

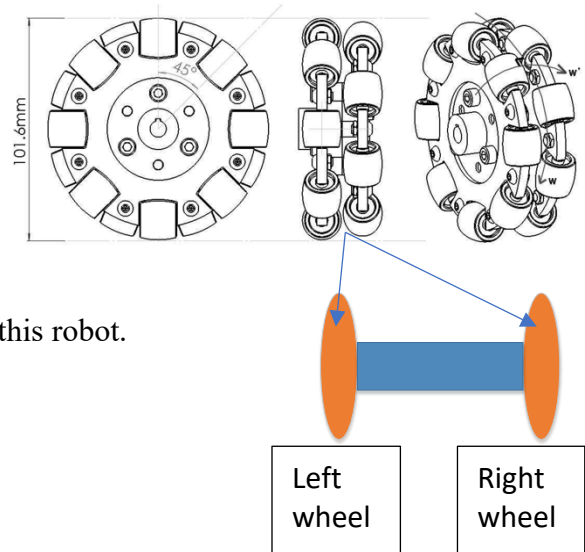
COMP417, Fall 2019 Quiz 1

First Name:

Last Name:

Student #:

Q1: This is an omni-directional wheel, that can achieve velocity in the typical x-direction  $v^x$ , by rotating the full wheel. It can have independent velocity in the perpendicular y-direction  $v^y$ , by rotating the smaller wheels. Consider a differential drive robot that uses these for both of its 2 wheels:



a) Write down a suitable state-space to describe this robot.

b) Is this robot holonomic or non-holonomic?

c) In pseudo-code or pseudo-math, complete the Inverse Kinematics assuming the current state of the robot is at the origin (all elements zero). Make sure to complete the underlined return value. Wherever you need a constant, write a sensible name:

\_\_\_\_\_ = InverseKinematics(goal\_state ){

}

Q2: Consider an actuated pendulum with maximum torque  $\frac{1}{2}mgl$  and recall that gravity applies a torque of  $mgl\sin(\theta)$ .

a) Is this pendulum controllable?

b) Is this pendulum fully actuated?

