CONNECTED WHEELS: BICYCLES (STATIC)

● Bicycle problems are a bit more complicated than static pulleys/gears, because there are more parts (5 in total)**:**

- The pedals **(1)** cause the middle sprocket **(2)** to spin →
- The chain connects both sprockets →
- The back sprocket **(3)** is connected to the back wheel **(4)** →
- If the bike is NOT free to move **(**wheels don't touch ground**),** the front wheel **(5)** doesn't move or spin **($v_5 = w_5 = 0$).**

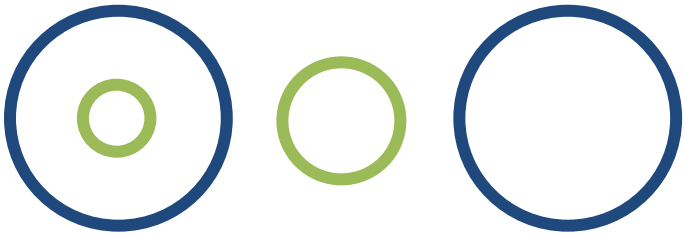
EXAMPLE 1**:** You turn your bicycle upside down for maintenance. The middle and back sprockets have diameters 16 cm and 10 cm, respectively. You spin the pedals at 8 rad/s. Calculate the resulting angular velocity for the**:**

(a) middle sprocket
(b) back sprocket
(c) back wheel
(d) front wheel

EXAMPLE 2**:** You lift your bicycle slightly and begin to spin its back wheel. The middle and back sprockets have diameters 2D and D, respectively. If you spin the back wheel at X RPM, at how many RPM (in terms of X), will the pedals spin**?**

CONNECTED GEARS: MOVING BICYCLES

- Remember: If the bike doesn't move when the wheels spin (FIXED Axis) → $v_{,front} = w_{,front} = \_\_\_\_.$
  - If the bike **IS** moving (FREE Axis: **w** AND **v**), you also have that → $v_{,CM,front} = v_{,CM,back} = v_{,BIKE}$
    - Remember: For Free Axis, we have →
    - For most bicycles $R_{,front} = R_{,back}$ →



EXAMPLE 1: The wheels on your bike have radius of 66 cm. If you ride with 15 m/s, calculate the: **(a)** linear speeds at the center of mass of both wheels; and **(b)** the angular speeds of both wheels.

EXAMPLE 2: The wheels on your bike have radius 70 cm. The middle and back sprockets on your bike have radii 15 cm and 8 cm, respectively. If you ride with 20 m/s, calculate the angular speed of the:

(a) front wheel
(b) back wheel
(c) back sprocket
(d) middle sprocket