

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 ($\mathbf{v_5 = w_5 = 0}$).



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) $\rightarrow \mathbf{v_{front} = w_{front} = \underline{\hspace{1cm}}}$.
- If the bike **IS** moving (FREE Axis: $\mathbf{w}$ AND $\mathbf{v}$), you also have that $\rightarrow \mathbf{v_{CM,front} = v_{CM,back} = v_{BIKE}}$
- Remember: For Free Axis, we have $\rightarrow$
- For most bicycles $\mathbf{R_{front} = R_{back}}$ $\rightarrow$



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