Rotational Kinematics: Using an Atwood's Machine

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Data Set 1 – Data and Analysis

Record the function $\theta(t)$ for the first data set.

Given the polynomial fit for θ_1, derive the equation for angular velocity ω_1 as a function of time by differentiating your angle as a function of time function.

Upload an Excel file with your data and graphs for data set 1. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

Record the values for t_1 and t_2, the start and stop time of the data sample being analyzed.

Record the value for z, the time between successive data samples, for later use.

Table 1

Time (s)	**Intercept (rad/s) (from fit at $n = 0$)**	**ω_1(n) (rad/s) (from derivative of function)**	**Difference (rad/s)**

Do your results for calculating ω_1 by derivation and by the limit processes agree?

Data Set 2 – Data and Analysis

Record the function $\theta(t)$ for the second data set.

Given the polynomial fit for θ_2, derive the equation for angular velocity ω_2 as a function of time by differentiating your angle as a function of time function once again.

Upload an Excel file with your data and graphs for data set 2. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

Record the values for t_1 and t_2, the start and stop time of the data sample being analyzed.

Record the value for z, the time between successive data samples, for later use.

Table 2

Time (s)	**Intercept (rad/s)**	**ω_2(n) (rad/s)**	**Difference (rad/s)**

Do your results for calculating ω_2 by derivation and by the limit processes agree?

Checking the Acceleration

Record the radius of the disk.

Data Set 1

Using the polynomial fit, find the angular acceleration.

Record the mass of the weight.

Record the time the weight travels.

Record the distance the weight travels.

Calculate the acceleration, a_{1a}, using the three previous values as needed.

Calculate $a_{1b} = \alpha R$.

Do your results agree with this prediction within your experimental errors?

Data Set 2

Using the polynomial fit, find the angular acceleration.

Record the mass of the weight.

Record the time the weight travels.

Record the distance the weight travels.

Calculate the acceleration, $a_{2\mathrm{a}}$, using the three previous values as needed.

Calculate $a_{2\mathrm{b}} = \alpha R$.

Do your results agree with this prediction within your experimental errors?