1. Radial versus Tangential Acceleration
Consider two rotating wheels. A point on the first wheel has an angular position given by \( \theta_1 = 5.0 - 4.0 \, t^2 \). A point on the second wheel has an angular position given by \( \theta_2 = 5.0 + 2.0 \, t^3 \). How do the accelerations change with time?
(a) The magnitude of the tangential acceleration for the first wheel is
Insufficient Information  Constant  Variable
Circle the correct answer and EXPLAIN your choice.

(b) The magnitude of the radial acceleration for the first wheel is
Insufficient Information  Constant  Variable
Circle the correct answer and EXPLAIN your choice.

(c) The magnitude of the tangential acceleration for the second wheel is
Insufficient Information  Constant  Variable
Circle the correct answer and EXPLAIN your choice.

(d) The magnitude of the radial acceleration for the second wheel is
Insufficient Information  Constant  Variable
Circle the correct answer and EXPLAIN your choice.

(e) For which of the cases above would your answer be different if the question did not say “magnitude”? Explain why.
2. This problem is called a “Jeopardy problem” because you must supply the question! I have given you the answer(s) below, you need to come up with a question that these parts are the answer to. I have a specific question in mind, but there may be more than one situation which this answer applies to. All parts apply to the same physical set-up, but if you can’t figure out one set-up that applies to all, do the parts separately.

- Begin by writing the equation in symbols for each numerical calculation I have given
- If you can identify the physics principle involved, say what it is
- Now describe what the physical set-up must look like

\[
(a) \quad I_x = \frac{1}{12} (0.050 \text{ kg})(1.00 \text{ m})^2 + (0.050 \text{ kg})(\frac{1.00 \text{ m}}{2})^2
\]
\[
= 1.67 \times 10^{-2} \text{ kg m}^2
\]
\[
I_z = \frac{2}{3}(0.070 \text{ kg})(0.050 \text{ m})^2 + (0.070 \text{ kg})(1.00 \text{ m})^2
\]
\[
= 7.01 \times 10^{-2} \text{ kg m}^2
\]
\[
I_{tot} = I_x + I_z = 8.67 \times 10^{-2} \text{ kg m}^2
\]

\[
(b) \quad x = \frac{1}{0.050 \text{ kg} + 0.070 \text{ kg}} \left[ (0.050 \text{ kg})(1.00 \text{ m}) + (0.070 \text{ kg})(1.00 \text{ m}) \right]
\]
\[
= 0.792 \text{ m}
\]

\[
(c) \quad (0.050 + 0.070 \text{ kg})(9.8 \frac{\text{ m}}{\text{s}^2})(0.792 \text{ m})
\]
\[
= 0 + \frac{1}{2} (8.67 \times 10^{-2} \text{ kg m}^2) \omega^2
\]
\[
\omega^2 = \frac{(0.931 \frac{\text{ kg m}^2}{\text{s}^2})^2}{8.67 \times 10^{-2} \text{ kg m}^2} = 21.5 \text{ s}^{-2}
\]
\[
\omega = 4.63 \text{ s}^{-1}
\]