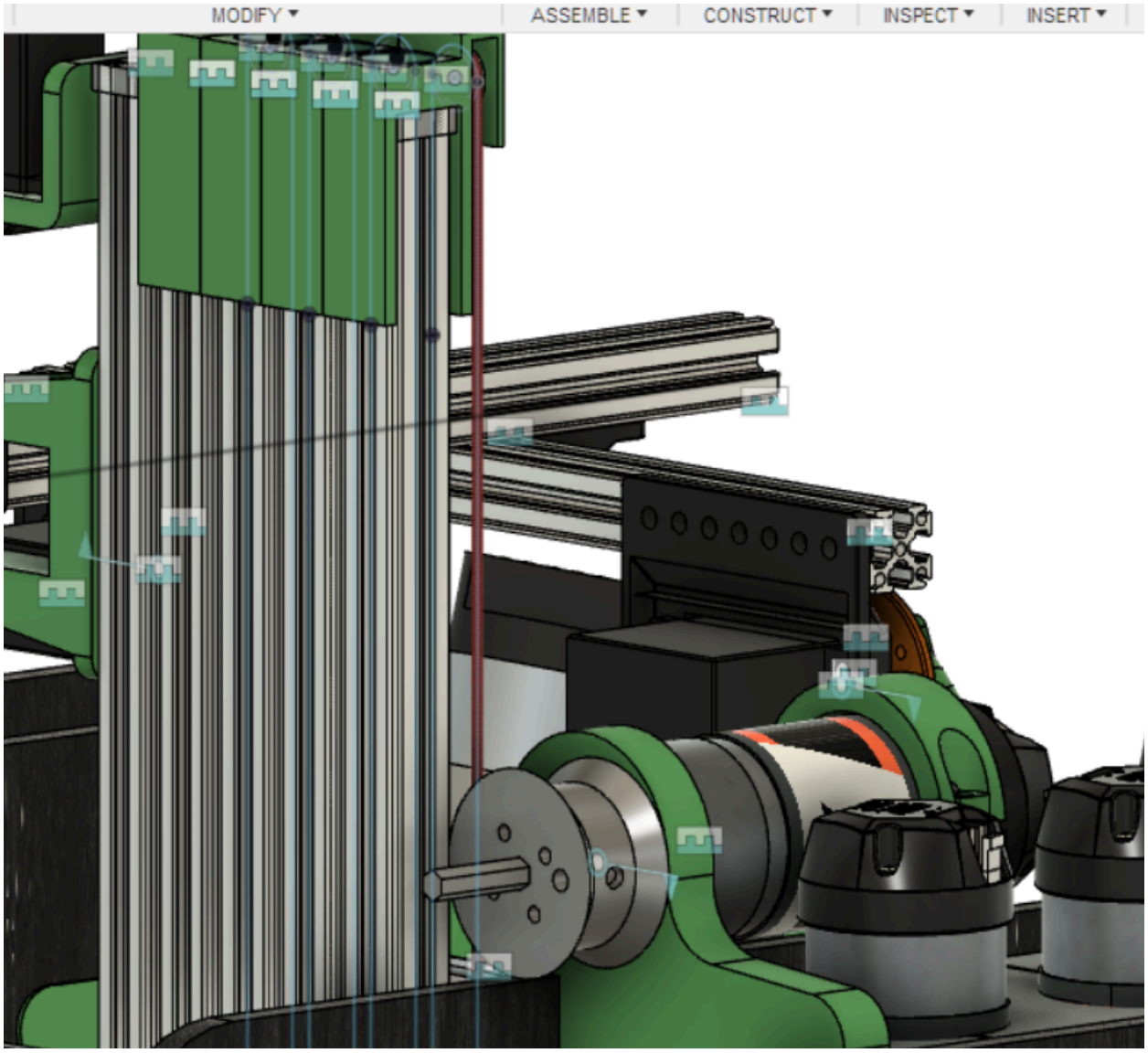
(Story time begins) On last year's bot, we used a spool to pull a string so our linear lift went up, Let's take a closer look at that system. The system needs 130N of force to lift the slides, and the pulley has a diameter of 30mm.



(Story time ends)

1. **What is the torque needed to spin the pulley?**

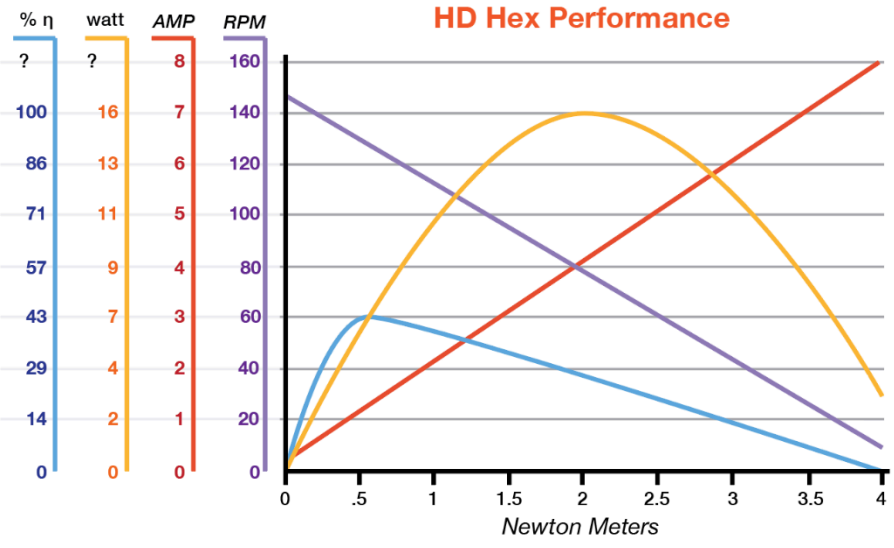
(Story time begins) Now that you have the torque, we need to choose a motor. Here are our choices:

	Stall Torque	Free Speed	Operating Voltage	Stall Current	Maximum Output Power
HD Hex, No Gearbox REV-41-1301	0.105 N·m 14.8 oz·in	628.3 rad/s 6000 RPM	12 V	8.5 Amps	15 Watts
HD Hex, 40:1 Spur REV-41-1301	4.2 N·m 594.7 oz·in	15.7 rad/s 150 RPM	12 V	8.5 Amps	15 Watts
HD Hex, 20:1 Spur REV-41-1301	2.1 N·m 297.4 oz·in	31.4 rad/s 300 RPM	12 V	8.5 Amps	15 Watts
HD Hex, 20:1 Planetary REV-41-1301	2.1 N·m 297.4 oz·in	31.4 rad/s 300 RPM	12 V	8.5 Amps	15 Watts
Core Hex, 72:1 REV-41-1300	3.2 N·m 453 oz·in	13 rad/s 125 RPM	12 V	4.4 Amps	8 Watts

(Story time ends)

2. **At what percentage of the stall torque is the motor outputting the most power?,**
3. **Which motor should we choose? Assume the motor will be directly attached to the pulley with no additional gears. (Hint: you need #1 and #2 for this)**

(Story time begins) This is great! We now have our motor, and we can build our system. However, we notice something is slightly off...



"% η" means "percent efficency"

(Story time ends)

4. **Due to some calculation errors, our actual load is 50N. What speed is the string being pulled at? Give your answer in mm/s**
5. **How long does it take this pulley to pull 140mm of string?**
6. **What pulley diameter should we have so the motor outputs the most power?**
7. **How long will it take for this new pulley to pull 140mm of string?**