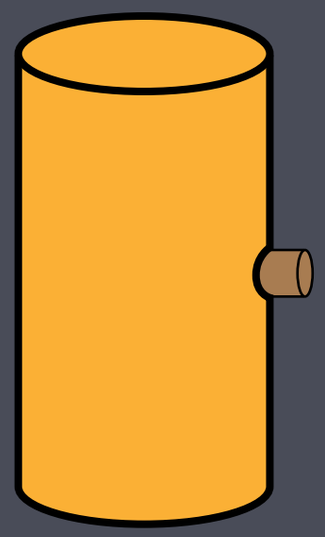
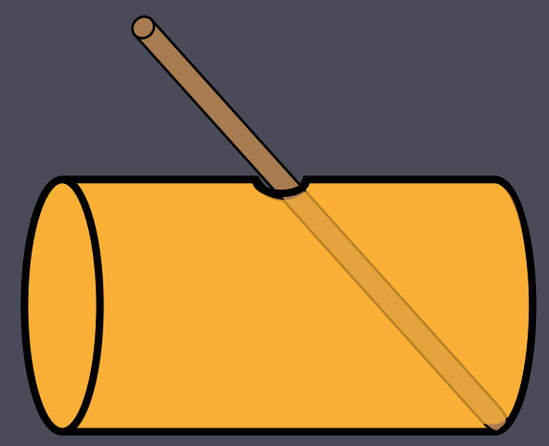
Today

- Office hours 12-2 pm today
- Quiz 2 - hopefully today
- Kepler's wedding.
- Optima foraging

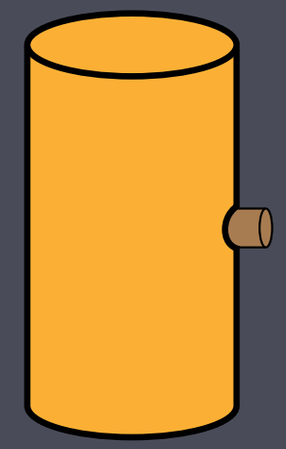
Wine for Kepler's wedding



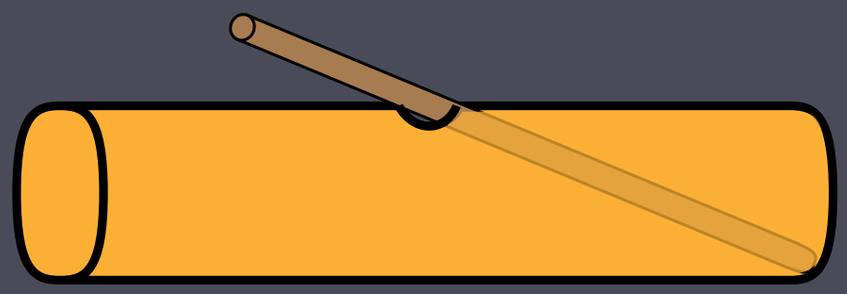


- Wine was sold by "the length of the submerged part of the rod"
- Same length of wet rod = same volume of wine?

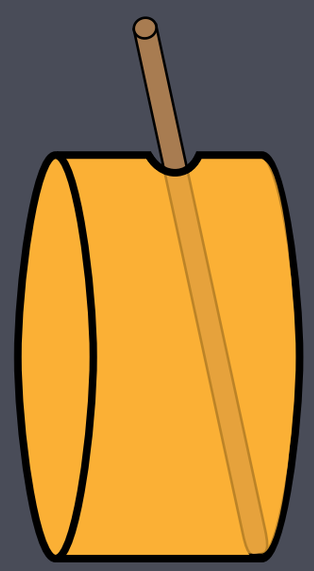
Which barrel would you buy?



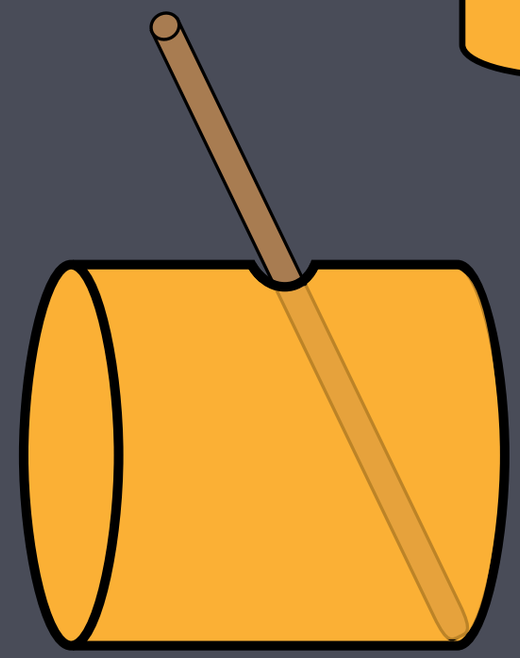
(A)



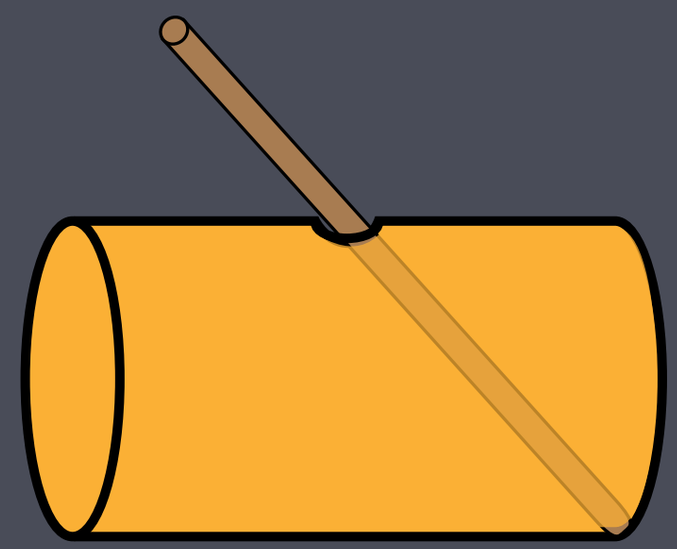
(B)



(C)



(D)



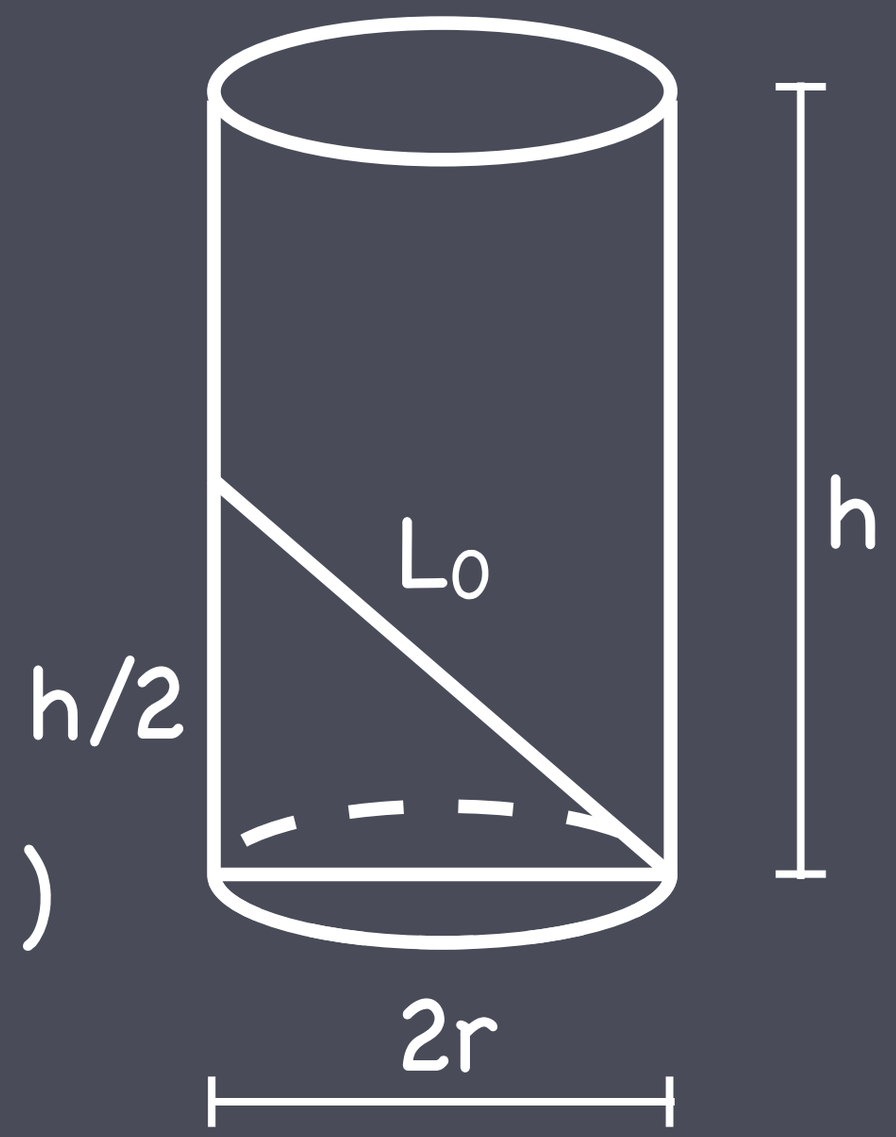
Objective function? (to be maximized)

(A) $V = 2\pi r h$

(B) $r^2 = L_0^2/4 - h^2/16$

(C) $V = \pi r^2 h$

(D) $L_0 = \mathrm{sqrt}(\ (2r)^2 + (h/2)^2\ )$



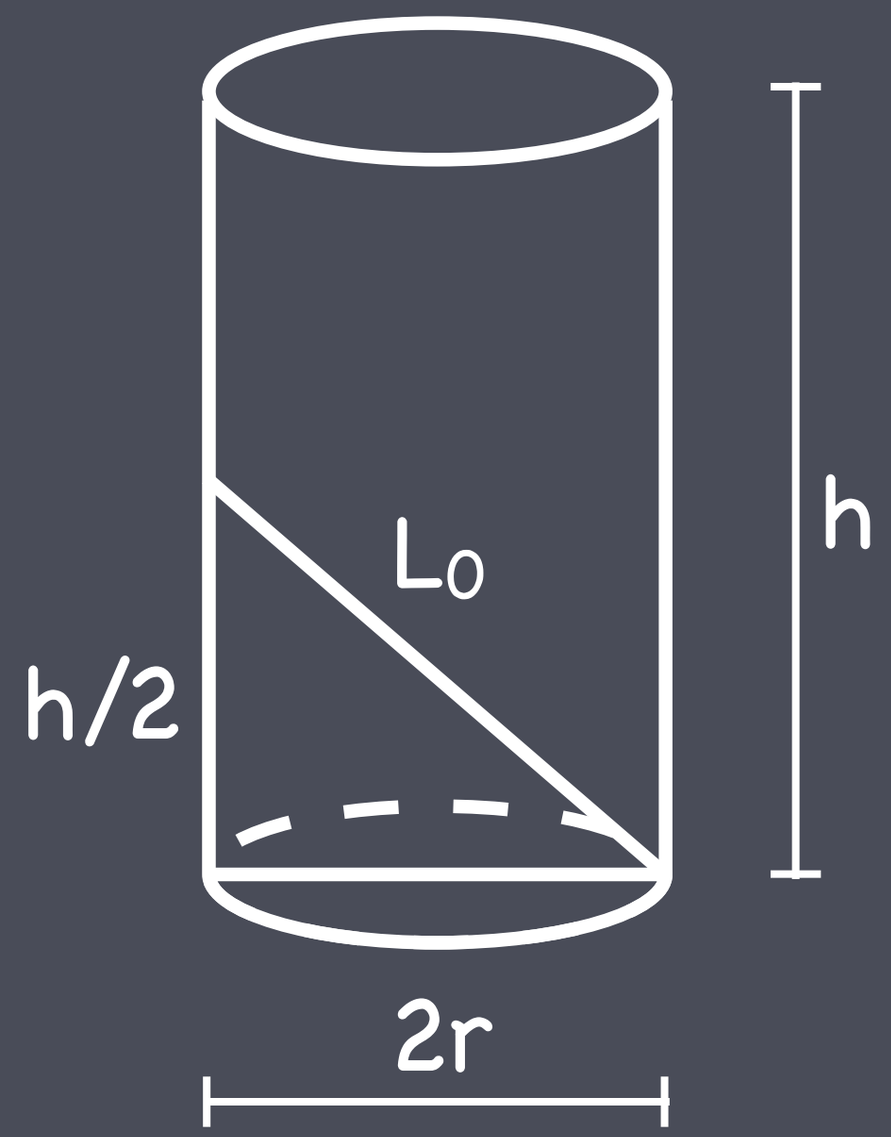
Constraint?
(used to simplify OF)

(A) $L_0^2 = (2r)^2 + (h/2)^2$

(B) $L_0^2 = (2r)^2 + h^2$

(C) $V = 2\pi rh$

(D) $L_0 = \tan(h/4r)$



Objective functions: $V = \pi r^2 h$.

Constraint: $L_0^2 = (2r)^2 + (h/2)^2$.

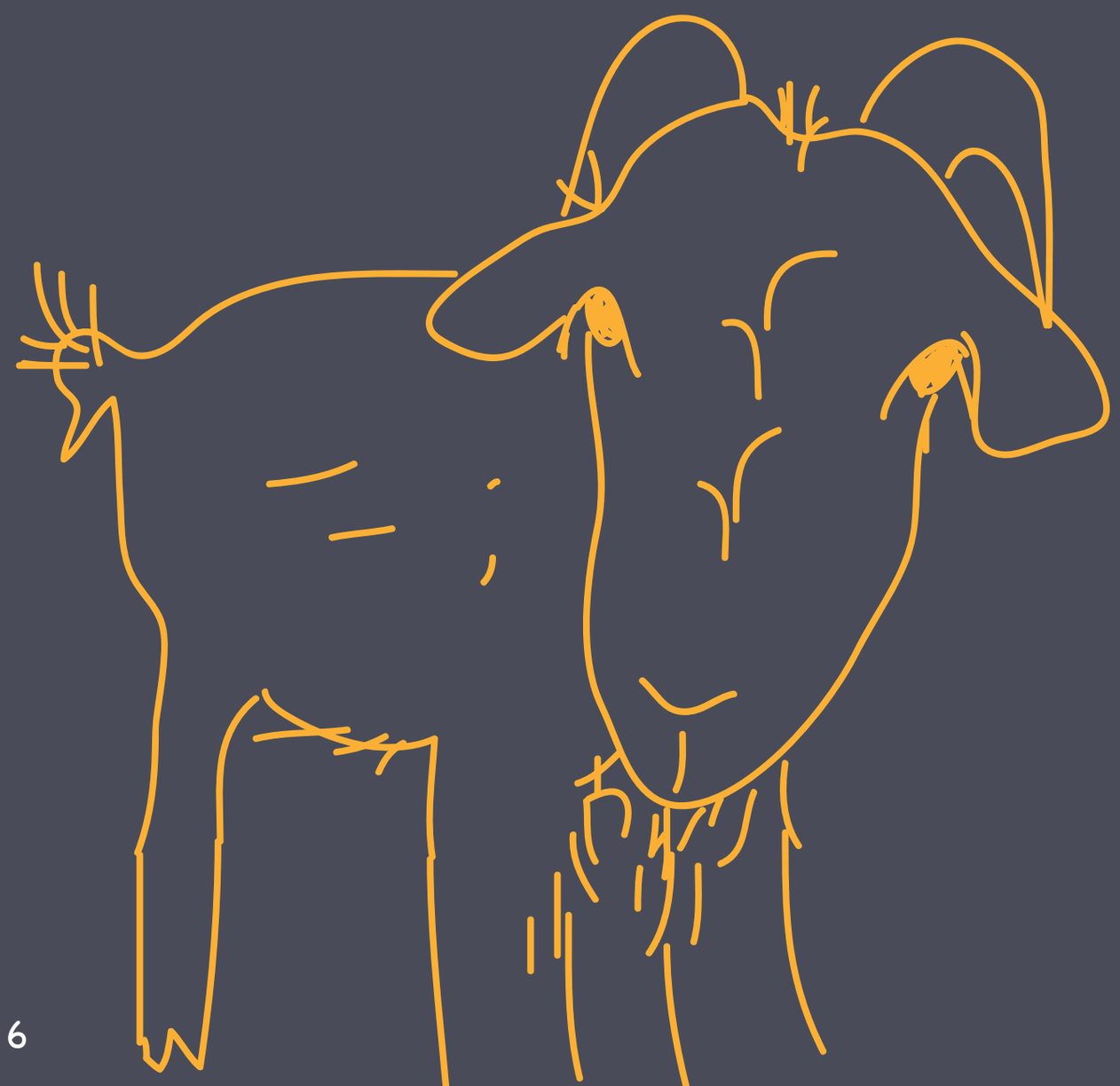
Solve for:

(A) r

(B) r^2

(C) h

(D) h^2



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Solve for:

(A) r

(B) r^2

(C) h

(D) h^2

$r^2 = (L_0^2 - h^2/4)\ /4$

Draw a few barrels ($h \approx 0$, $r \approx 0$)

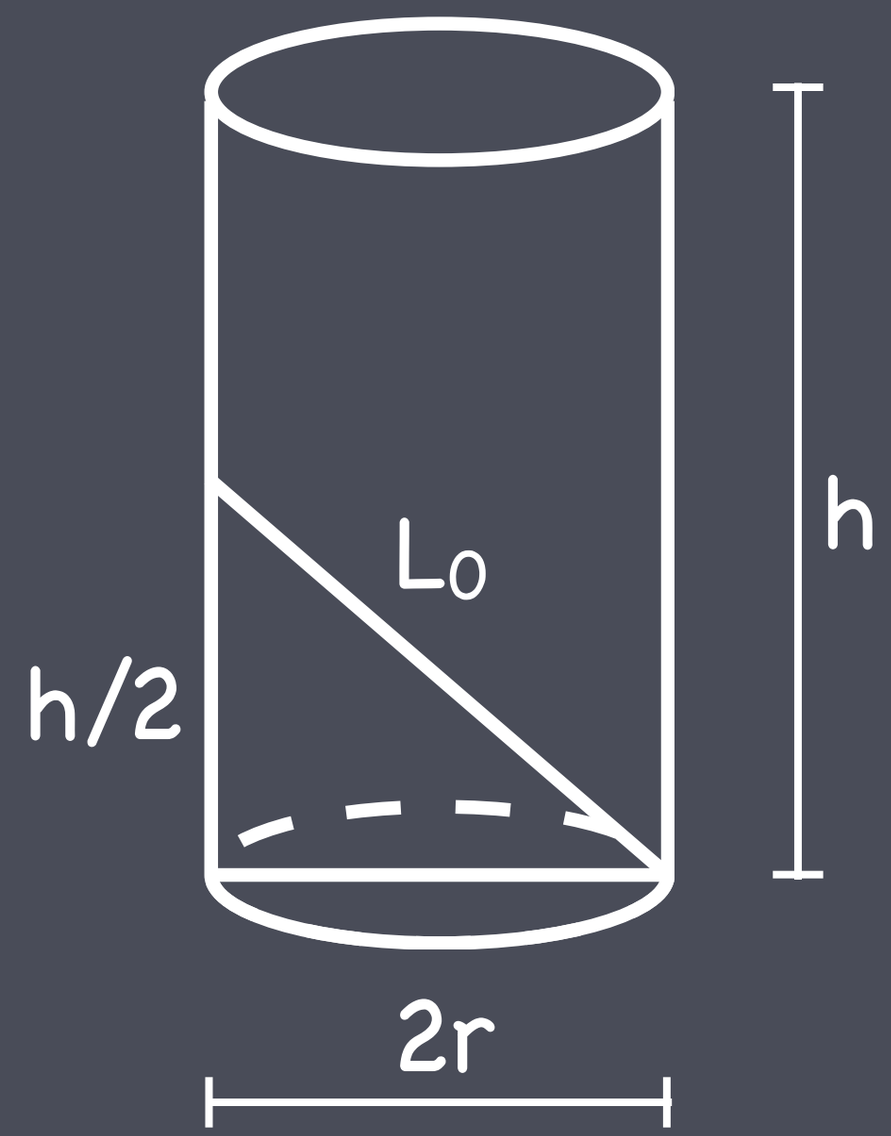
What is the model domain for V(h)?

(A) $h > 0$

(B) $0 < h < L_0$

(C) $0 < h < 2L_0$

(D) $0 < h < 2r$



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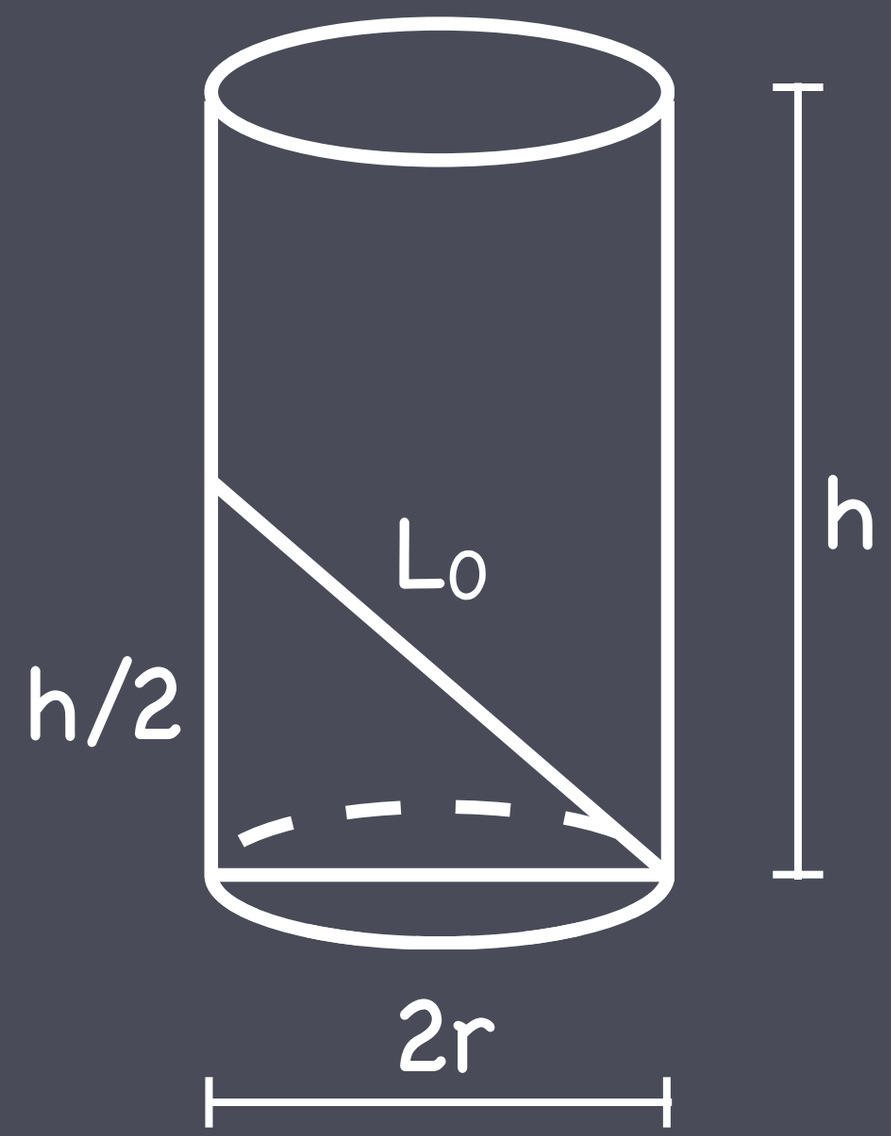


$V(h) = \pi h(4L_0^2 - h^2)/16$
What is the best h?

(A) $h = 0$

(B) $h = 2L_0$

(C) $h = \sqrt{3}\ L_0$

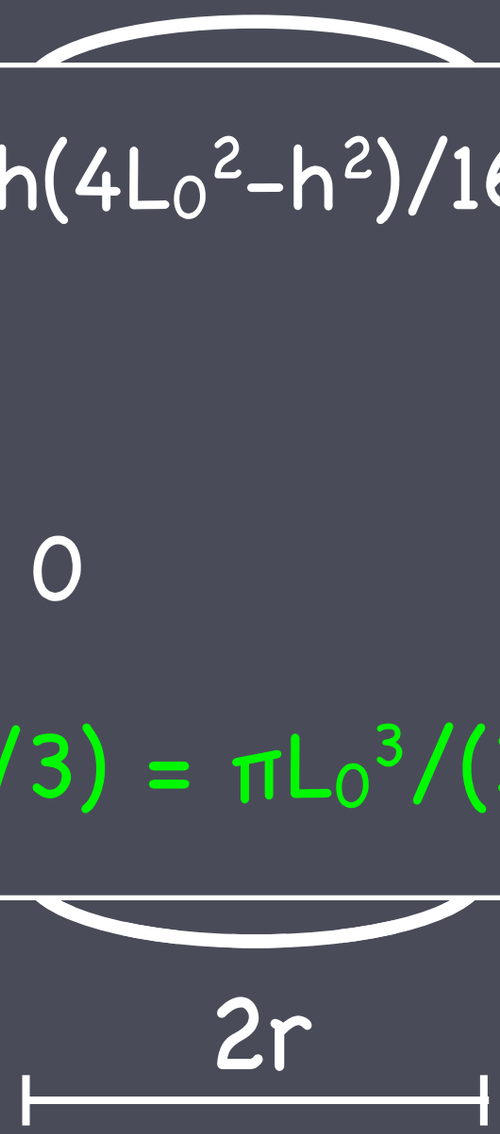
(D) $h = 2L_0/\sqrt{3}$

$V(h) = \pi h(4L_0^2 - h^2)/16$

$V(0) = 0$

$V(2L_0) = 0$

$V(2L_0/\sqrt{3}) = \pi L_0^3/(3\sqrt{3})$



http://www.matematicasvisuales.com/english/html/history/kepler/doliometry.html

Overall procedure

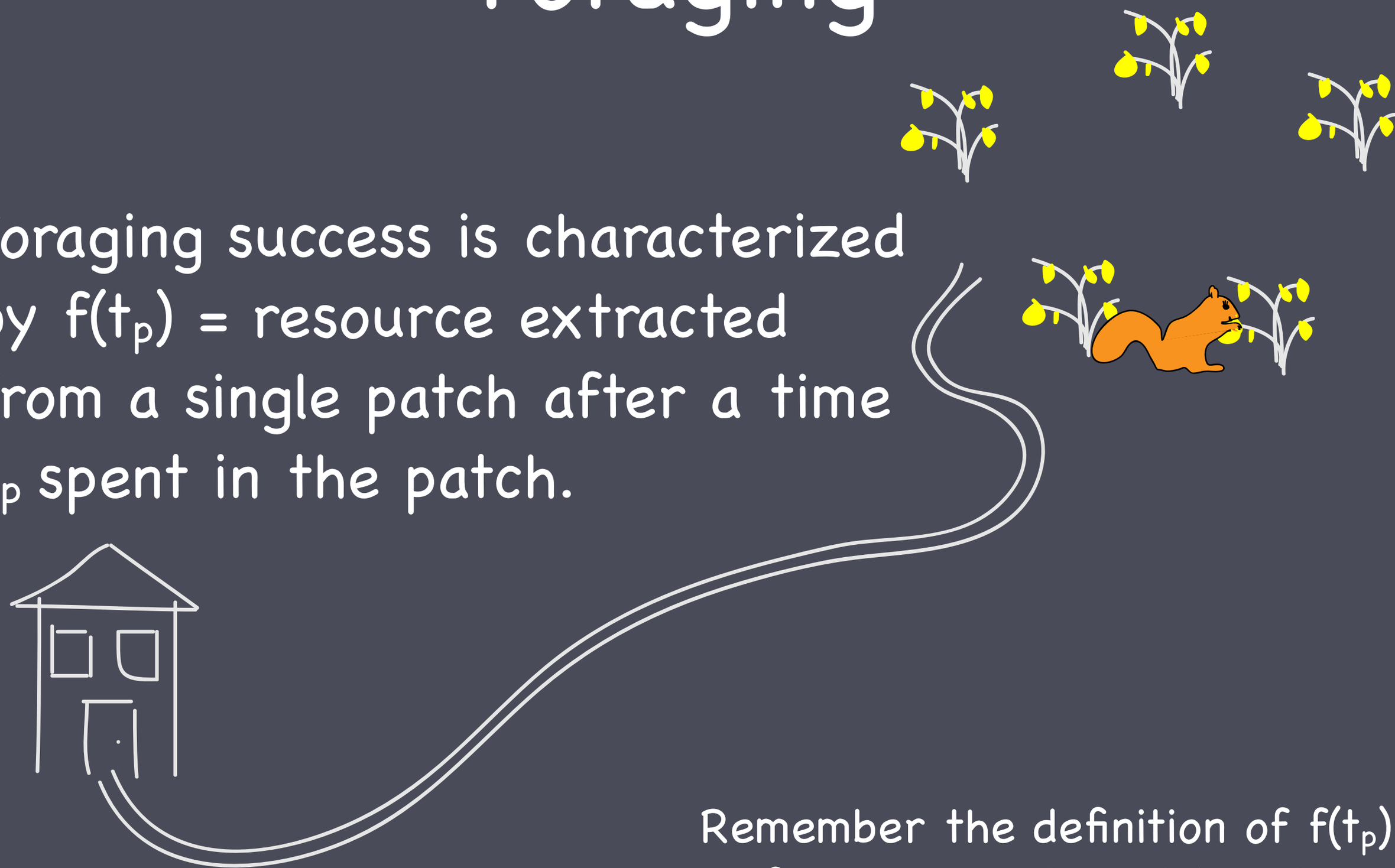
1. Draw some sketches, establish an expectation.
2. Determine the objective function.
3. Determine the constraint (if necessary).
4. More sketching, check/update expectation.
5. Use constraint --> one variable, make life easy.
6. Find end points and all crit pts.
7. Substitute them into the objective function.
8. Biggest value is the absolute extremum.

Foraging

Foraging time includes

- travel to a patch (t_0),
- foraging in a patch (t_p)

Foraging

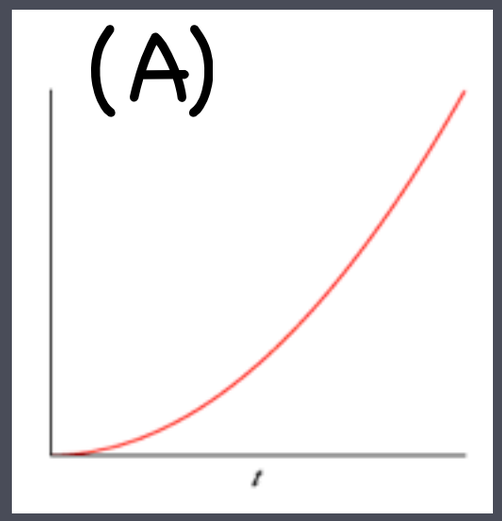


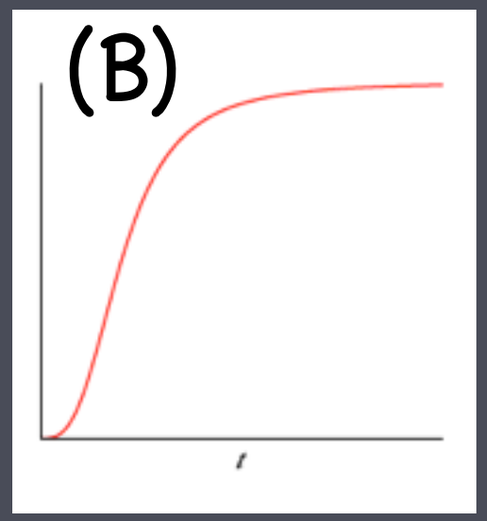
Foraging success is characterized by $f(t_p)$ = resource extracted from a single patch after a time t_p spent in the patch.

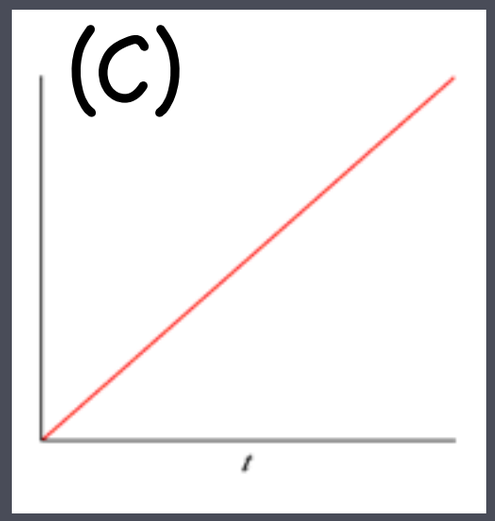
Remember the definition of $f(t_p)$ for an upcoming clicker Q.

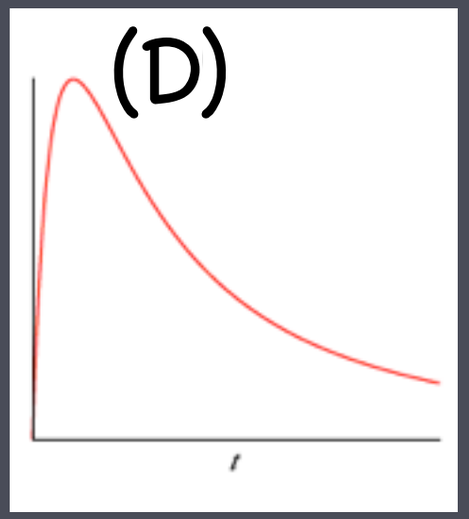
Which of the following graphs matches the given description of f(t)?

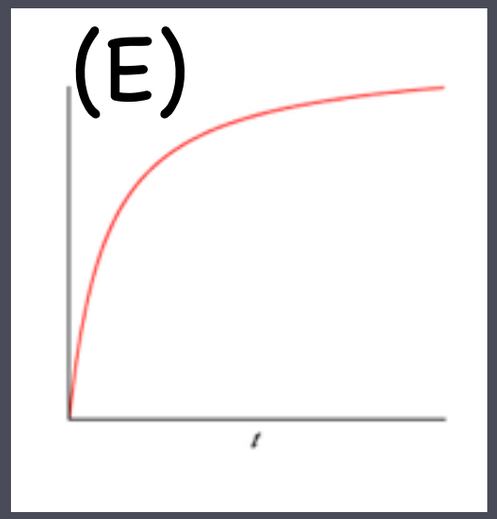
Collection goes well at first but gradually slows down as the resource is depleted.











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