

# Max/Min Tension Investigation

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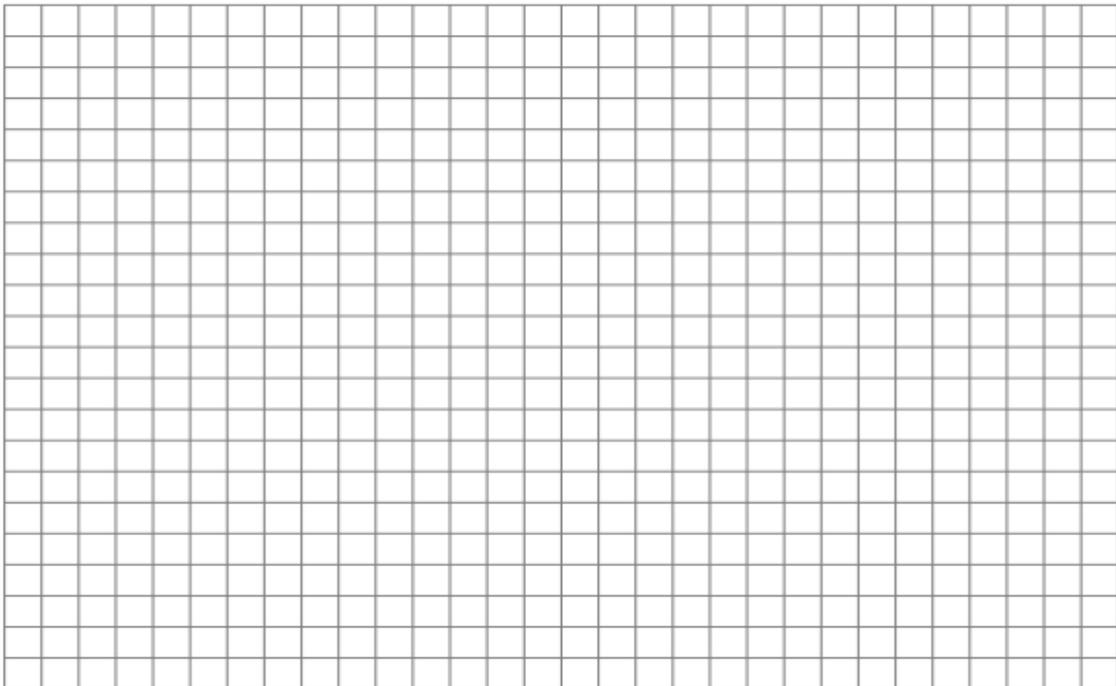
Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Purpose:** investigate, using a force sensor and related software, the maximum and minimum tensions in a string while vertically rotating a mass at a “constant” speed.

**Procedure:**

- Attach approximately 80 cm of string to a 100g mass, then attach this to a “Dual-Range Force Sensor.
- Turn on and plug in the sensor to the Vernier Lab Quest handheld device.
- Do a practice run of rotating the mass in a vertical circle at a constant speed.
- When ready begin rotating the mass and once uniform circular motion is achieved press the “record” button on the screen. Your data will be collected for 10 seconds.
- Sketch the graph (or if you have access to a printer, print the data) in the observation chart.
- Go to the analysis section to analysis the data.

**Observations:**



**Analysis:**

1. On the graph you sketched (or printed) draw an arrow to the tensions indicated the top and bottom of the swing. Measure the radius of rotation (length of string): \_\_\_\_\_

- Use the stylus to touch and record on the graph you made the tensions at the min and max positions as well as the time at these locations.
- Using the data you recorded on the graph calculate the average maximum and average minimum tensions.

Average **Minimum** Tension: \_\_\_\_\_ Average **Maximum** Tension: \_\_\_\_\_

- Calculate the frequency of rotation by counting the number of full cycles that you collected and then finding the time interval (last value – first value).

Average frequency: \_\_\_\_\_

- Calculate the theoretical min and max tensions. Draw the FBD at the top and bottom of the rotation and using the radius and mass values from your investigation as well as the average frequency calculate the theoretical min and max tensions.



**Minimum** Tension: \_\_\_\_\_ **Maximum** Tension: \_\_\_\_\_

- Compare the theoretical values to the experimental values. Were they close? Compare your results with others. What do you notice? How can you account for the differences?