



Sun-Moon-Earth Automaton

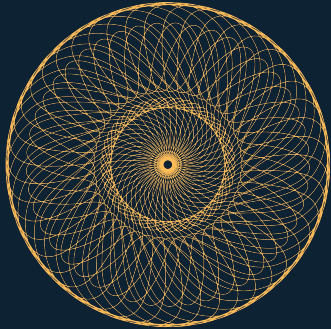


DIY Project to Learn
about Gear Ratios!



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Engineering Models

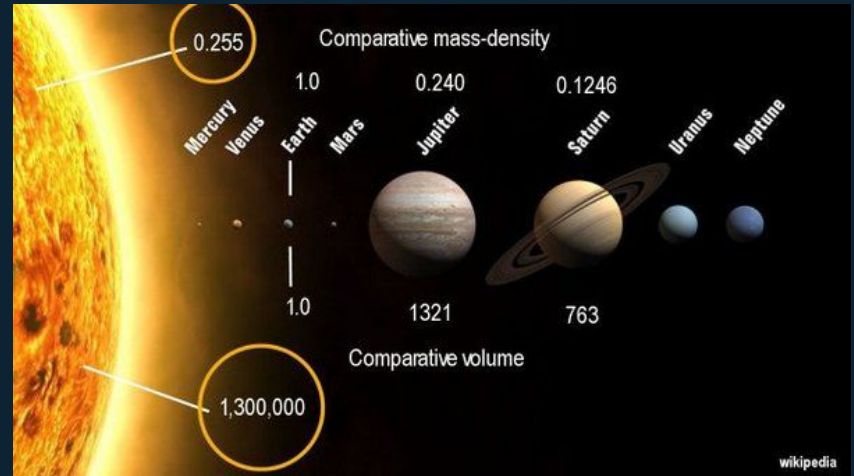
What are some examples of systems?

- *Student input*

Sun-Moon-Earth System (cont.)

What do you know about the sun-moon-earth system? What elements might you need to include to make a model of this system accurate?

- *Student input*



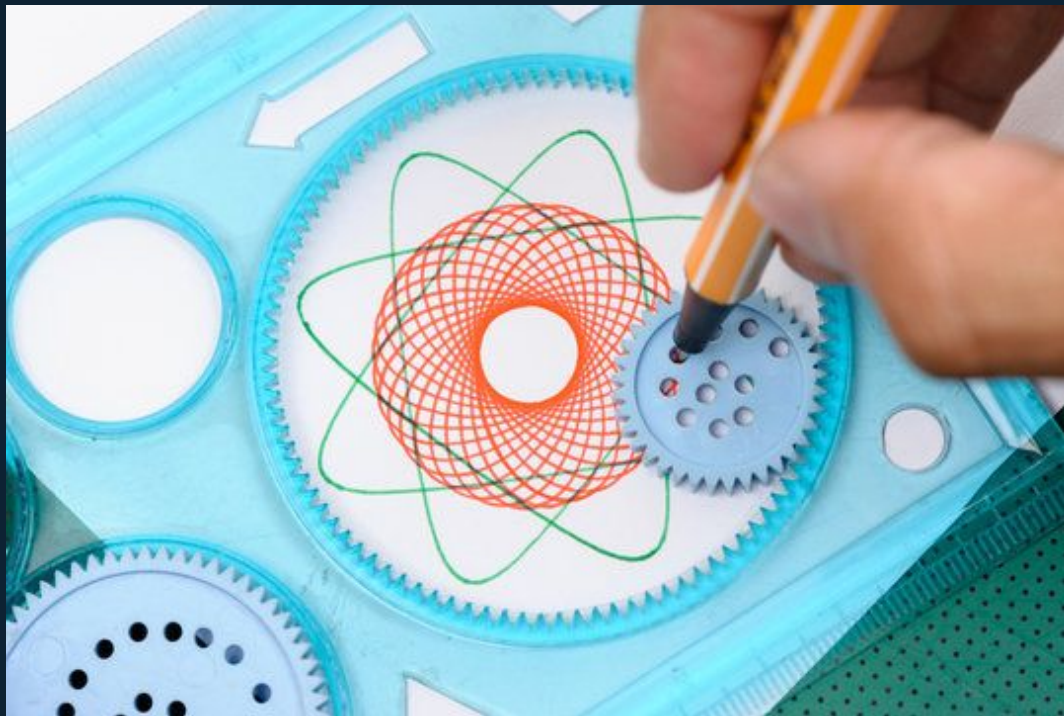
[Distance Between the Sun, Moon, and Earth could be fitted into the interior of the sun? - Quora](#)



Gears!



Spirographs



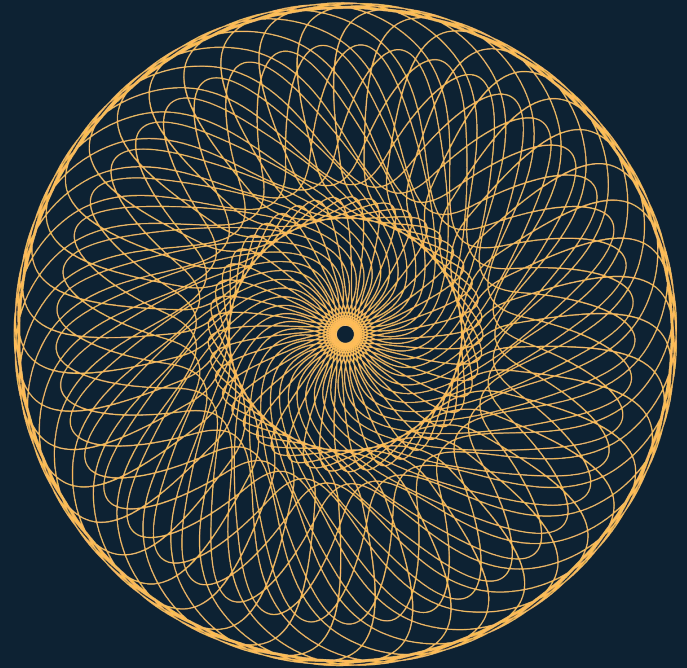
Spirographs are a great example of gear ratios.

What happens if you use a 10-tooth gear as the inner gear?

What about 40-tooth?

What about 60-tooth?

What if you swap out the outer gear?

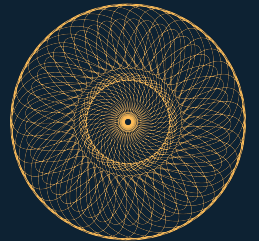


Spirographs are a great example of gear ratios.

How many “peaks” are in each design?

| | 20-tooth gear | 30-tooth gear | 40-tooth gear | 60-tooth gear |
|---------------|---------------|---------------|---------------|---------------|
| 60-tooth gear | | | | |
| 90-tooth gear | | | | |

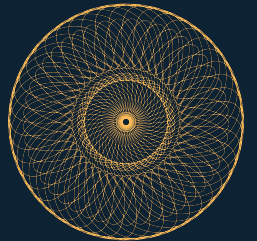
Can anyone guess why this happens?



Spirographs are a great example of gear ratios.

| | 20-tooth gear | 30-tooth gear | 40-tooth gear | 60-tooth gear |
|---------------|---------------|---------------|---------------|---------------|
| 60-tooth gear | 3 | 2 | 3 | 1 |
| 90-tooth gear | 9 | 3 | 9 | 3 |

Can anyone guess why this happens?

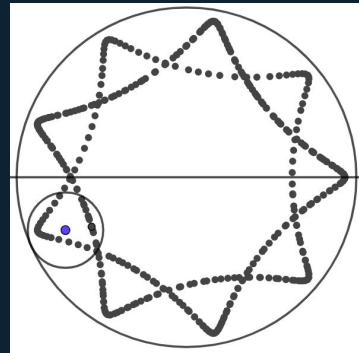


Spirographs are a great example of gear ratios.

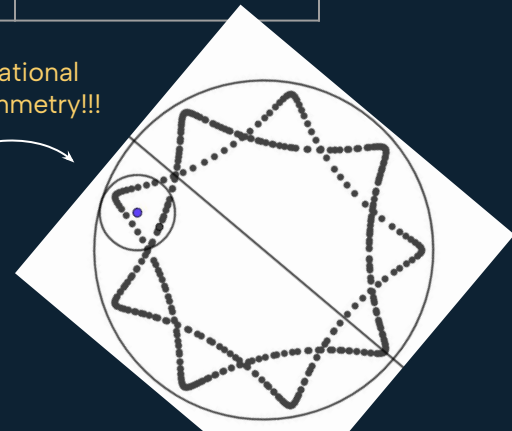
| | 20-tooth gear | 30-tooth gear | 40-tooth gear | 60-tooth gear |
|---------------|---------------|---------------|---------------|---------------|
| 60-tooth gear | 3 | 2 | 3 | 1 |
| 90-tooth gear | 9 | 3 | 9 | 3 |

Can anyone guess why this happens?

90-tooth & 20-tooth →



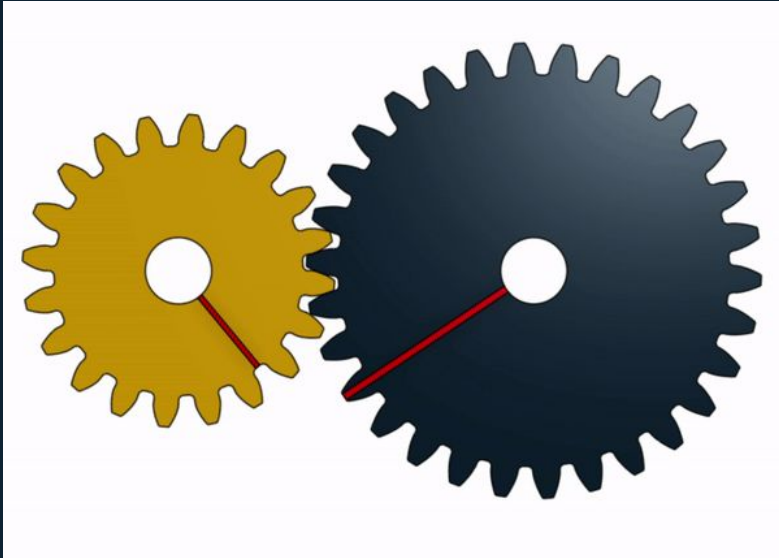
Rotational Symmetry!!!



Gear ratios

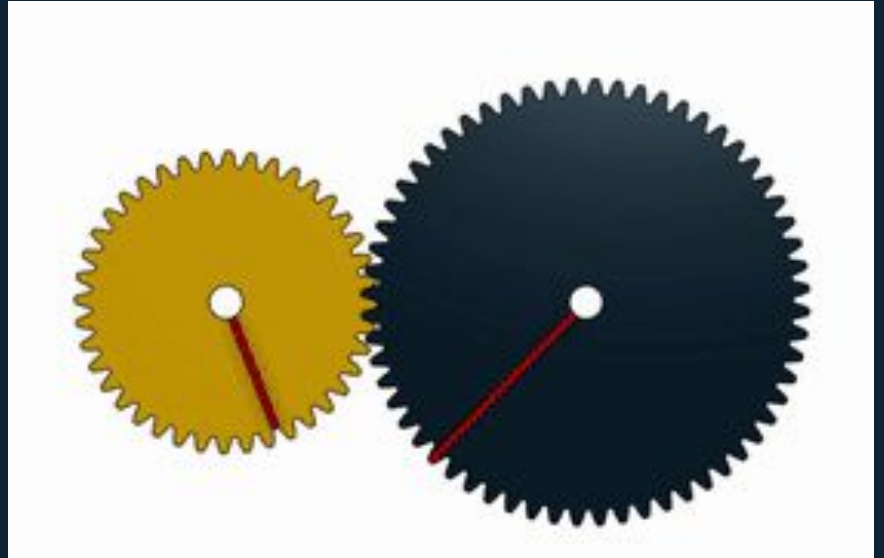
20
teeth

30
teeth



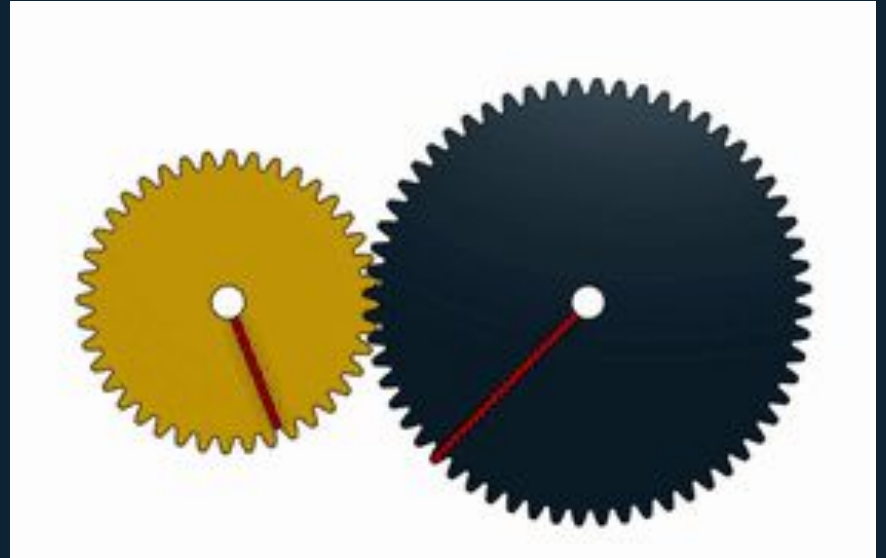
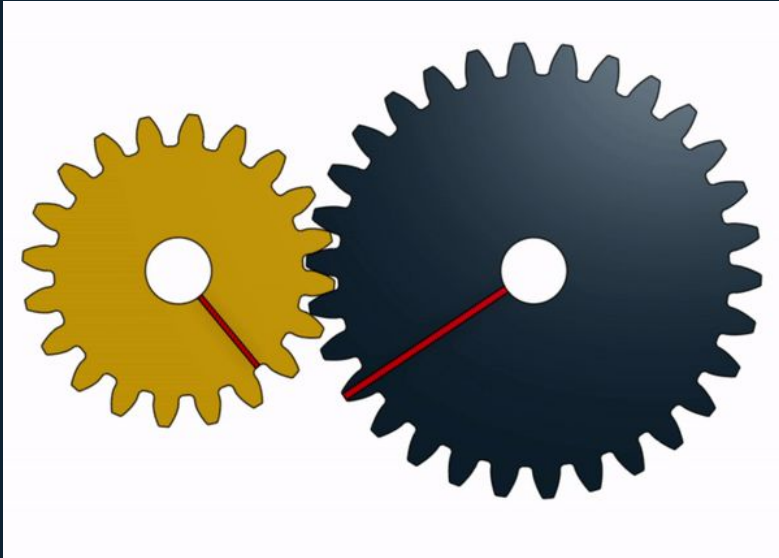
40
teeth

60
teeth

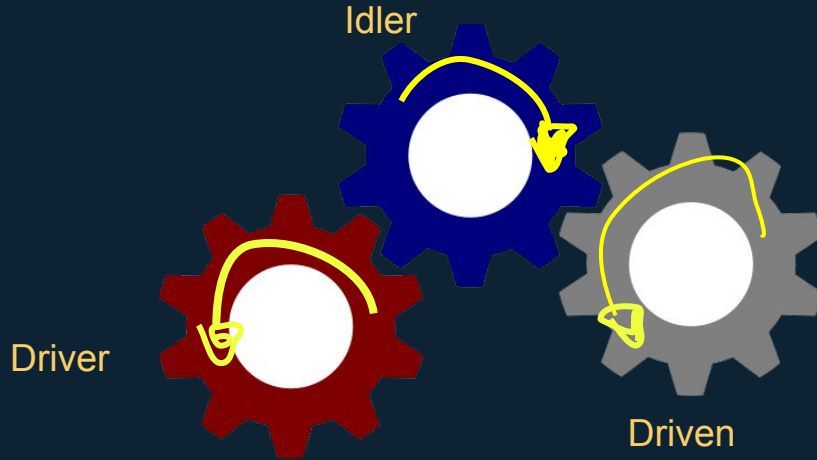


Gear ratios

$(20 \text{ teeth}) / (30 \text{ teeth}) \rightarrow 2/3$



Roles of Gears



Driver

produces the energy for the rest of the gears to move.

Idler

in the middle, to transit the power between the gears

Driven

loads and at the end. It moves the same direction as the driver



Sun-Moon-Earth System (cont.)

The earth revolves around the sun once every **365** days.

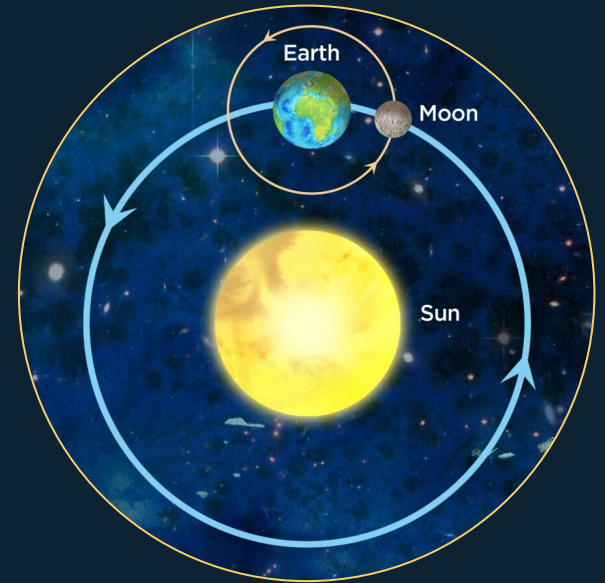
The moon revolves around the earth once every **28** days.

How can we make this simpler to model?

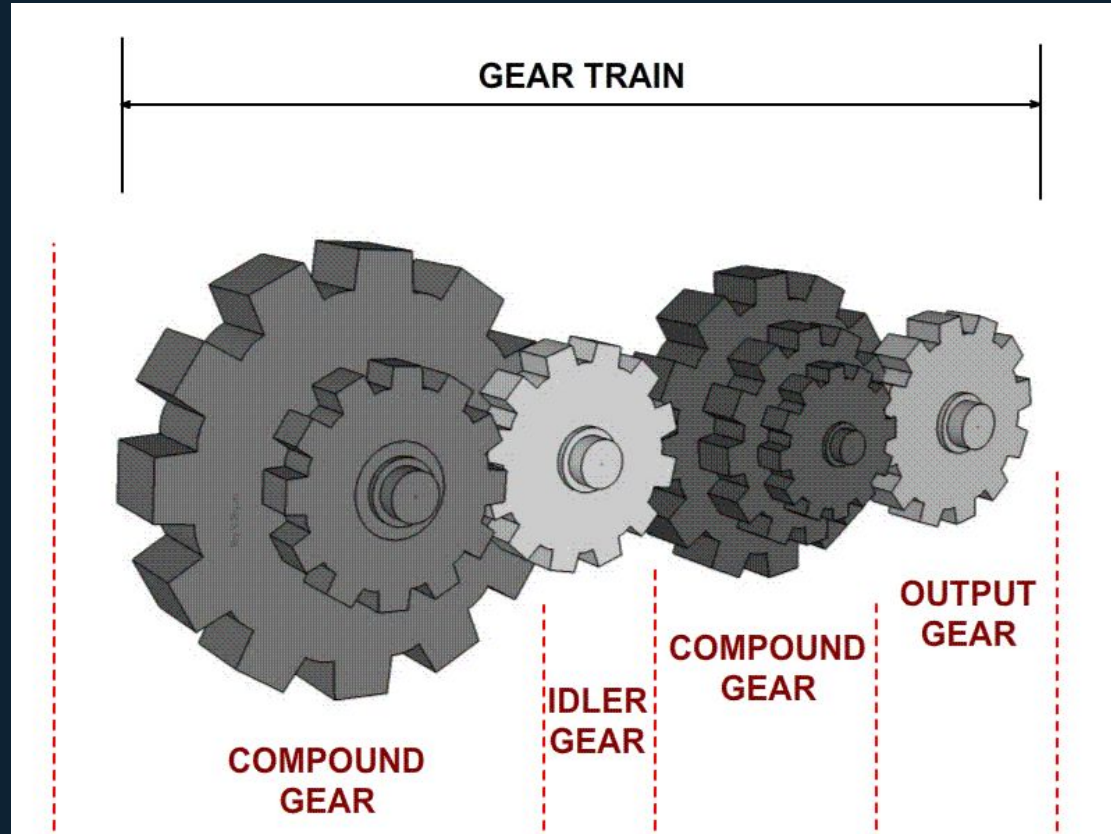
360

30

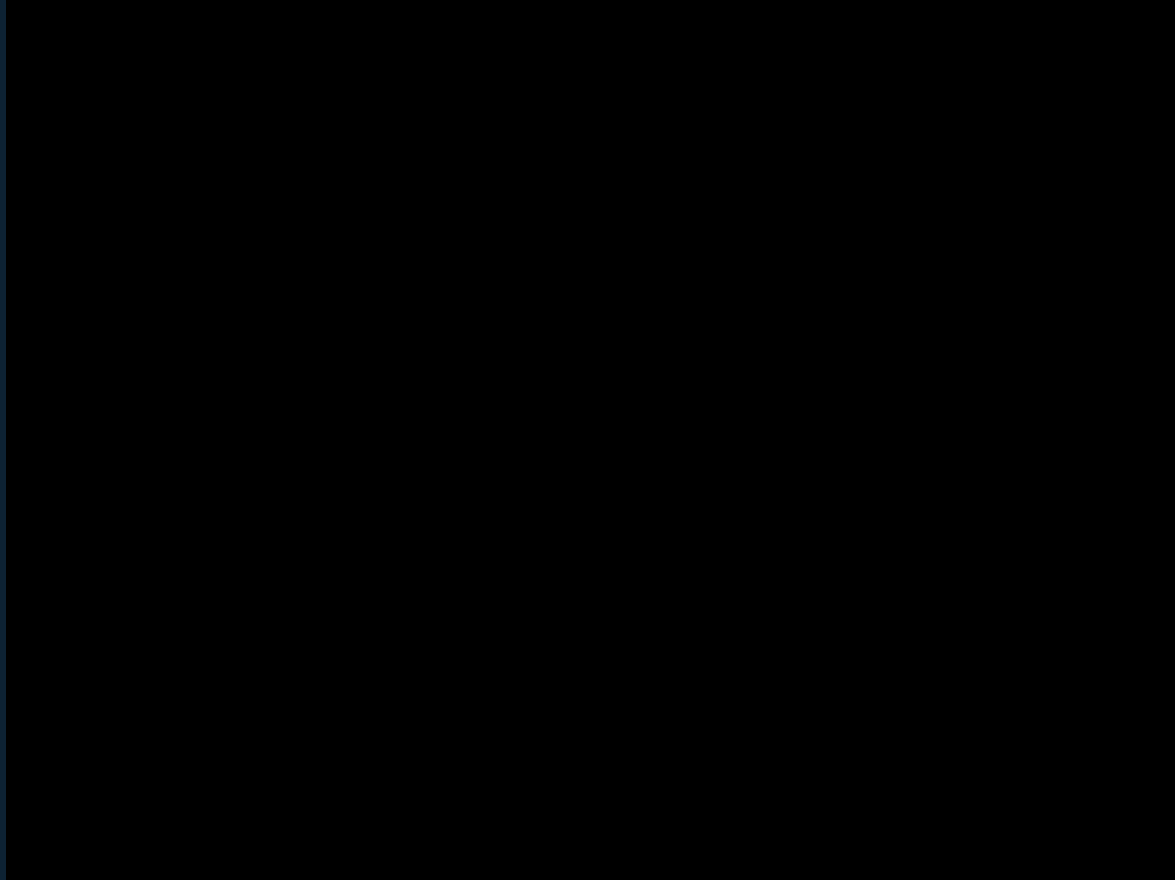
12:1



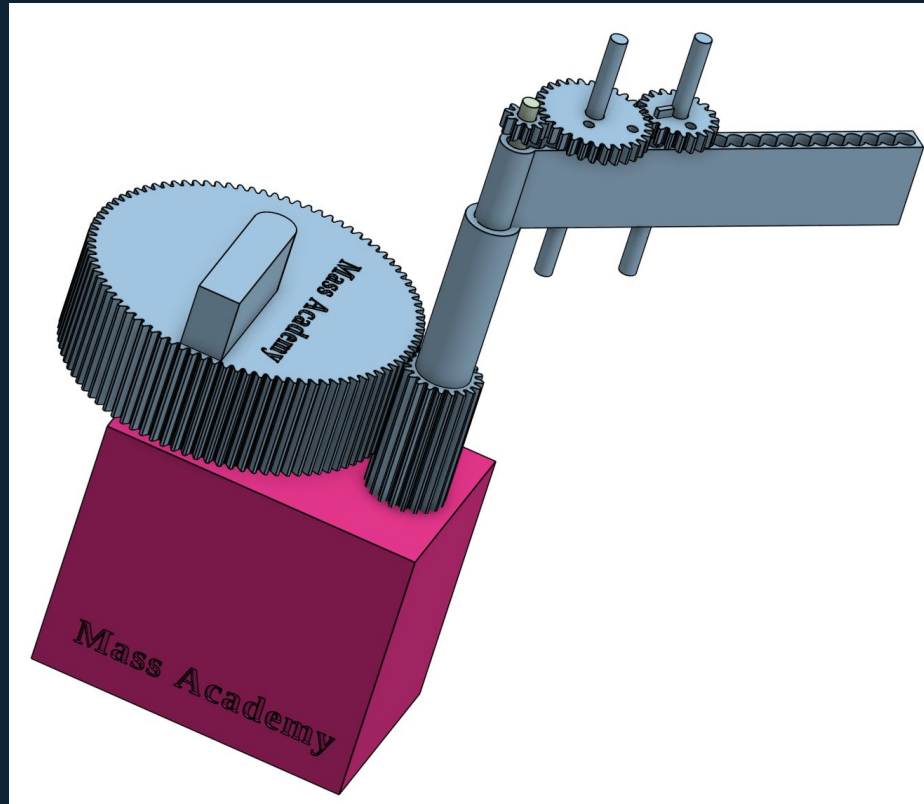
Compound Gears



Gear Ratios in Action



Physical example

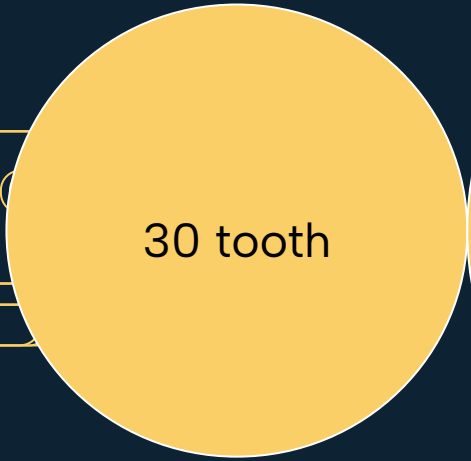




Now you
try!



Gear Ratio Review!!!



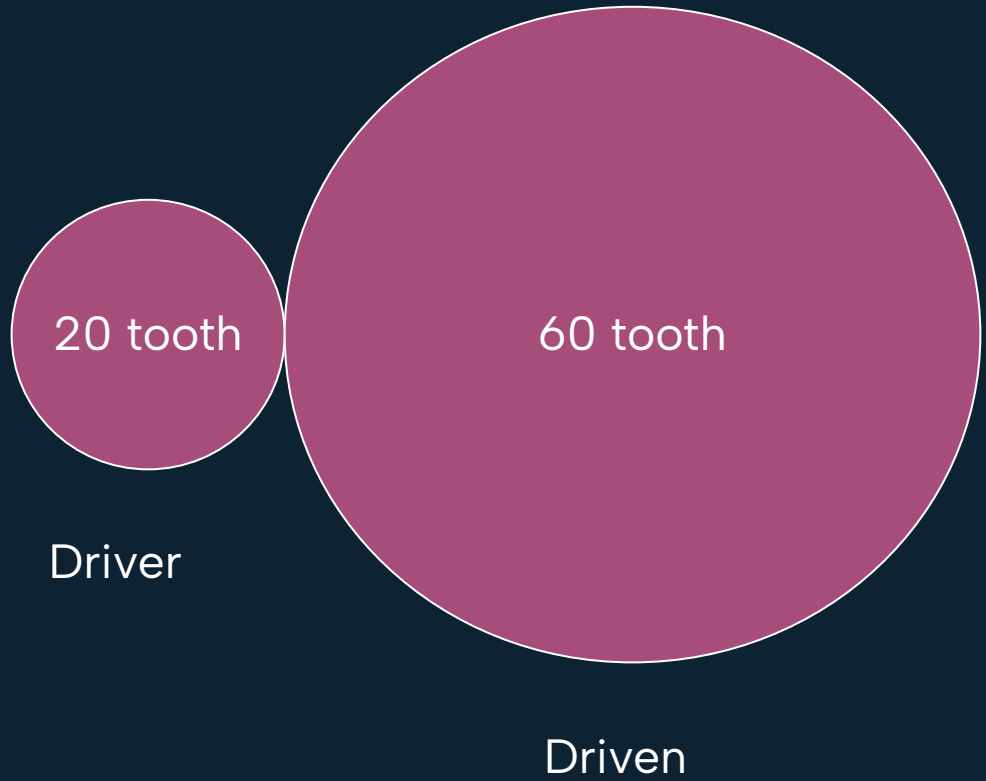
30 tooth

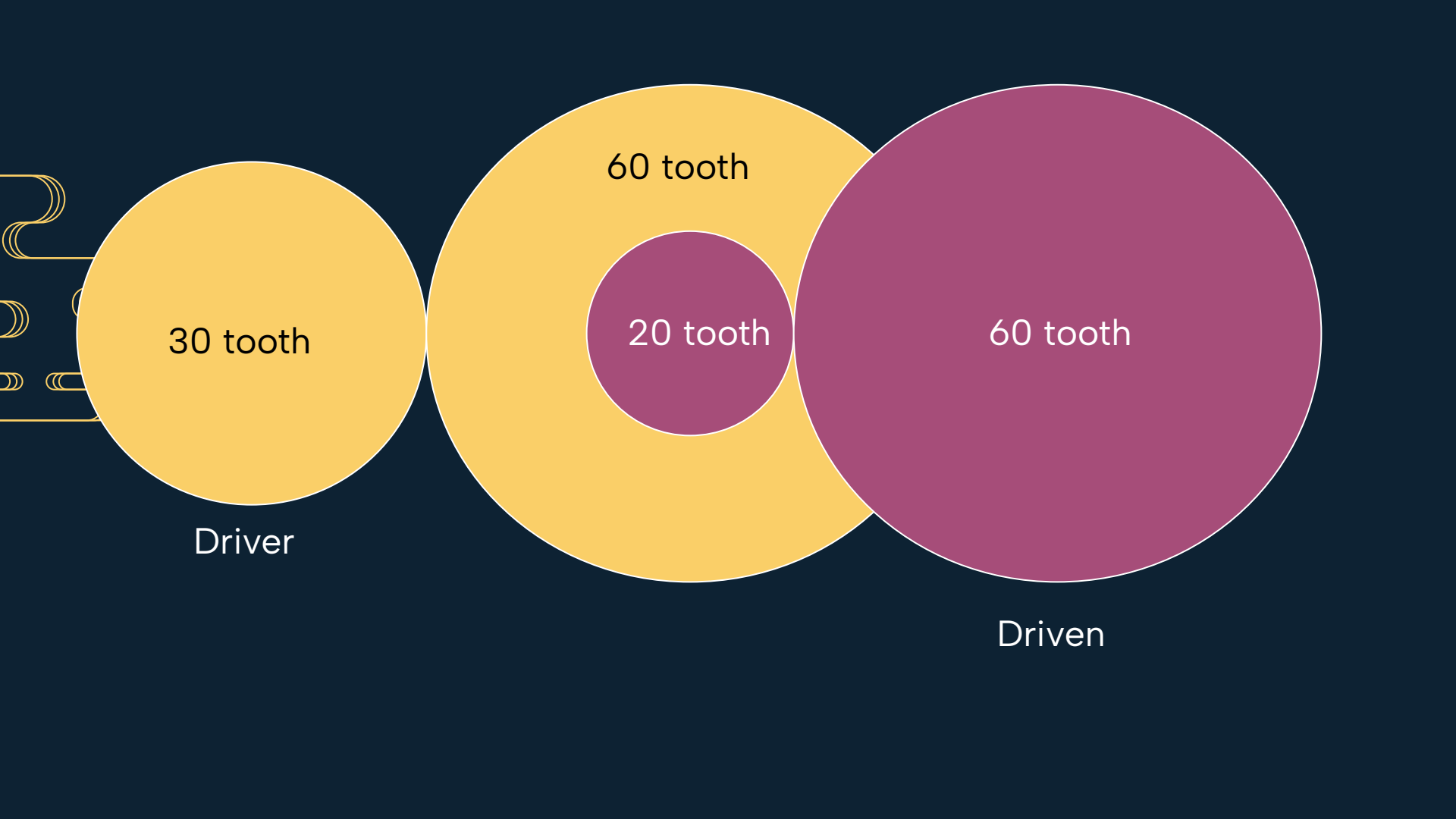
Driver



60 tooth

Driven





30 tooth

Driver

60 tooth

20 tooth

60 tooth

Driven

