Prelab

What is the basic difference between an open and closed-loop control system?
Open-loop control systems do not have any feedback and can only directly generate an output given certain inputs. Closed-loop systems on the other hand take a secondary input in the form of feedback from their output to self-regulate their output according to the desired input.

What does the acronym "PID" stand for?
Proportional Integral Derivative

When does proportional control lose effectiveness?
It becomes ineffective when the error multiplied by the gain only meets at most a baseline "no movement" speed, such as a quadcopter trying to reach a certain height. In this case, the error will shrink asymptotically but never quite reach 0, as, for example from the video, an error of 1 with a gain of 100 would give us the 100 rpm needed to only hover but not move.

In other words, if there is a "steady-state" error, then it loses effectiveness. Using an integrator can help resolve this issue.

PID controller as a whole also begin to lose effectiveness when an actuator being controlled reaches a saturation point and can no longer go any faster, or the supplied current is at a maximum. Real-life systems are not linear like the assumptions for a bare-bones PID controller makes.

Alternately, in a scenario given by the videos, "integral windup" can cause PID control to lose effectiveness if something being controlled is held back. This causes the integral to potentially count up far higher than normally expected or possible, which leads to unintended behavior. "Clamping" the integrator—that is, turning it off past a threshold, is one option to prevent this.

Did you watch the intro videos?
Yes