# RACING TO THE FUTURE™
# MATH LESSON #2 WORKSHEET
# GEAR RATIOS

In this worksheet you will learn about how the gears in a slot can affect the performance and speed of the car. You will also learn how to use math to determine how a change in the gears will change the car, before you race it on the track.

Slot cars use gears to take the power from a spinning armature and send it to the wheels to move the car. You can change how fast a car can move by changing the gears.

You can also figure out how to reach top speed at the best time by having the right gears in your slot car. You can do all this with some simple math and figuring out what we will call the *"Gear Ratio"*.

On a slot car, a *gear ratio* is the number of teeth on the crown gear (on the rear axle), divided by the number of teeth on a pinion gear (on the motor). The number you get is equal to the number of times it takes the motor to turn, to turn the wheels 1 full rotation.



Crown Gear
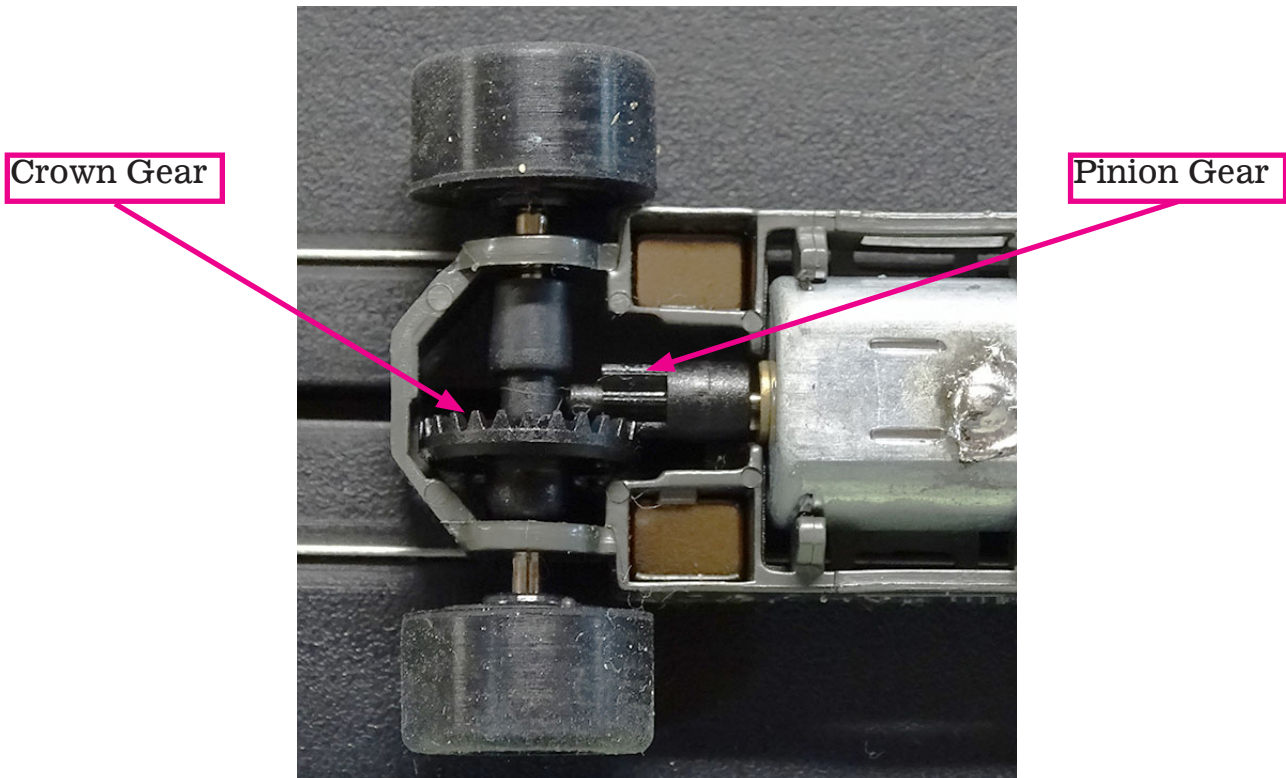
Pinion Gear

Here's an example of how to determine what your car's gear ratio would be.  If your crown gear on the rear axle has 24 teeth and your pinion gear on the motor has 8 teeth, your gear ratio would be 3:1.  Here's the equation and how to do math,

Number of teeth on the Crown Gear ÷ Number of teeth on the Pinion Gear = The Gear Ratio

$$24 \div 8 = 3$$

In this example the gear ratio is 3 to 1 or 3:1. This means the motor needs to turn 3 times, to turn the rear wheels 1 time.

This information is very useful when you are building your car for racing.  By knowing your gear ratio, you can determine how fast your car will go and when it will hit its top speed.  We will work on both of those in the next worksheet.

In the slot car world, the number of teeth on a gear is shown like this:
24T which means 24 Teeth
-OR-
7T which means 7 Teeth

# What is the gear ratio?

1.) Dan has a car that he wants to know what its gear ratio is.  The crown gear has 21 teeth and the pinion gear has 7 teeth.  What is the gear ratio of Dan's car?

Use the equation below to determine the gear ratio.

Number of teeth on the Crown Gear ÷ Number of teeth on the Pinion Gear = The Gear Ratio

2.) Briana has a car with an 8T pinion gear and a 22T crown gear.  What is the gear ratio of Briana's car?

3.)Rob wants to build his car with a high gear ratio so it will have faster starting speed. He has 2 crown gears and 1 pinion gear to work with.  The pinion gear has 7 teeth. The first crown gear has 22 teeth and the second crown gear has 20 teeth.  Which combination of pinion and crown gears gives him the higher gear ratio?  Figure out each gear ratio and the greater number of the two is the higher gear ratio.

# Answer Key

1.) 21 ÷ 7 = 3   Dan's Car has a 3 to 1 gear ratio.

2.) 22 ÷ 8 = 2.75   Briana's car has a 2.75 to 1 gear ratio

3.) Rob's first gear ratio option:

   22 ÷ 7 = 3.14 to 1 gear ratio

   Rob's second gear ratio option:

   20 ÷ 7 = 2.85 to 1 gear ratio

   3.14 > 2.85

   3.14 to 1 is the higher gear ratio that Rob is looking for.

## Teacher's Chart Showing Common Gear Ratios

### Crown Gears

| Pinion Gears | 15t | 19t | 20t | 21t | 22t | 23t | 24t | 25t | 26t |
|---|---|---|---|---|---|---|---|---|---|
| 6t | 2.5 | 3.16 | 3.33 | 3.5 | 3.66 | 3.83 | 4.0 | 4.16 | 4.33 |
| 7t | 2.14 | 2.71 | 2.85 | 3.0 | 3.14 | 3.28 | 3.42 | 3.57 | 3.71 |
| 8t | 1.87 | 2.37 | 2.5 | 2.62 | 2.75 | 2.87 | 3.0 | 3.12 | 3.25 |
| 9t | 1.66 | 2.11 | 2.22 | 2.33 | 2.44 | 2.55 | 2.66 | 2.77 | 2.88 |
| 12t | 1.25 | 1.58 | 1.66 | 1.75 | 1.83 | 1.91 | 2.0 | 2.08 | 2.16 |
| 14t | 1.07 | 1.35 | 1.42 | 1.5 | 1.57 | 1.64 | 1.71 | 1.78 | 1.85 |