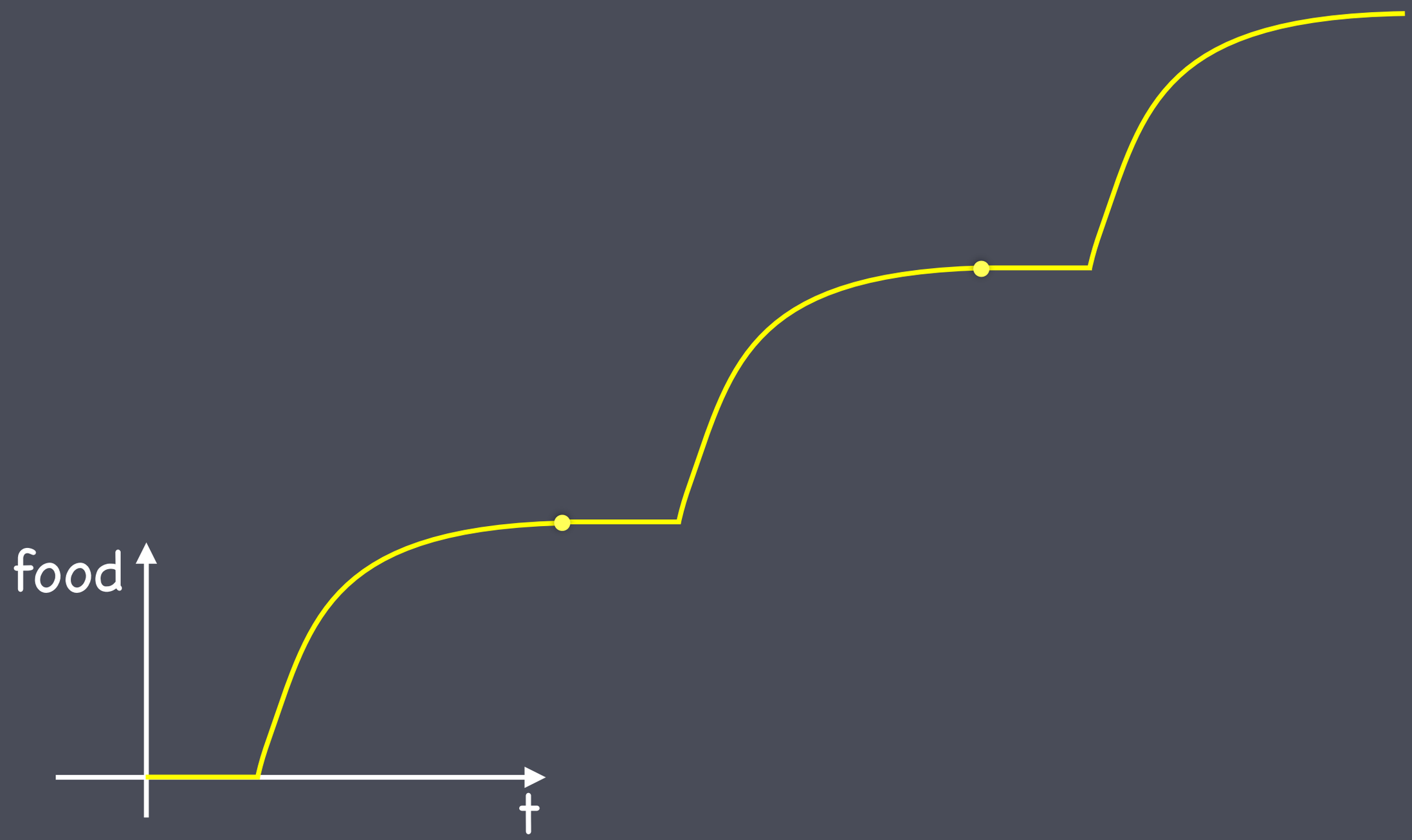

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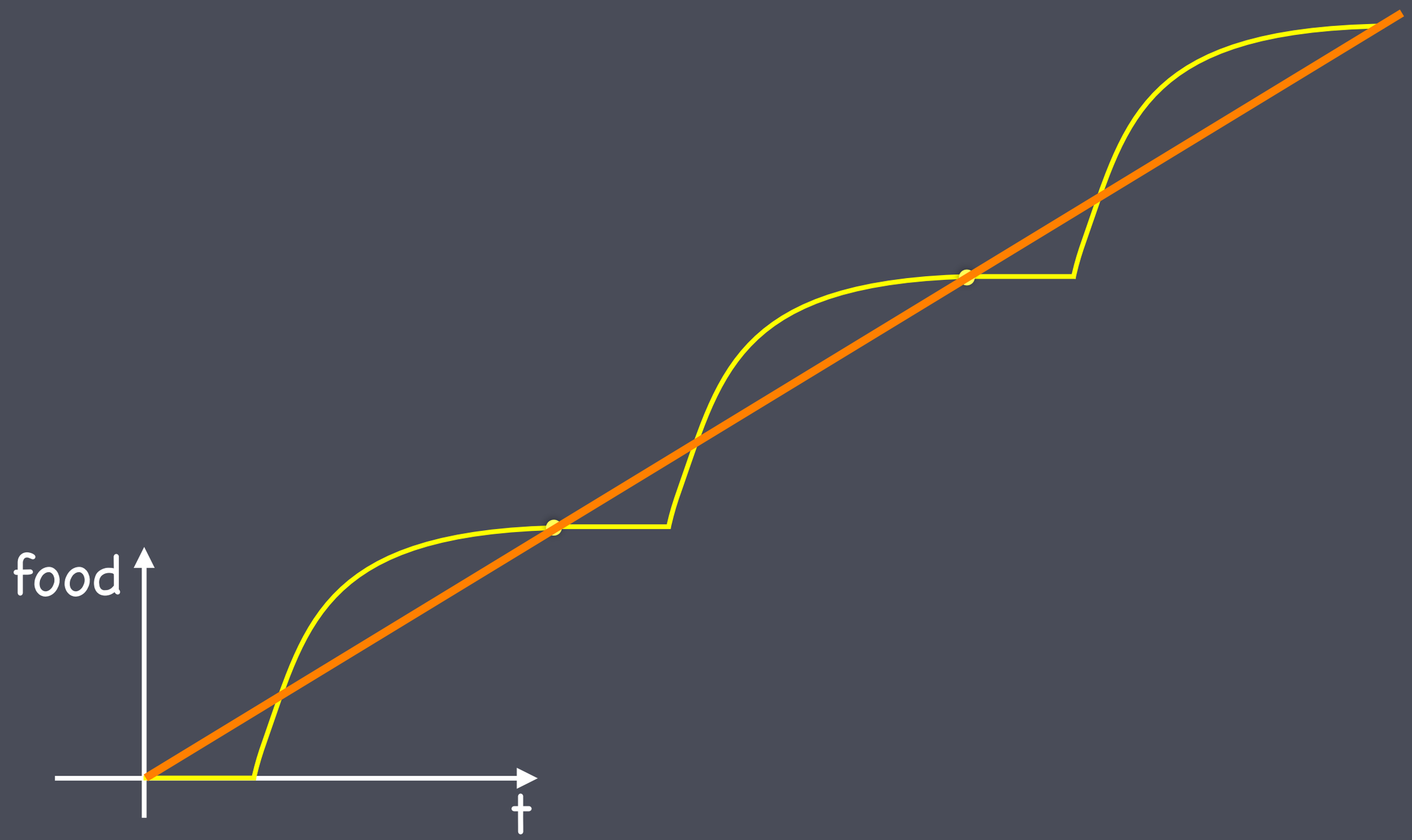

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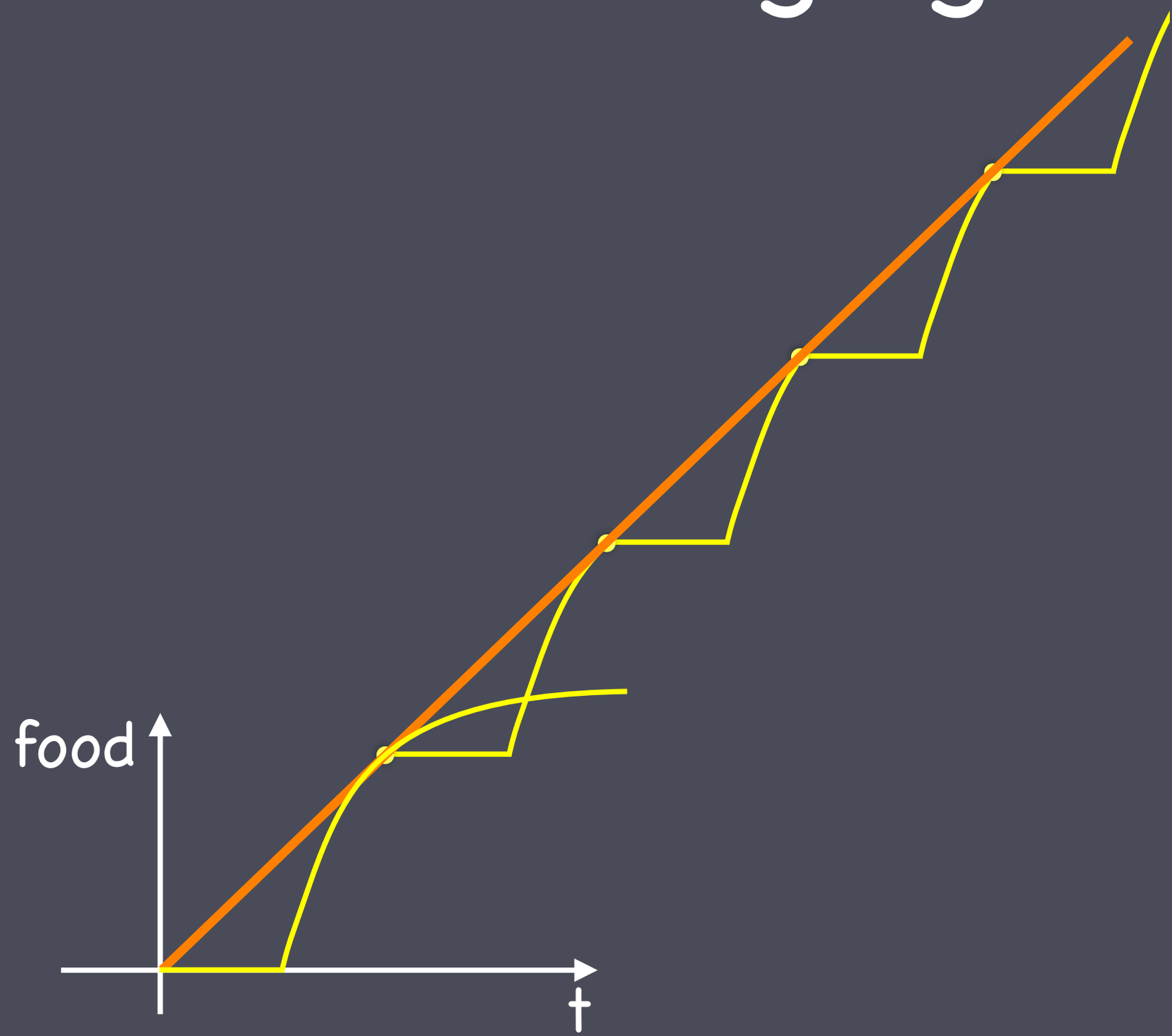

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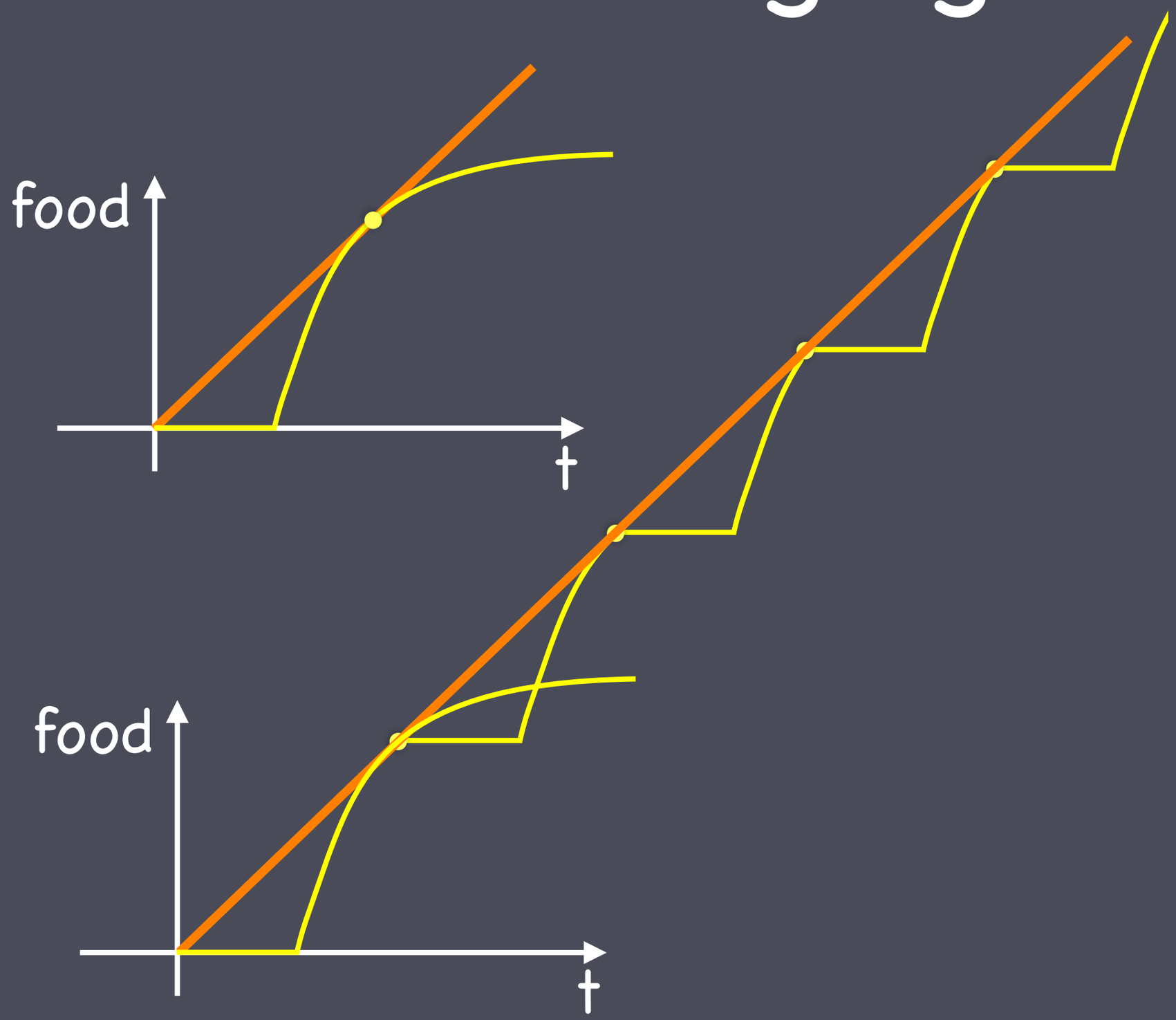

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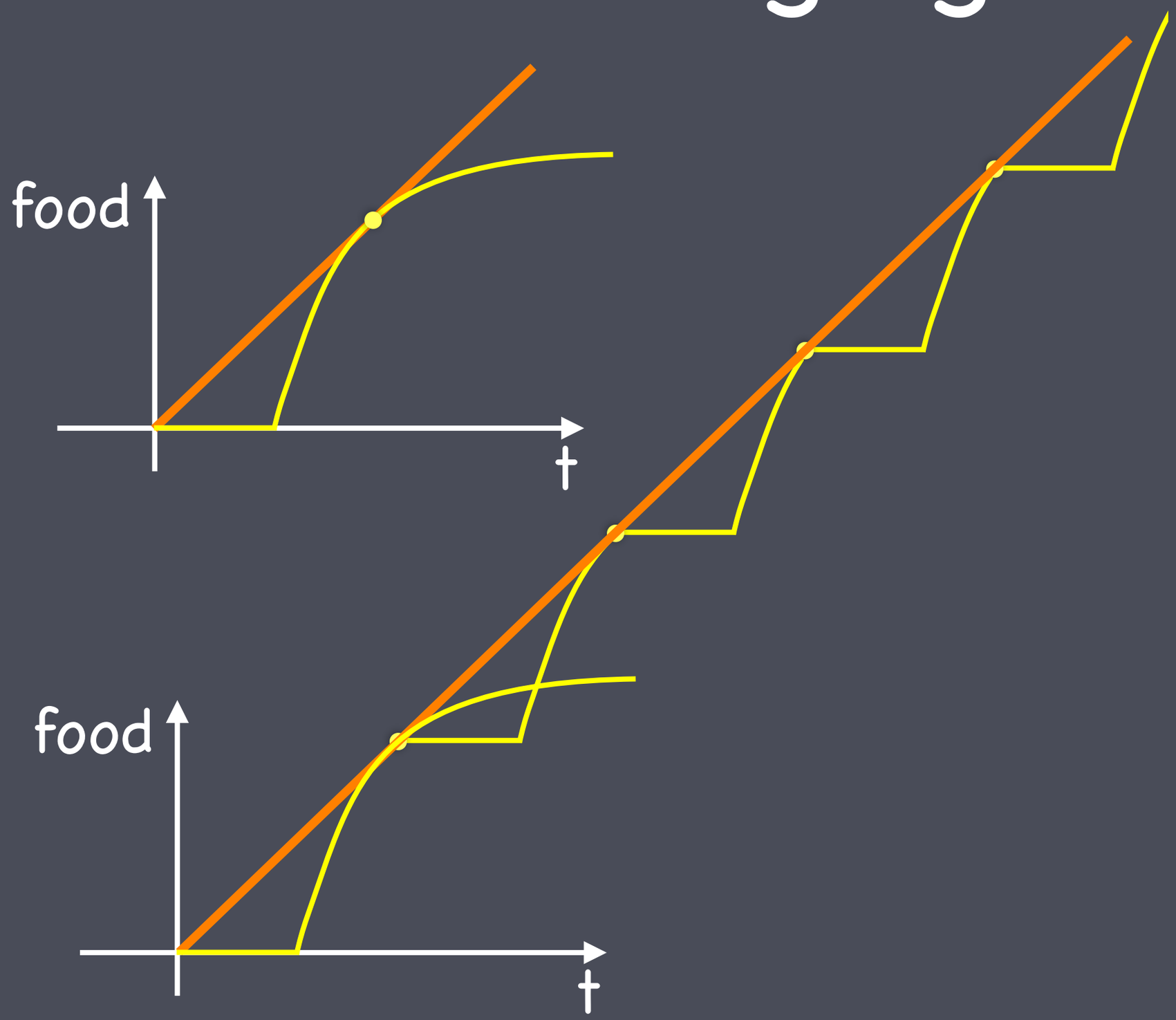

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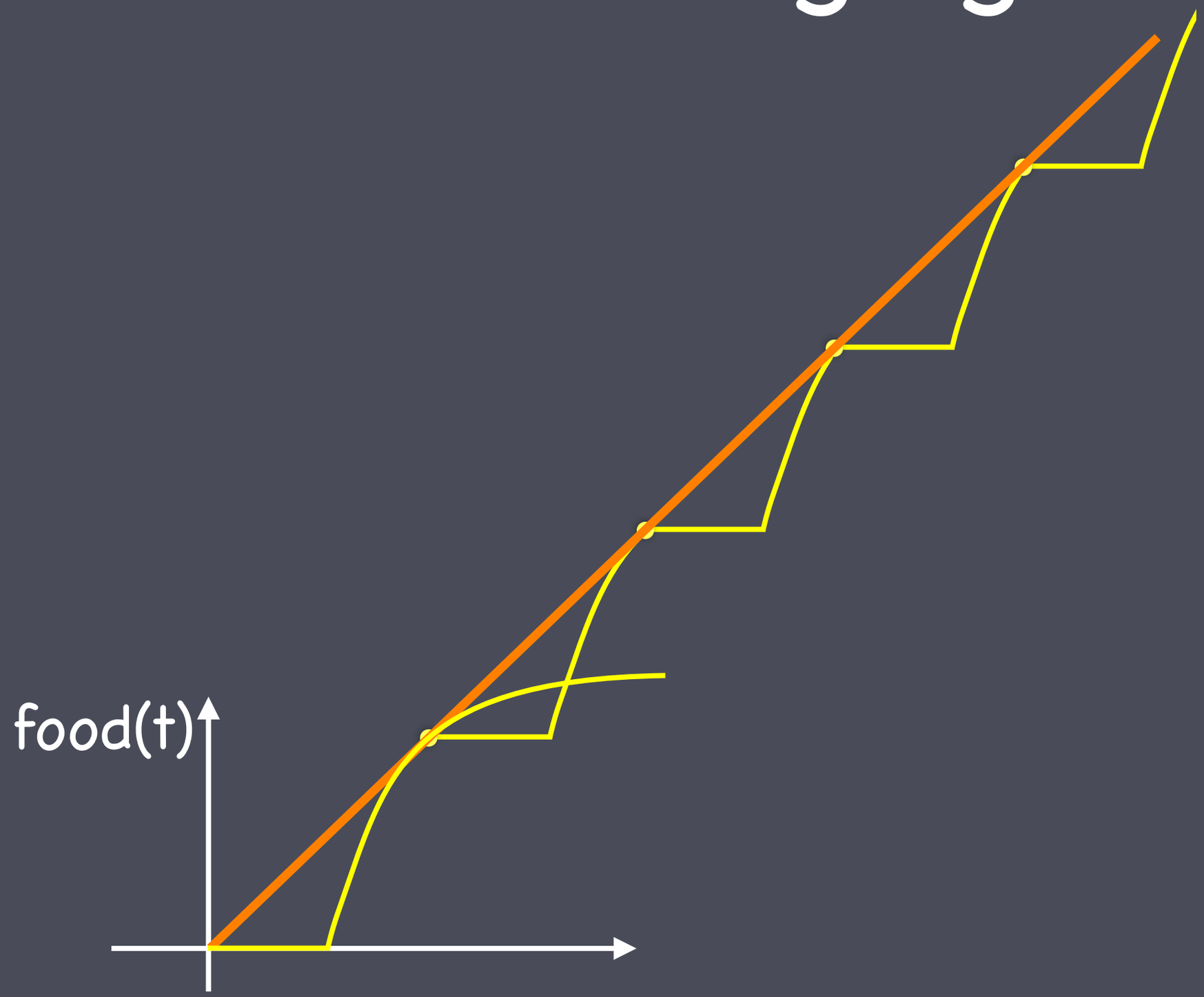
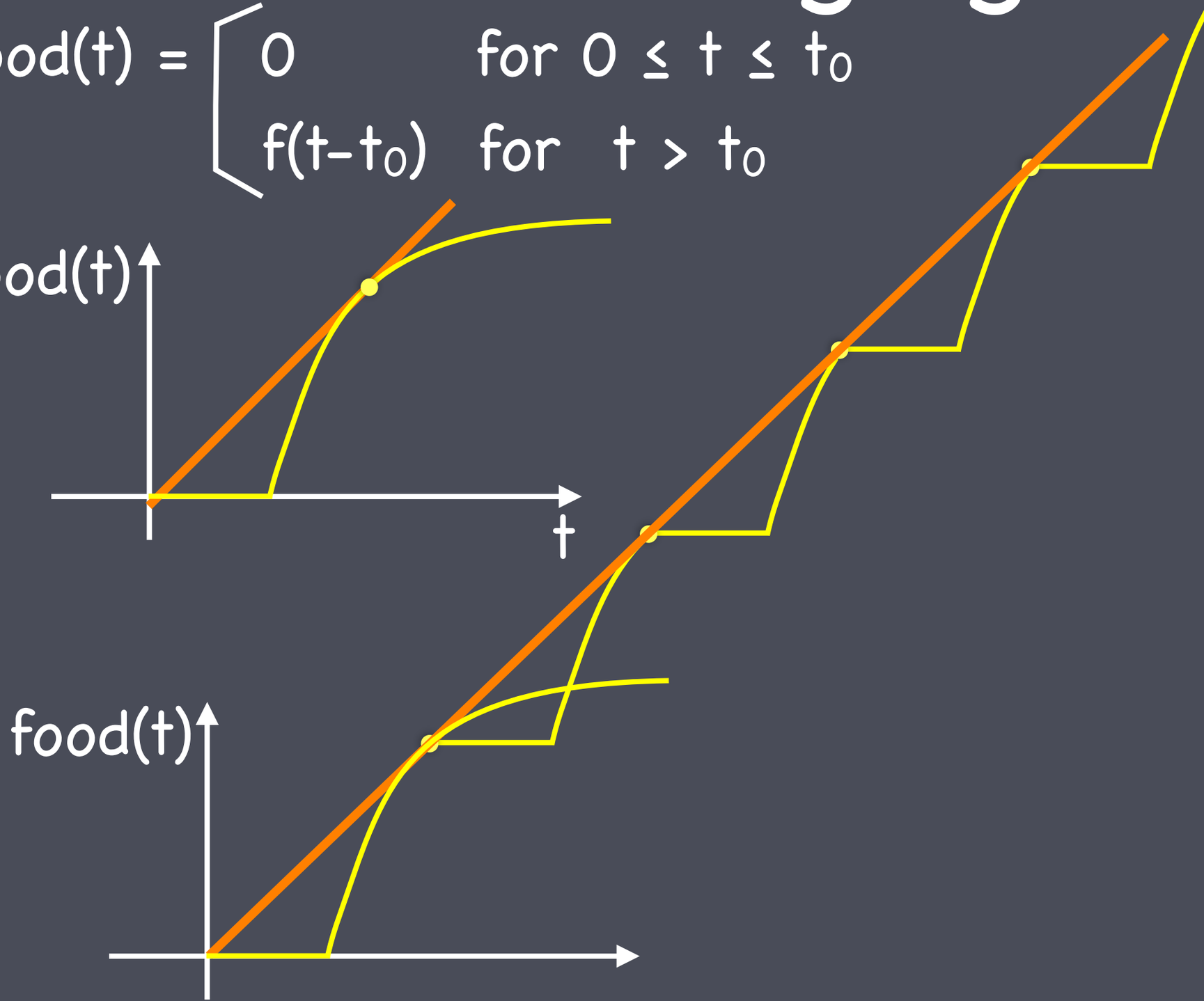


Foraging

$$\text{food}(t) = \begin{cases} 0 & \text{for } 0 \le t \le t_0 \\ f(t-t_0) & \text{for } t > t_0 \end{cases}$$



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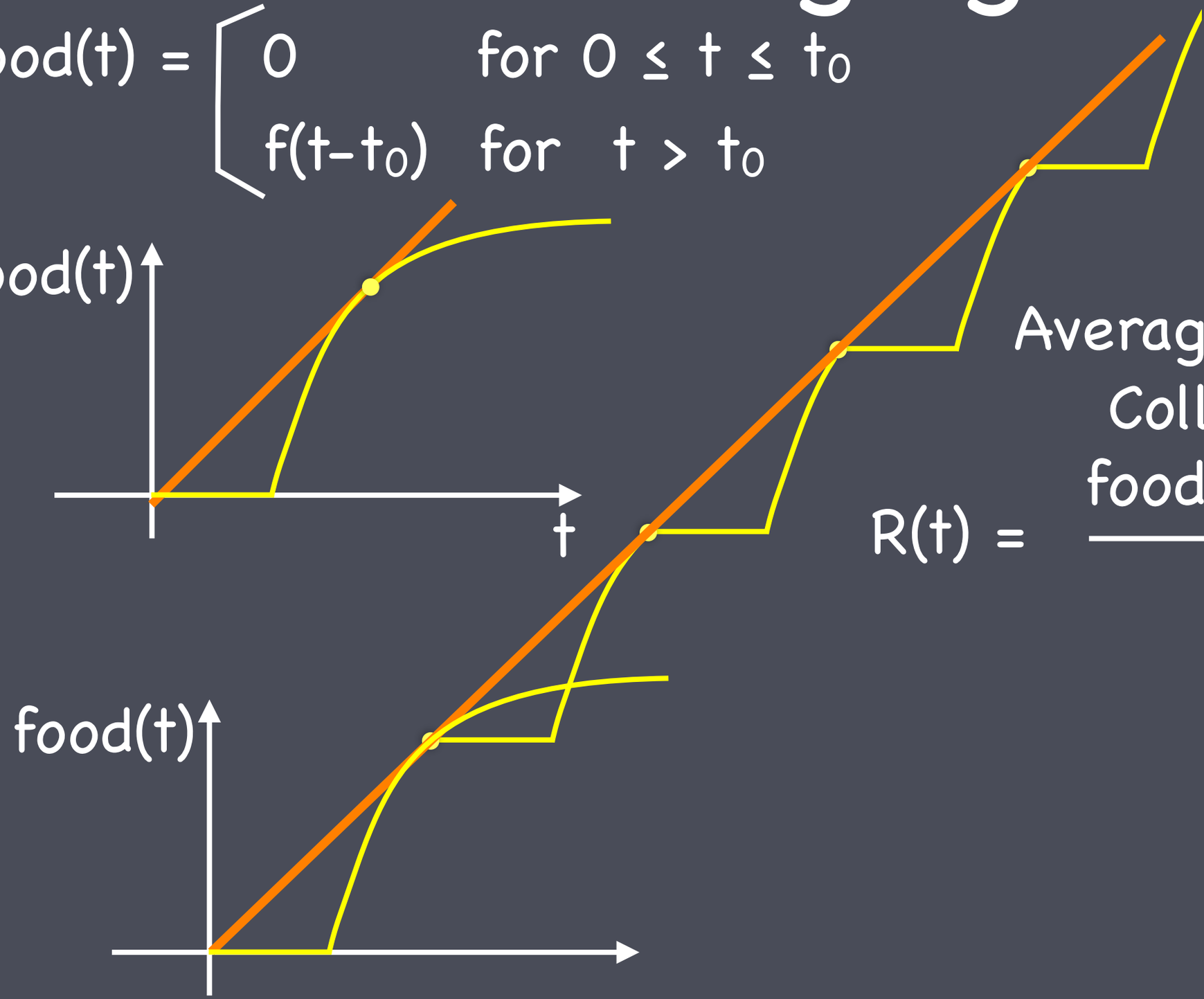
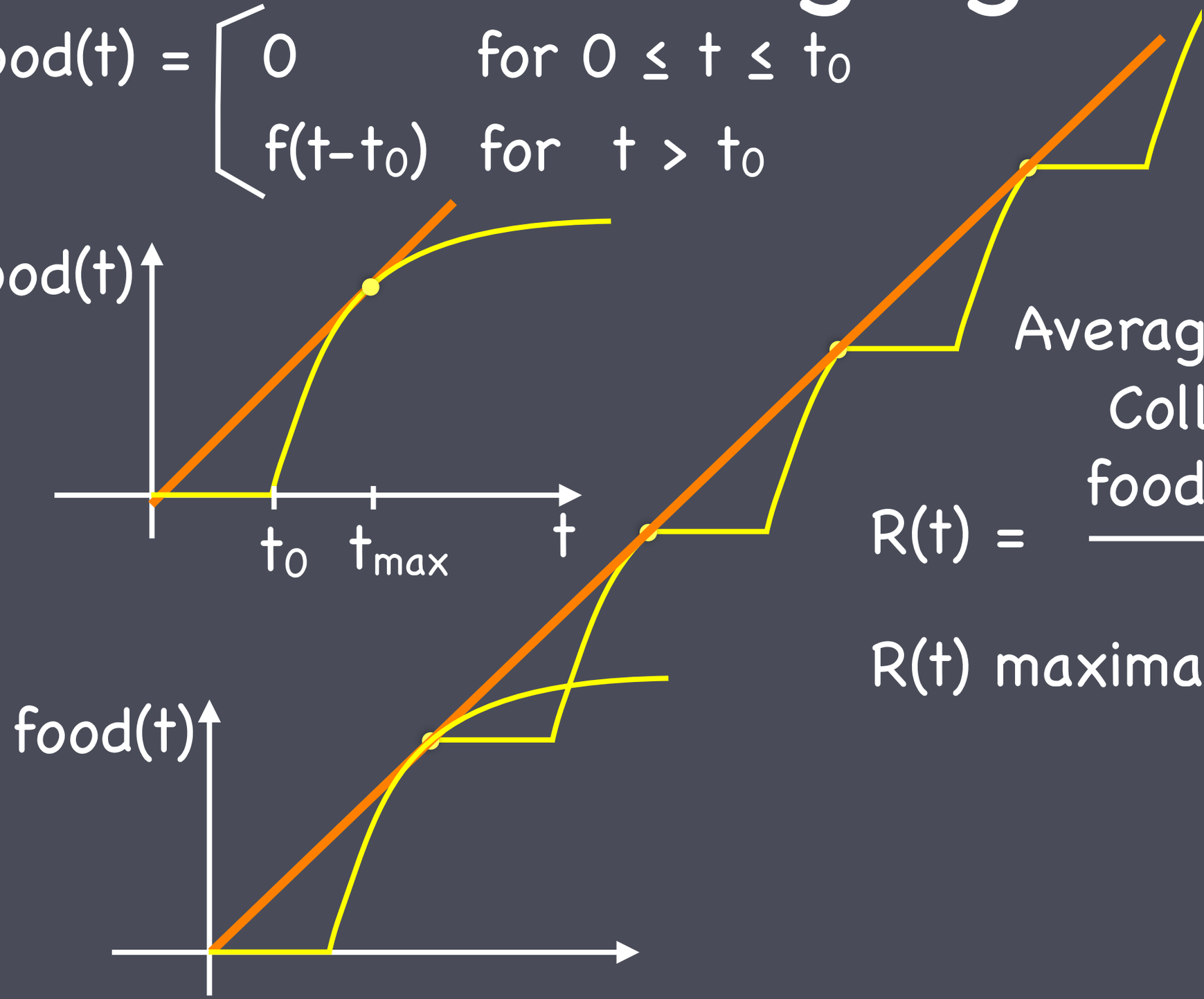


Average Rate of Collection

$$R(t) = \frac{\text{food}(t) - \text{food}(0)}{t - 0}$$

Foraging

$$\text{food}(t) = \begin{cases} 0 & \text{for } 0 \le t \le t_0 \\ f(t-t_0) & \text{for } t > t_0 \end{cases}$$



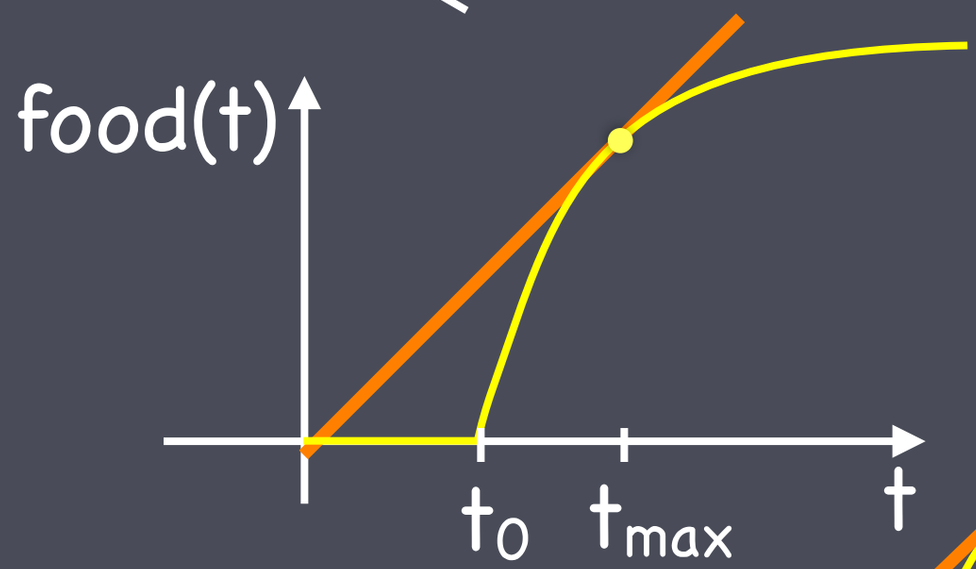
Average Rate of Collection

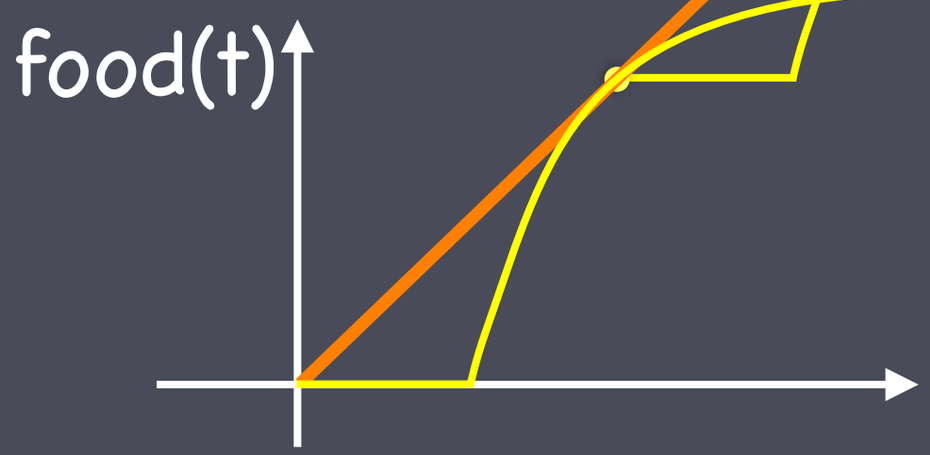
$$R(t) = \frac{\text{food}(t) - \text{food}(0)}{t - 0}$$

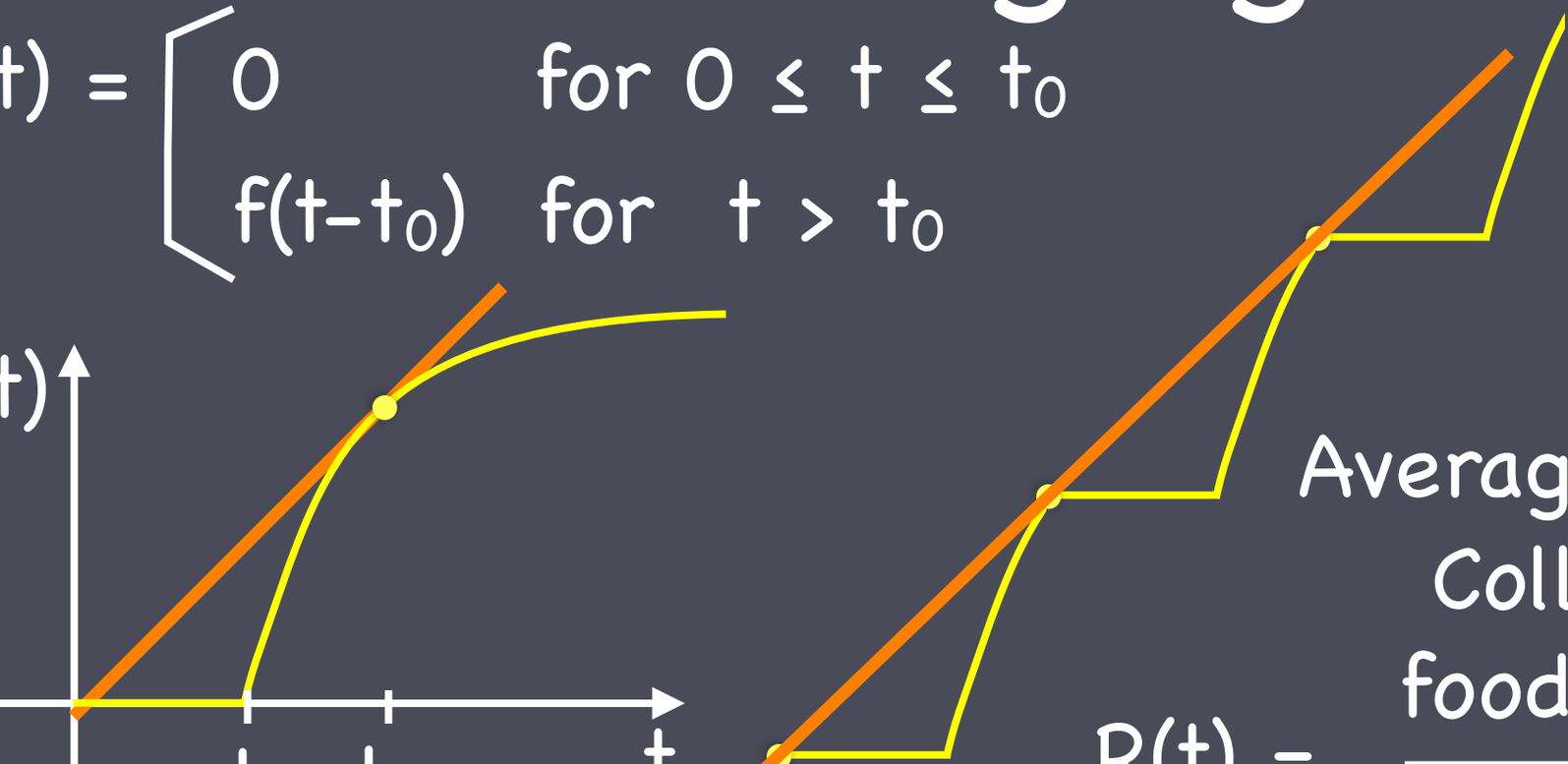
R(t) maximal at t_{max}.

Foraging

$$\text{food}(t) = \begin{cases} 0 & \text{for } 0 \le t \le t_0 \\ f(t-t_0) & \text{for } t > t_0 \end{cases}$$







Average Rate of Collection

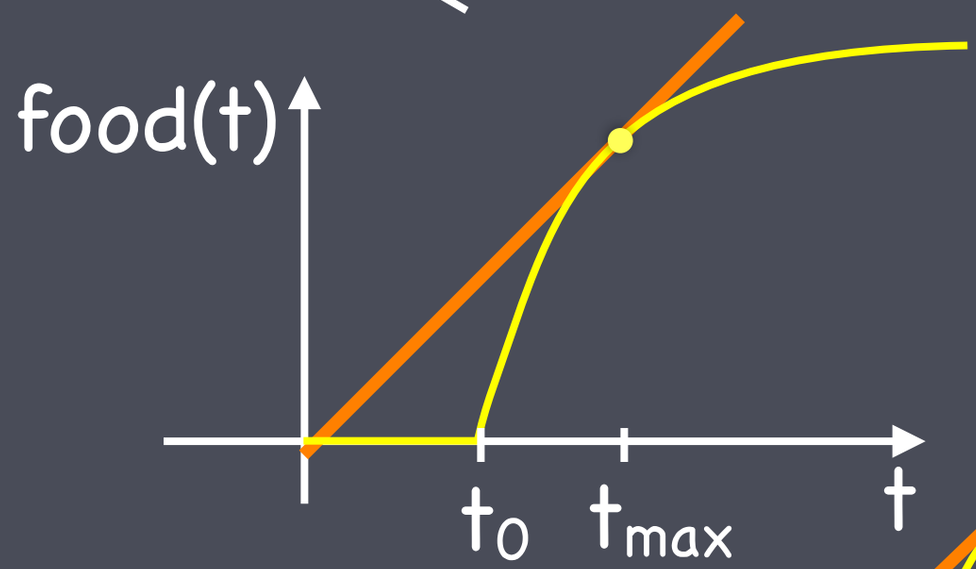
$$R(t) = \frac{\text{food}(t) - \text{food}(0)}{t - 0}$$

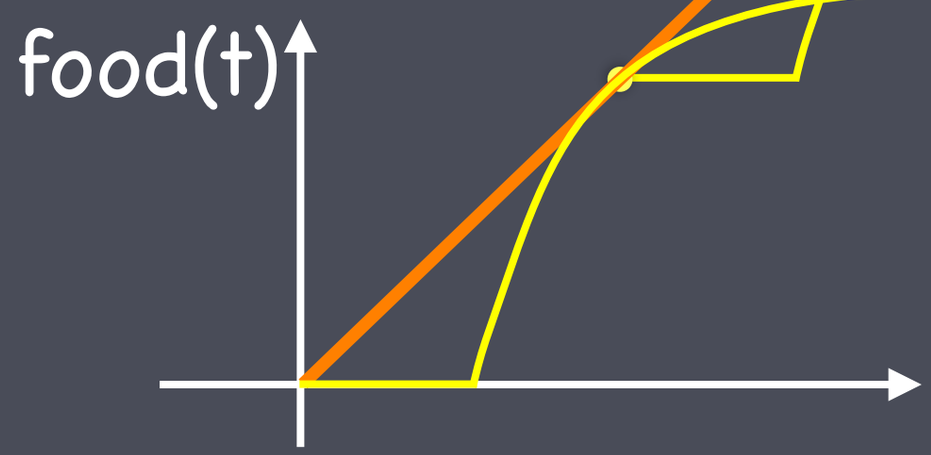
$R(t)$ maximal at t_{max}.

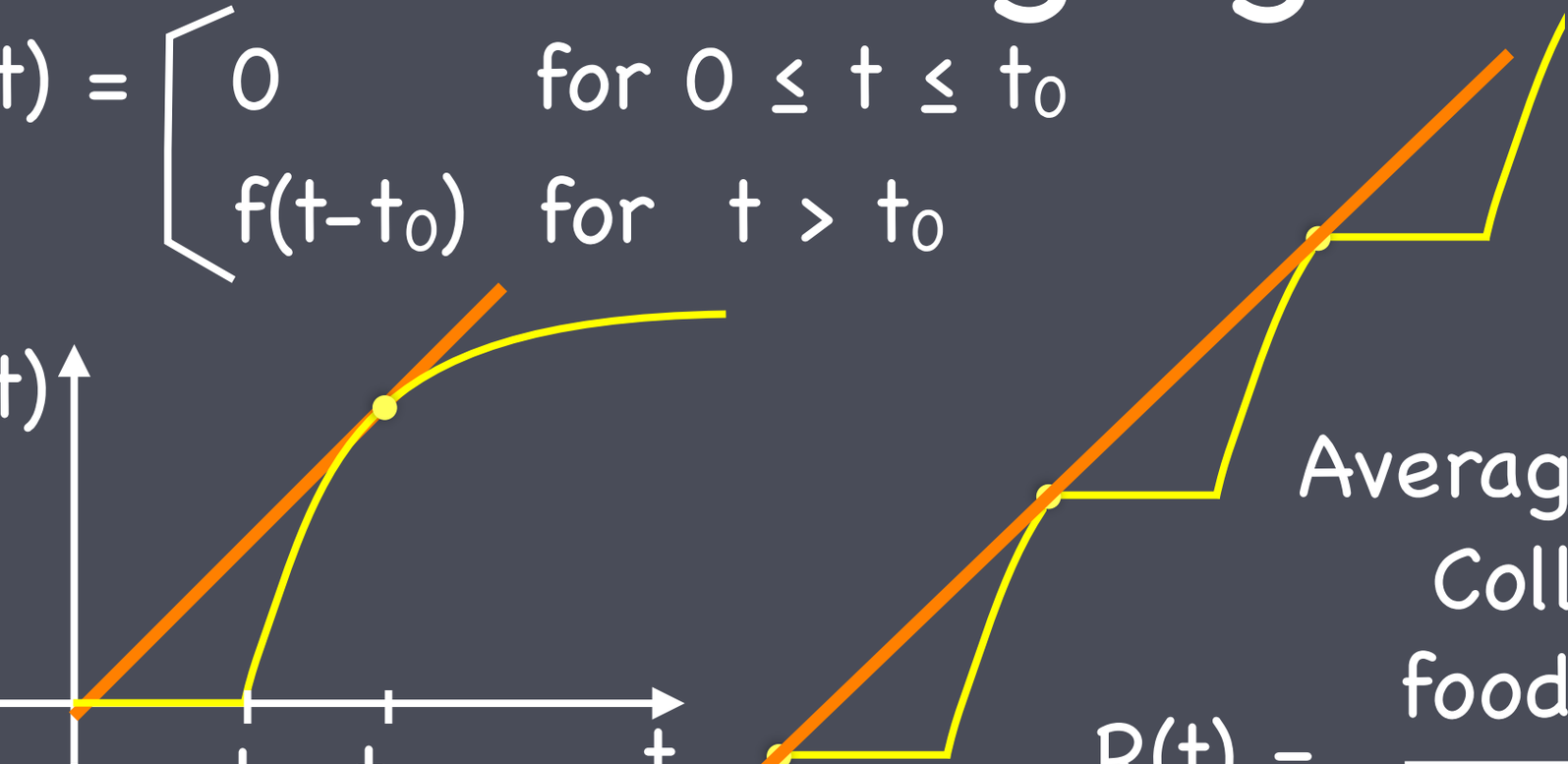
Optimal $t_p = t_{max} - t_0$.

Foraging

$$\text{food}(t) = \begin{cases} 0 & \text{for } 0 \le t \le t_0 \\ f(t-t_0) & \text{for } t > t_0 \end{cases}$$







Average Rate of Collection

$$R(t) = \frac{\text{food}(t) - \text{food}(0)}{t - 0}$$

$R(t)$ maximal at t_{max}.

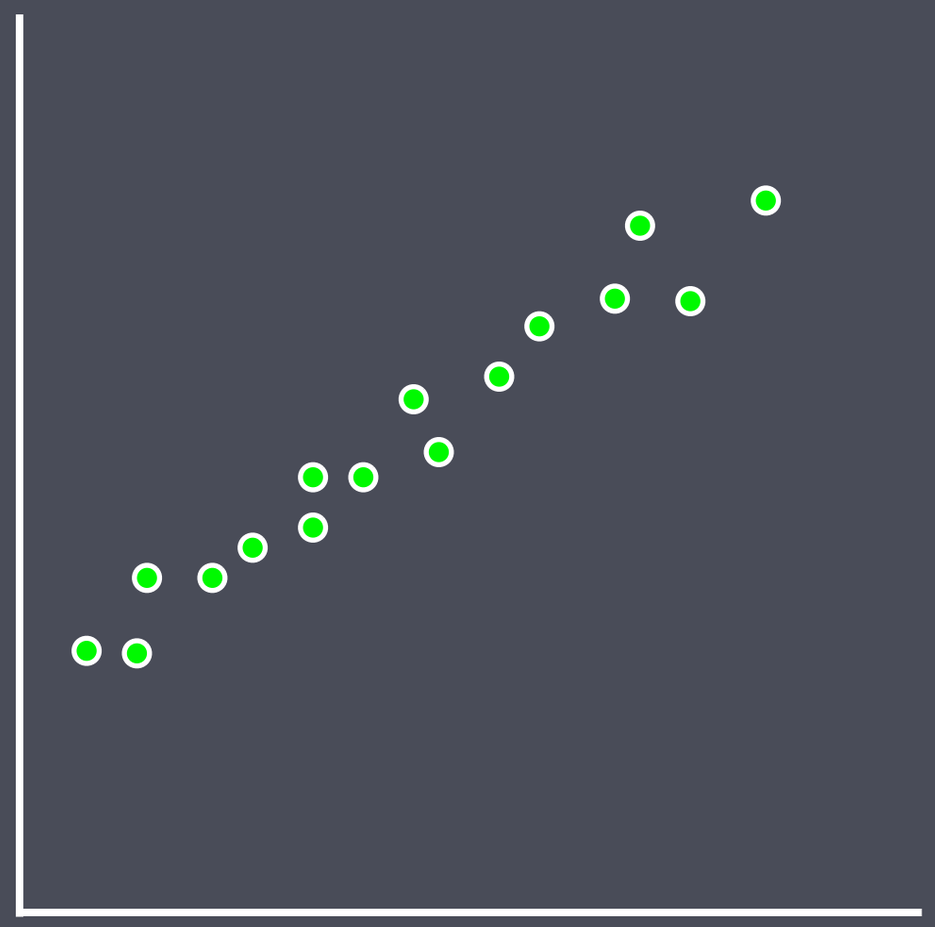
Optimal $t_p = t_{max} - t_0$.

Could have maximized

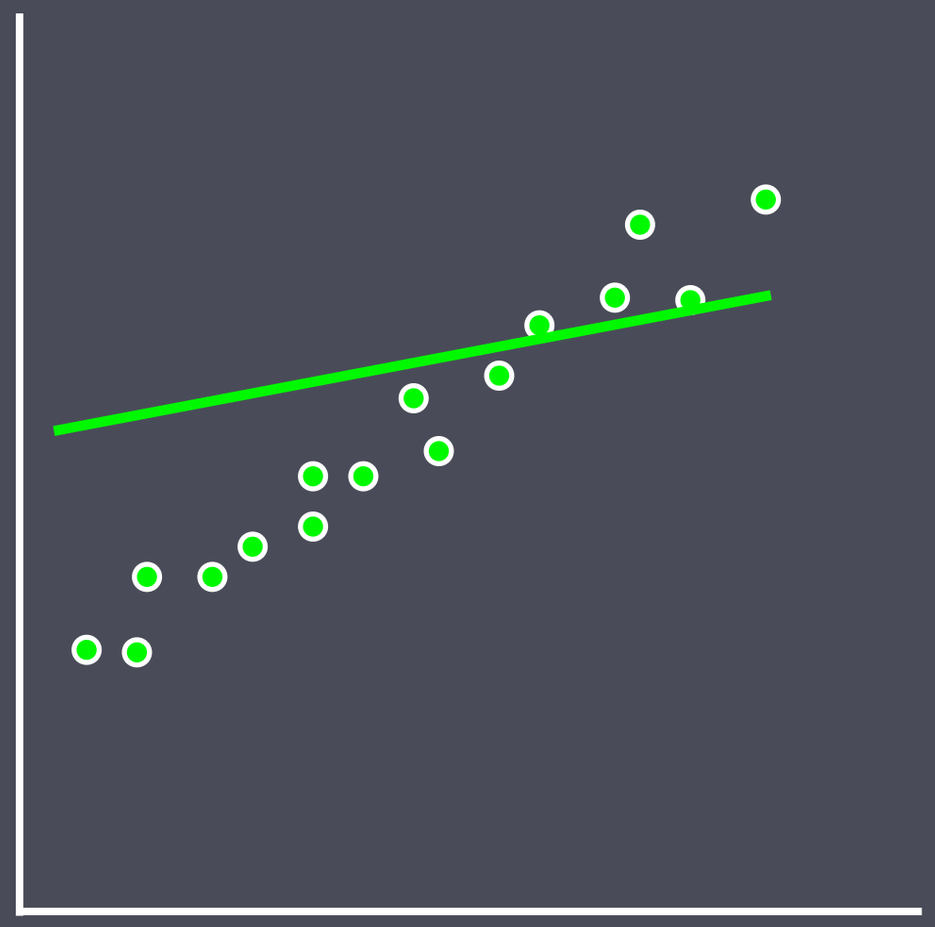
$$R(t_p+t_0) = f(t_p) \,/\, (t_p+t_0)$$

to get best t_p.

Least squares model fitting

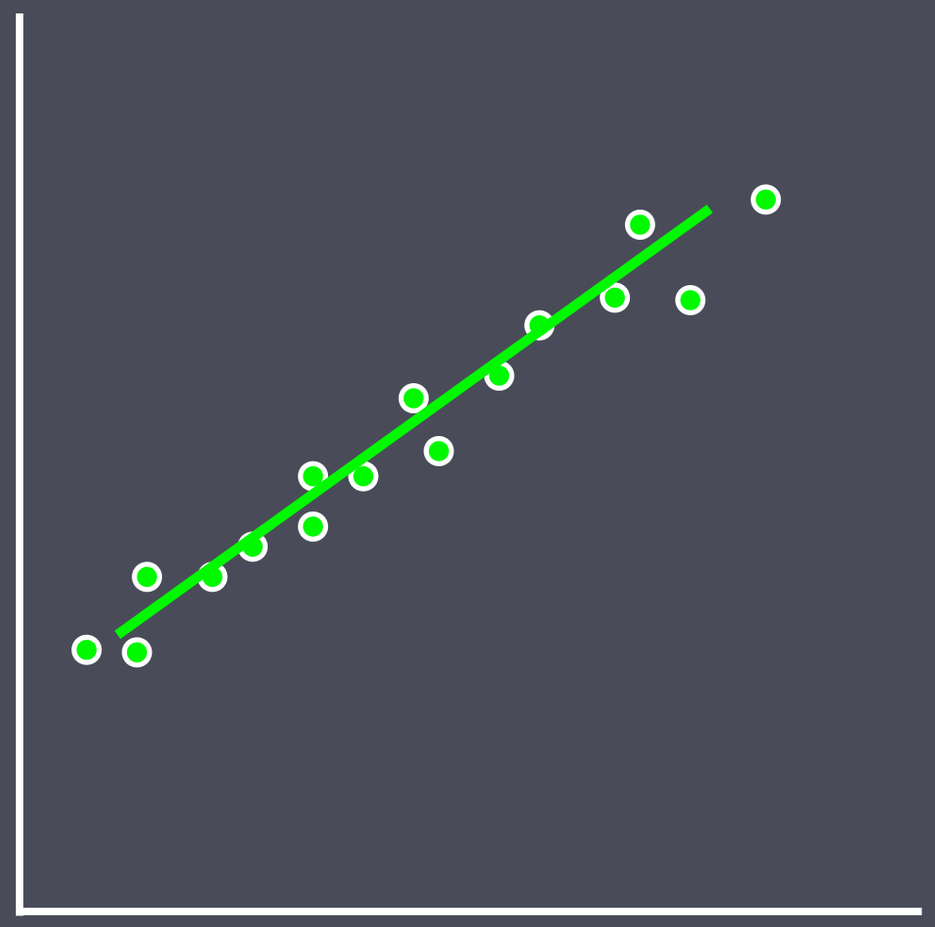


Least squares model fitting



How do we find the best line
to fit through the data?

Least squares model fitting



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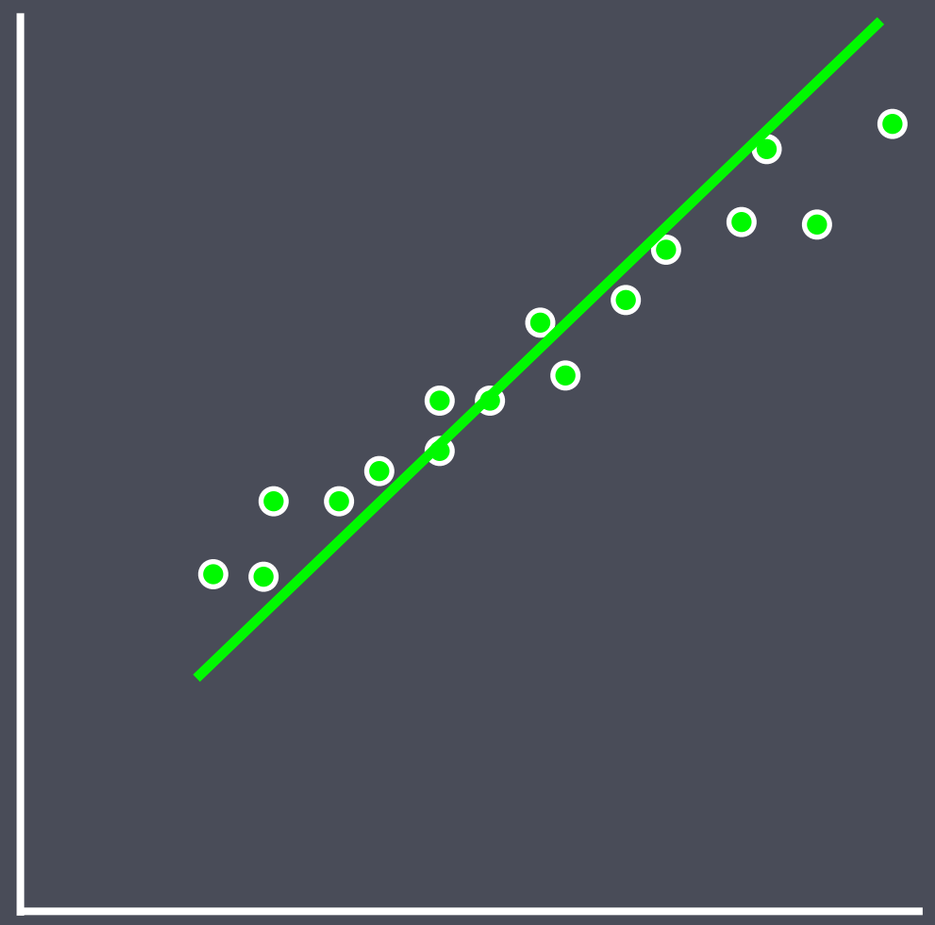
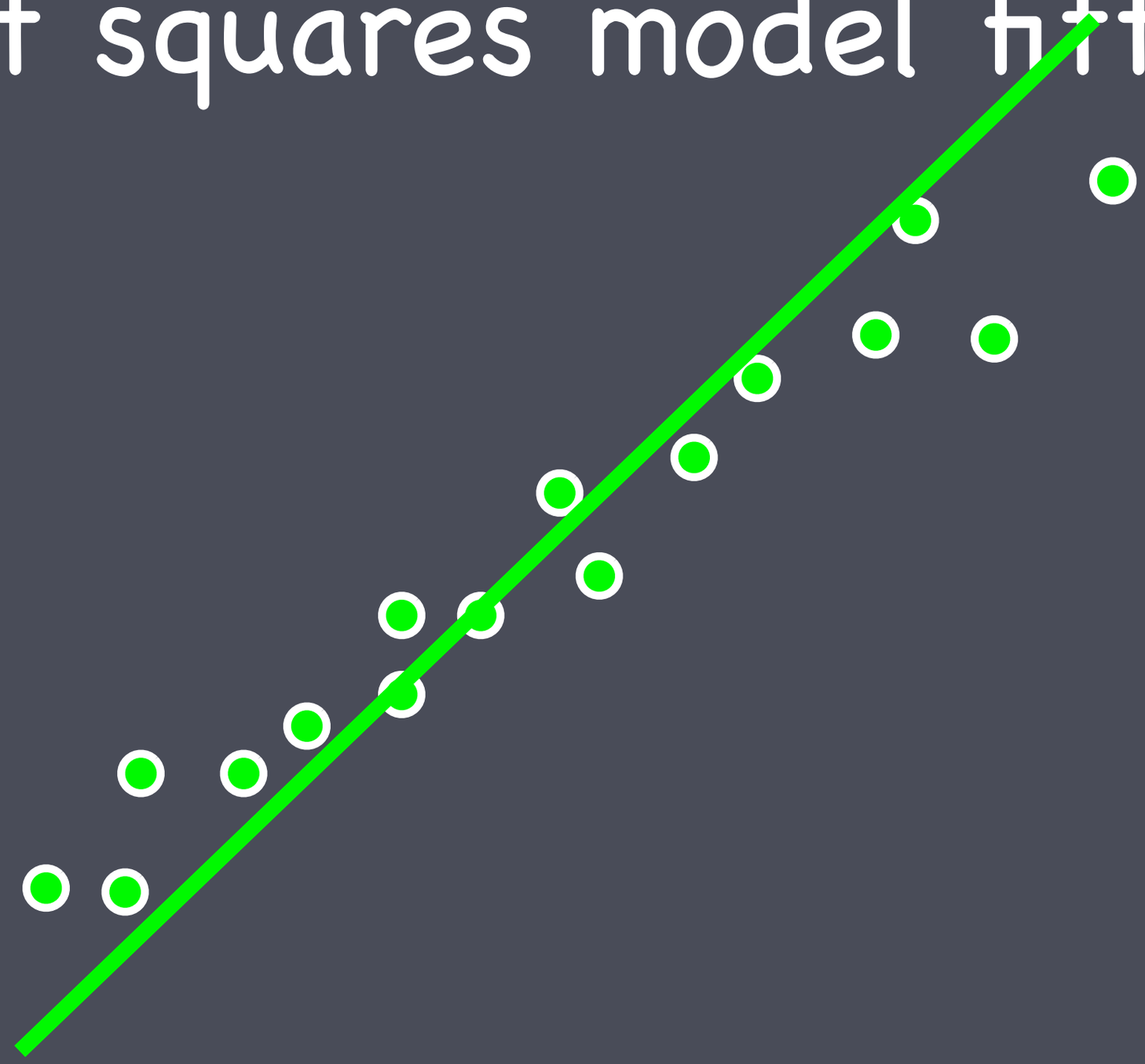
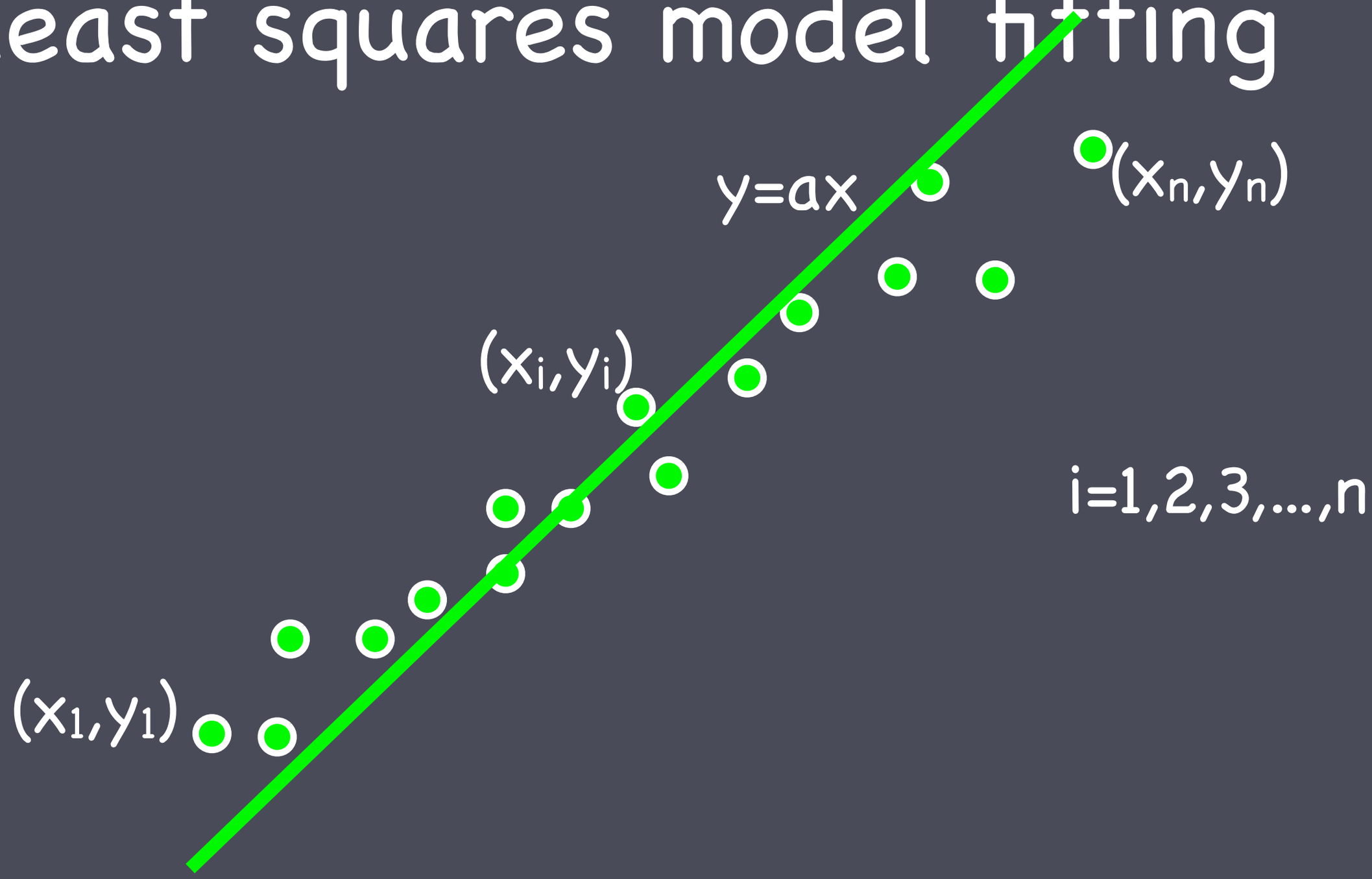


Least squares model fitting

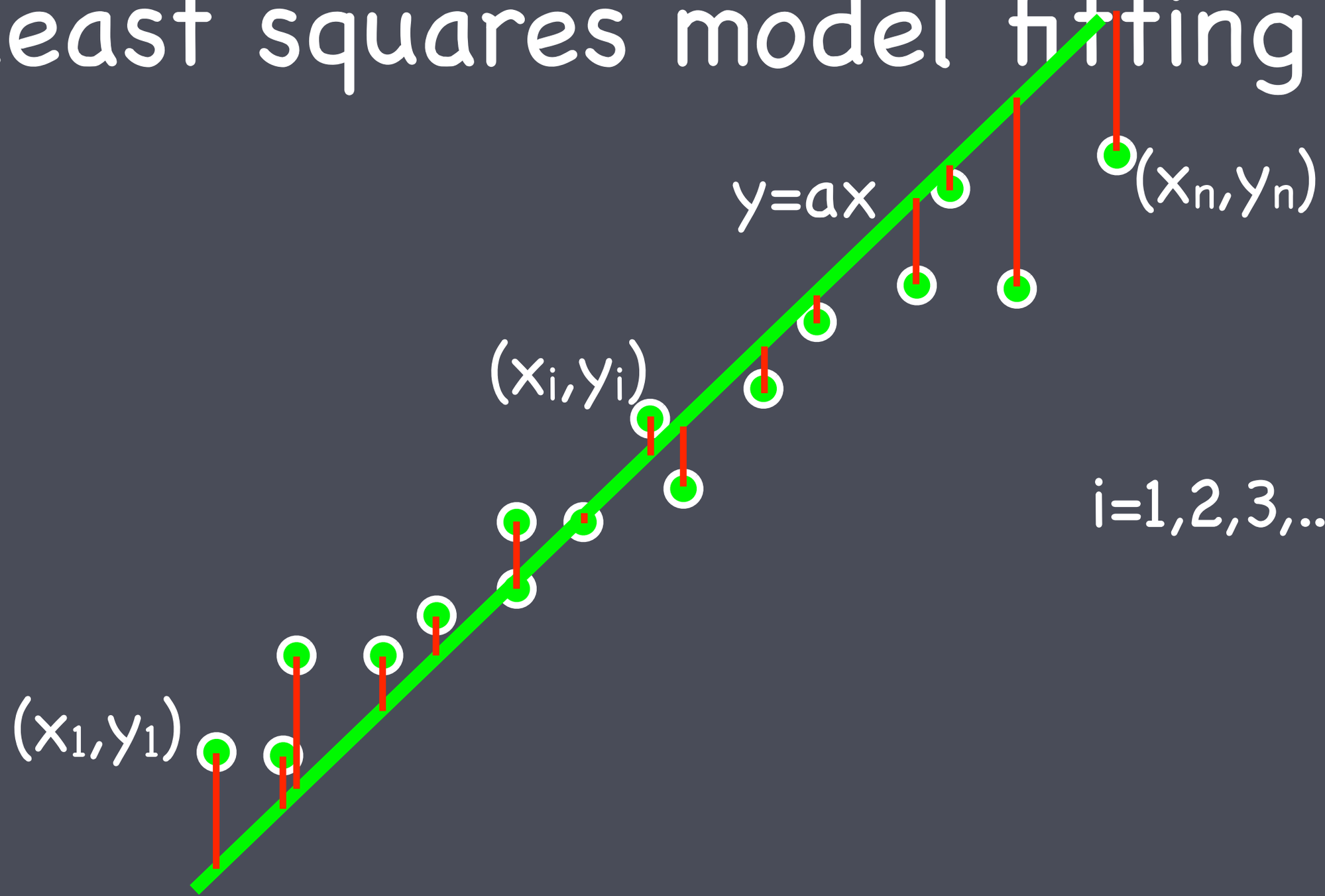


Least squares model fitting



$i=1,2,3,\ldots,n$

Least squares model fitting



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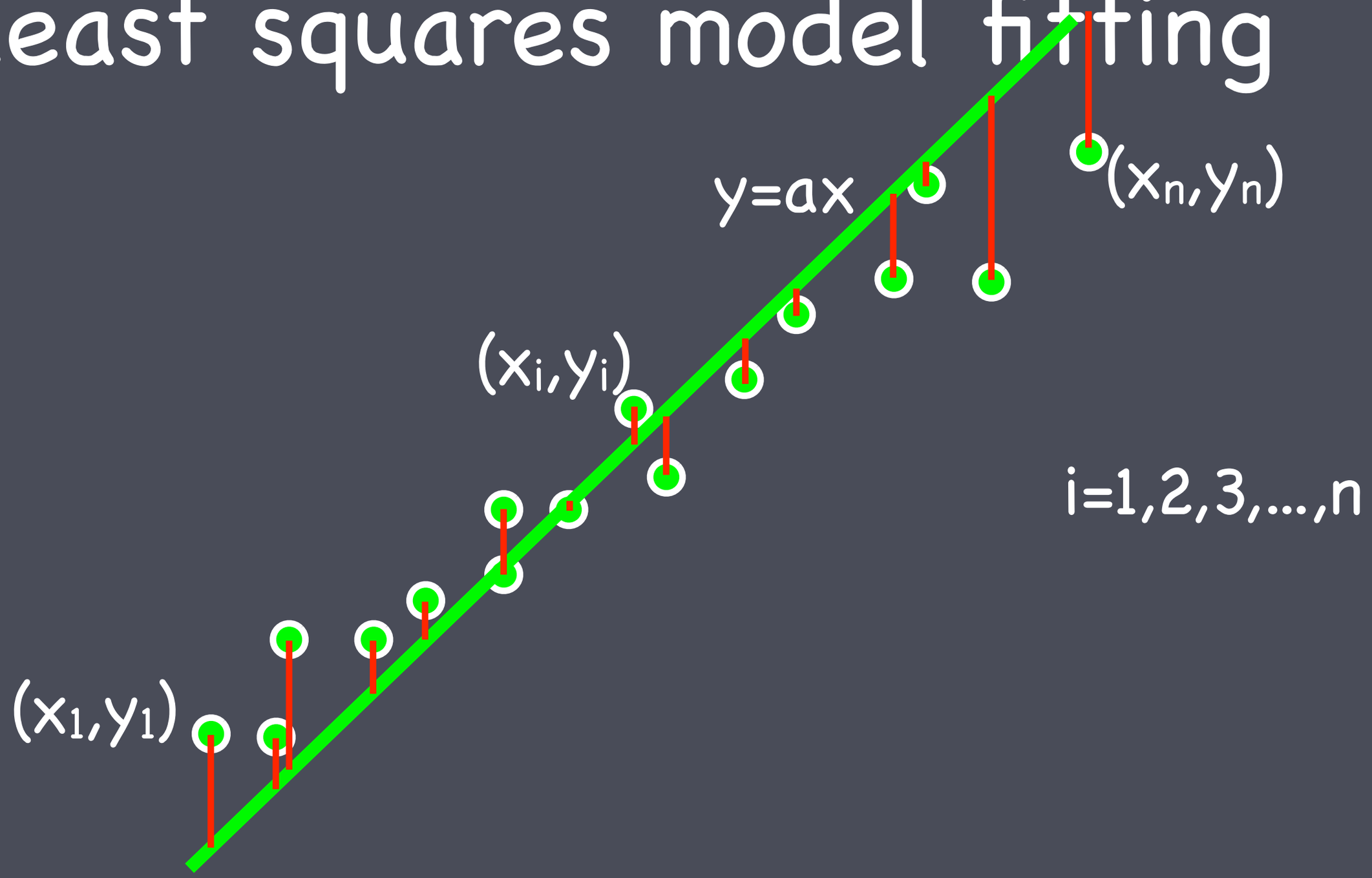
Least squares model fitting



Each red bar is called a residual. We want all the residuals to be as small as possible.

The residuals are...

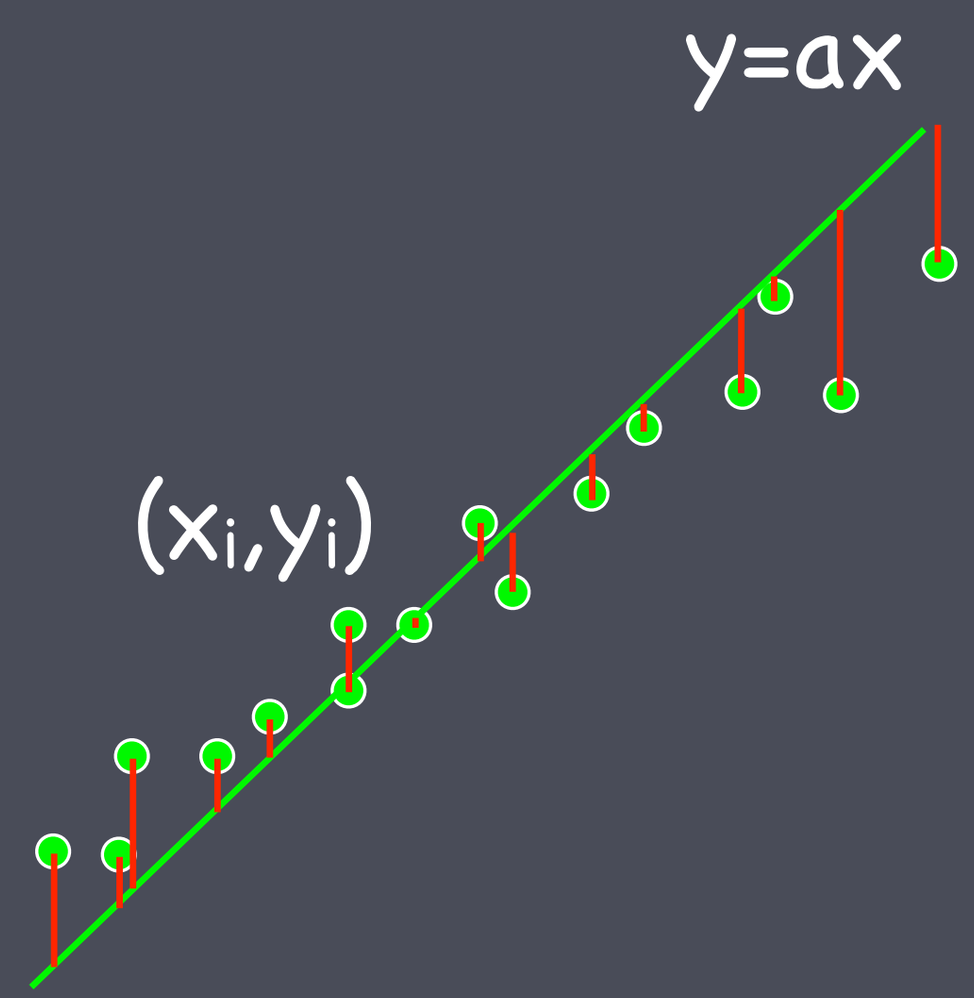
(A) $r_i = y_i^2 + x_i^2$

(B) $r_i = a^2 (y_i^2 + x_i^2)$

(C) $r_i = y_i - ax_i$

(D) $r_i = y_i - x_i$

(E) $r_i = x_i - y_i$



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