

AI-01197 Bicycle Gear Ratio vs Power

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Calculate the power output of a cyclist with a front chainring of 50/34t and rear sprocket of 30,34,36,40t with the crank length of 170mm. Speed at 6mph and Cadence at 60rpm. List all the combinations of gearing vs output in an easier to read tabulated data.

Calculating Power Output for Different Gear Combinations

Understanding the Problem:

- **Given:**
 - Front chainring: 50/34 teeth
 - Rear sprocket: 30, 34, 36, 40 teeth
 - Crank length: 170mm
 - Speed: 6 mph (approximately 2.68 m/s)
 - Cadence: 60 rpm
- **Required:**
 - Power output for each gear combination

Formula for Power: $\text{Power} = \text{Force} * \text{Velocity}$

Calculating Force:

- We can estimate force based on the gear ratio and cadence. A higher gear ratio and cadence generally mean higher force.
- For simplicity, we'll assume a constant force for each gear combination and adjust the power output based on the gear ratio.

Calculating Gear Ratios:

- Gear ratio = (Front chainring teeth) / (Rear sprocket teeth)

Calculating Power Output:

- For each gear combination, calculate the gear ratio and then adjust the power output based on that ratio.

Assumptions and Notes:

- This calculation is a simplified approximation. Actual power output can vary based on factors like rider efficiency, wind resistance, and terrain.
- A more accurate calculation would involve considering torque, which is related to force and crank length.

Table of Gear Combinations and Power Output:

Front Chainring	Rear Sprocket	Gear Ratio	Power Output (Approximate)
50	30	1.67	High
50	34	1.47	Medium-high
50	36	1.39	Medium
50	40	1.25	Low
34	30	1.13	Medium-low
34	34	1.00	Low
34	36	0.94	Very low
34	40	0.85	Extremely low

Interpretation:

- Higher gear ratios (e.g., 50/30) generally lead to higher power output, but they also require more effort from the rider.

- Lower gear ratios (e.g., 34/40) are easier on the rider but result in lower power output.
- The "best" gear combination depends on factors like the rider's fitness, the terrain, and the desired speed.

Note: To get a more precise calculation, consider using a power meter or consulting with a cycling coach.

Does the power output in watts change if I have different set of gears but the same gear ratio such as Front - 34t and Rear - 34t. or Front 39t and Rear 39t. Explain and delve. Which combination will give me less effort?

No, the power output in watts does not change if you have different sets of gears but the same gear ratio.

Here's why:

- **Gear Ratio:** The gear ratio determines the mechanical advantage of a bicycle. It's the ratio of the number of teeth on the front chainring to the number of teeth on the rear sprocket.
- **Power:** Power is the rate at which work is done. In cycling, it's essentially the product of force and velocity.
- **Force and Velocity:** For a given power output, if you increase the gear ratio (e.g., 39/39), you'll decrease the rotational speed of the pedals (cadence) but increase the force applied to the pedals. Conversely, a lower gear ratio (e.g., 34/34) will increase cadence but decrease pedal force.
- **Constant Power:** As long as the gear ratio remains the same, the overall mechanical advantage remains the same. Therefore, the power output will also remain the same, regardless of the specific number of teeth on the front and rear sprockets.

Which combination will give you less effort?

Generally, a lower gear ratio (e.g., 34/34) will feel easier on your legs because it requires less force to maintain a given speed. This is often used when climbing hills or overcoming other obstacles. However, it also means you'll need to pedal faster to maintain the same speed.

Ultimately, the "best" gear combination depends on your individual preferences, the terrain, and the desired speed. Some riders may find it more comfortable to pedal faster in a lower gear, while others may prefer to exert more force in a higher gear.

Note: While the power output remains the same for the same gear ratio, the *feel* of pedaling can vary slightly due to factors like pedal stroke efficiency and individual physiology.