SUMO CARS

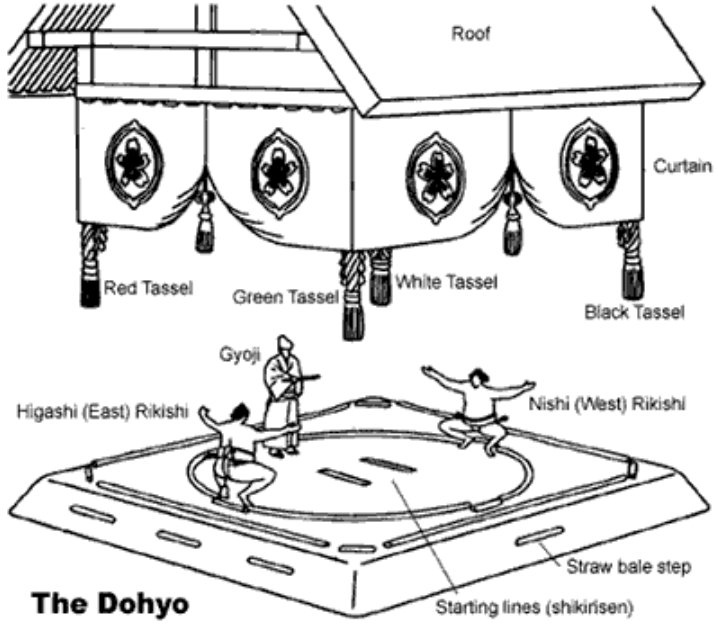
BBHHS Tech Ed

Mr. Goubeaux

Sumo Wrestling

Sumo Wrestling

- Very few rules.
- Push other person out of the ring.
- Must start at one of the two lines in the center of the ring.
- Must stay in the ring at all times.



What you will be doing

- http://www.history.com/shows/top-gear/videos/car-sumo-wrestling

Many different options

- Offense vs defense
- Speed vs strength
- Large vs small
- Heavy vs lite

Horsepower vs Torque

- Sports Car have horsepower - sprinter
- Big Trucks have torque - bodybuilder

- Torque: Ability so start motion
- Horsepower: Ability to maintain motion

Horsepower vs Torque

- “You know, a lot of people buy horsepower, when what they really want is torque,” Hubbard told me. “Torque is what gets you to the speed you want quickly; horsepower is what keeps you there.”

- The concept of horsepower as a measurement of work was identified in the 1800s by steam engine pioneer James Watt, who ponied up the term based on his observation of horses working in a mill. It’s an arcane concept that has stuck with us to this day.

- Torque, on the other hand, is the twisting, rotational force generated by an engine; this force is transferred through the drive system into the wheels. Torque is what pushes you back in the seat when you step on the accelerator.

- An engine might have plenty of horsepower, but hardly any torque. Think of a ship’s engine: it has the strength to move thousands of tons of steel, but it takes a loooong time to get up to speed. In other words, very little torque. By contrast, a vehicle can have so much torque that its tires are unable to get a grip, and simply spin. Pointless.

Gears – What are they?

- Gears are wheels with teeth. Gears mesh together and make things turn. Gears are used to transfer motion or power from one moving part to another.
- https://www.youtube.com/watch?v=D_i3PJIYtuY

Gears – The Purpose

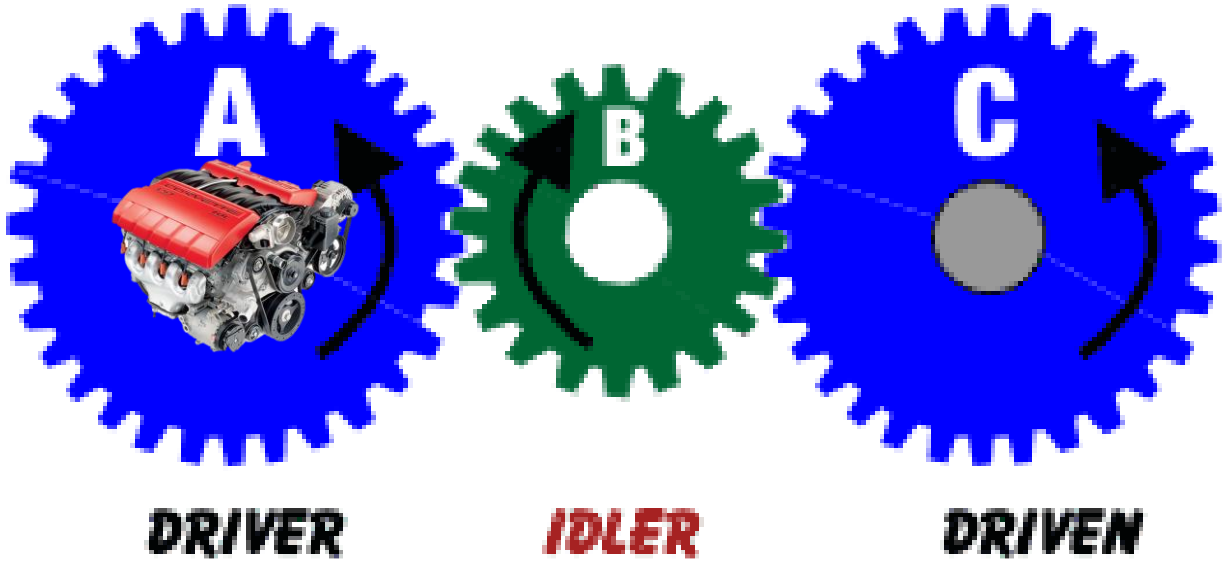
- To reverse the direction of rotation
- To increase or decrease the speed of rotation
- To increase or decrease the amount of work that can be done

Gears – The Purpose

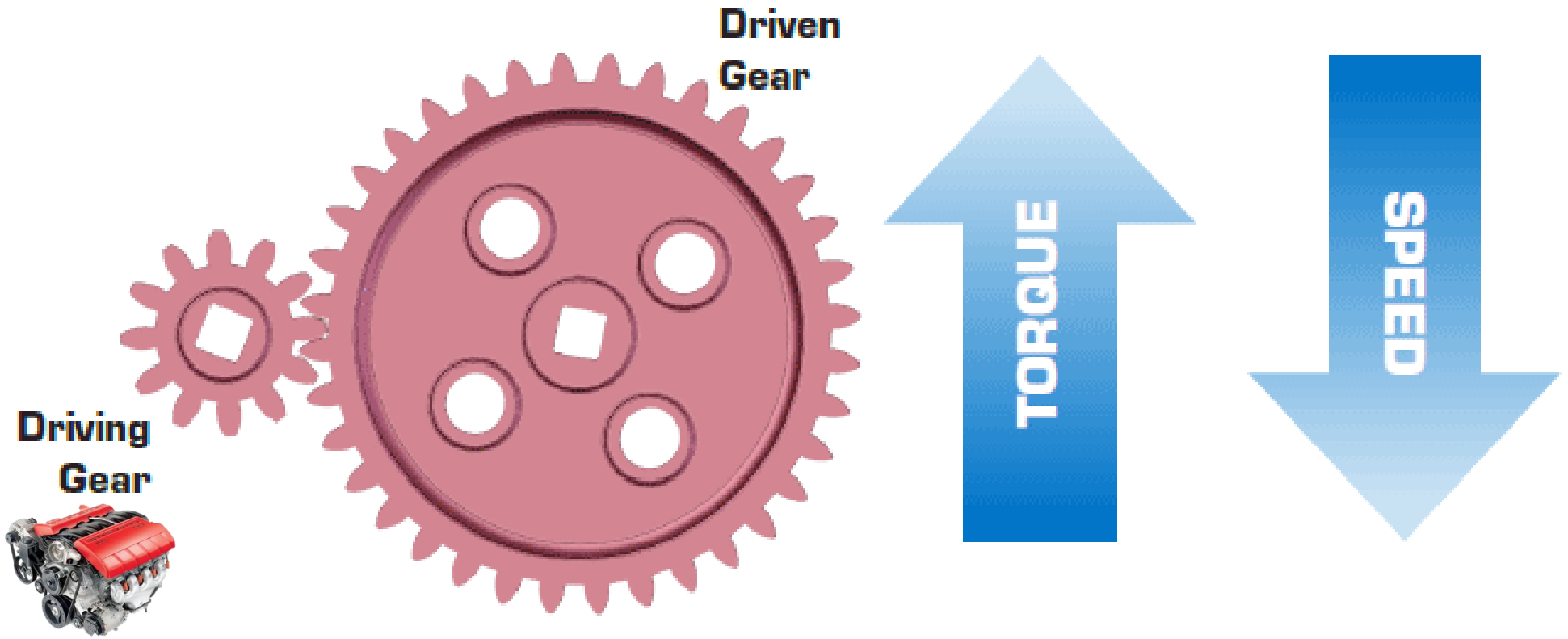
- Sports cars go fast (have speed) but cannot pull any weight. Big trucks can pull heavy loads (have power), but cannot go fast. Gears cause this.
- Gears increase or decrease the power or speed, but you cannot generally speaking.

Gear Train

- Driver – Gear connected to motor
- Idler – Gear used to change direction of rotation
- Driven – Gear connected to output



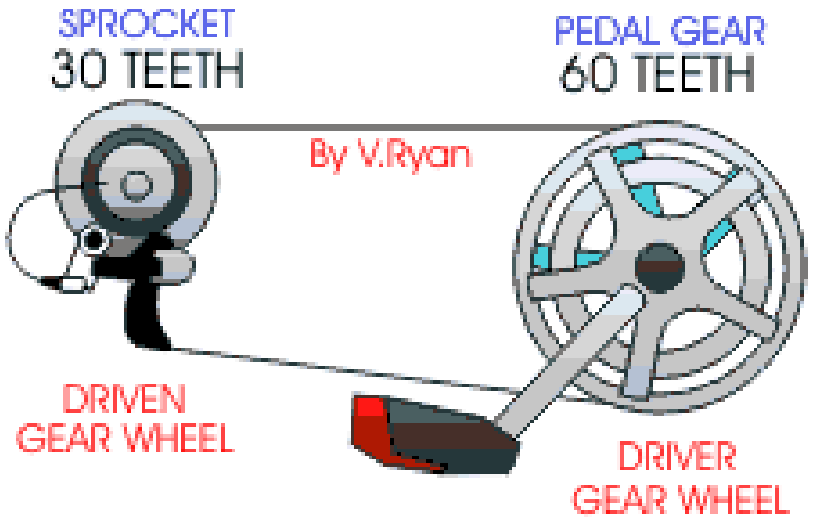
Gearing for Horsepower vs Torque



Gear Ratio(Velocity Ratio)

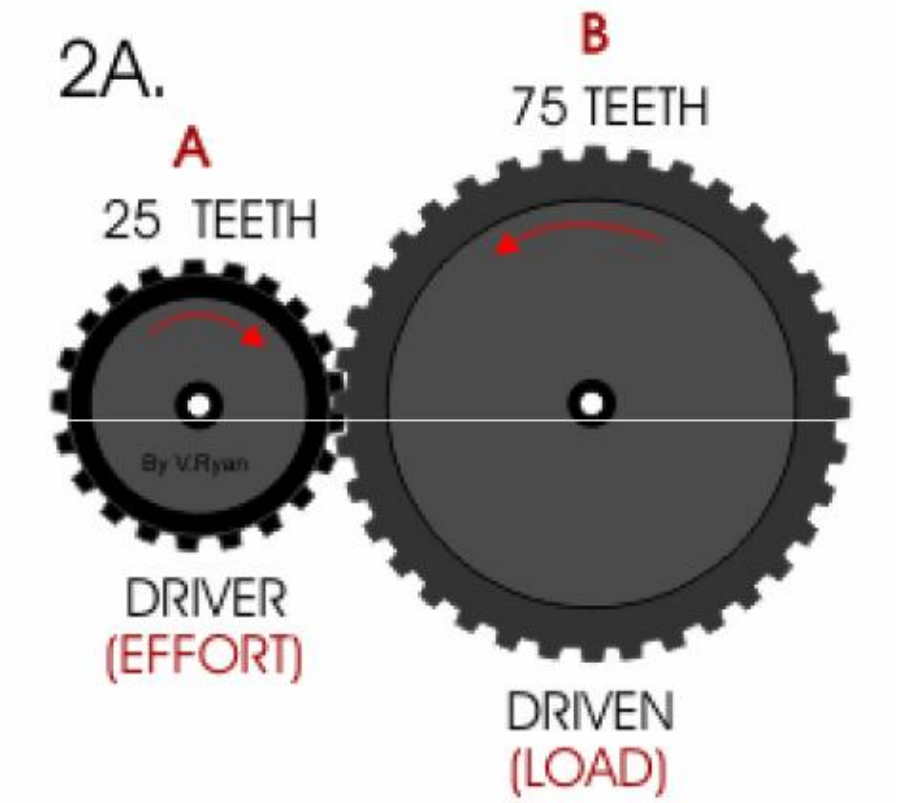
But WHAT does this mean? It means that the DRIVEN gear makes TWO rotations for every ONE rotation of the Driving Gear.

- The reason bicycles are easier to cycle up a hill when the gears are changed is due to what is called Gear Ratio (velocity ratio). Gear ratio can be worked out in the form of numbers and examples are shown. Basically, the ratio is determined by the number of teeth on each gear wheel, the chain is ignored and does not enter the equation.



$$\frac{Driven}{Driving} = \frac{30}{60} = \frac{1}{2} \rightarrow 1:2$$

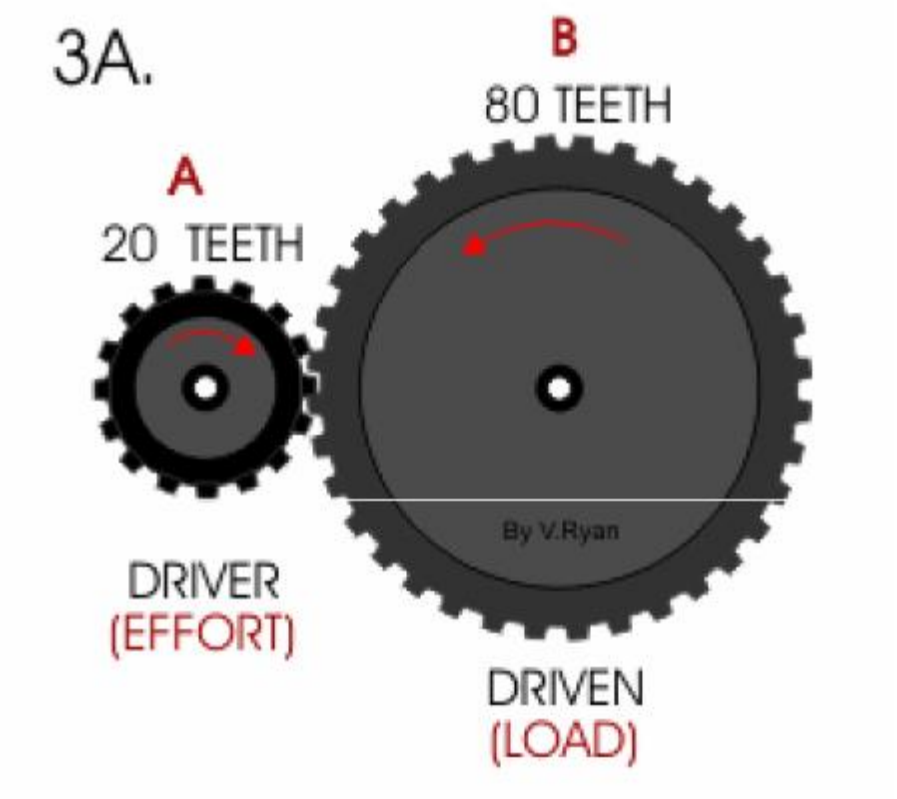
Gear Ratio - Examples



$$\frac{Driven}{Driving} = \frac{75}{25} = \frac{3}{1} \rightarrow 3:1$$

What does this mean? For every 3 rotations of the driving gear, the driven gear makes one rotation.

Gear Ratio - Examples

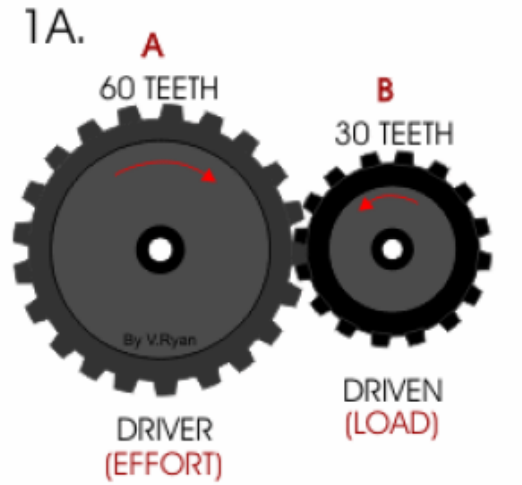


$$\frac{Driven}{Driving} = \frac{80}{20} = \frac{4}{1} \rightarrow 4:1$$

What does this mean? For every 4 rotations of the driving gear, the driven gear makes 1 rotation.

Working out RPMs (revolutions per minute)

In the example shown, the DRIVER gear is larger than the DRIVEN gear. The general rule is - large to small gear means 'multiply' the velocity ratio by the rpm of the first gear.
Divide 60 teeth by 30 teeth to find the velocity ratio(1:2).
Multiply this number (2) by the rpm (120). This gives an answer of 240rpm



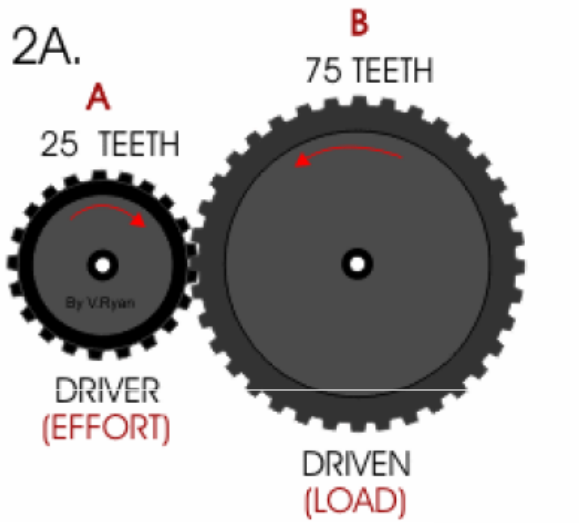
GEAR A	GEAR B
60 teeth	30 teeth
120 rpm	?

$$\frac{60}{30} = 2$$

$$= 120 \times 2 = 240 \text{ revs/min}$$

Working out RPMs (revolutions per minute)

In the example shown, the DRIVER gear is smaller than the DRIVEN gear. The general rule is - small to large gear means 'divide' the velocity ratio(3:1) by the rpm of the first gear. Divide 75 teeth by 25 teeth to find the velocity ratio. divide the 60rpm by the velocity ration (3). The answer is 20rpm.



GEAR A	GEAR B
25 teeth	75 teeth
60 rpm	?

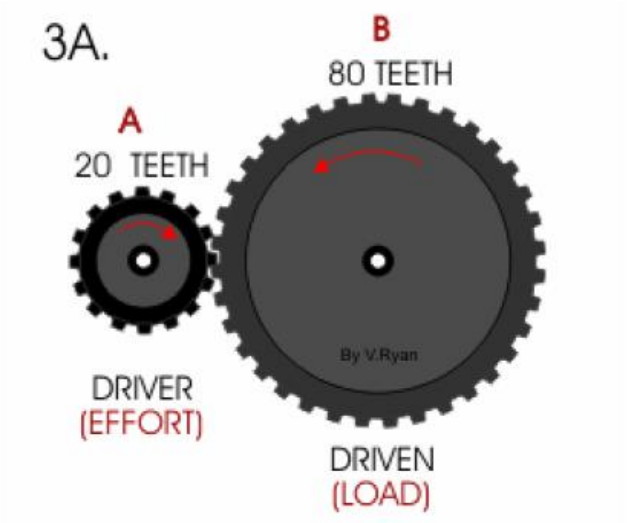
$$\frac{75}{25} = 3$$

$$= \frac{60}{3} = 20 \text{ revs/min}$$

Working out RPMs (revolutions per minute)

If A revolves at 100 revs/min what is B ?

(Remember small gear to large gear decreases revs)

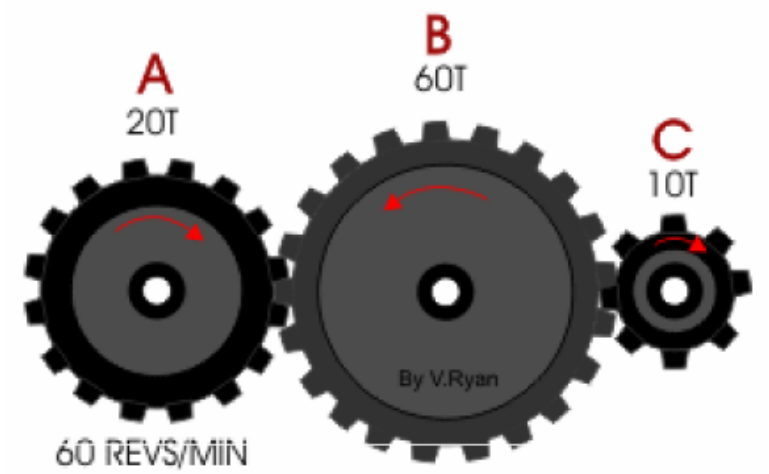


GEAR A	GEAR B
20 teeth	80 teeth
100 rpm	?

$$\frac{80}{20} = 4$$

$$= \frac{100}{4} = 25 \text{ revs/min}$$

Working out RPMs (revolutions per minute)



GEAR A	GEAR B	GEAR C
20 teeth	60 teeth	10 teeth

$$\frac{Driven}{Driving} = \frac{60}{20} = \frac{3}{1} \rightarrow 3:1$$

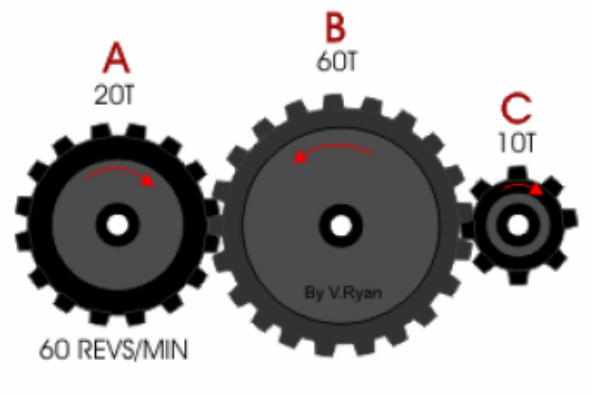
This means that for every THREE revolutions of GEAR A, Gear B travels once. Since we are going from a SMALLER gear to a LARGER gear we DIVIDE the Rpms.

$$\frac{60\ rev/\min}{3} = 20\ rev/\min$$

Now find the gear ratio for B & C.

$$\frac{Driven}{Driving} = \frac{10}{60} = \frac{1}{6} \rightarrow 1:6$$

Is there an easier way?



$$\frac{Driven}{Driving} = \frac{60}{20} \bullet \frac{10}{60} = \frac{10}{20} = \frac{1}{2} \rightarrow 1:2$$

You can also multiply the two gear ratios together to get the TOTAL gear ratio. In the above figure we see that gear C will make TWO rotations for every one rotation of gear A. And since gear C is smaller than gear A we multiply.

$$60\,rev/\min \bullet 2 = 120\,rev/\min$$