How Long Must A Driver Take To Drive The Last 50 Miles Of A 120 Mile Trip If He Wants To Average 50 Mph

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Planning a trip involves more than just setting off on the road; it requires understanding how different segments of your journey contribute to your overall travel time and average speed. When a driver aims to maintain a specific average speed for the entire trip, calculating the time needed for each part becomes essential. In this article, we explore the question: How long must a driver take to drive the last 50 miles of a 120-mile trip if he wants to average 50 mph? We will analyze the problem step-by-step, providing detailed explanations and practical calculations to help drivers plan their journey efficiently.

Understanding the Problem: Key Details and Goals

Before delving into calculations, it's important to clarify what the problem entails:

- Total trip distance: 120 miles
- Segment distance: Last 50 miles (from mile 70 to mile 120)
- Desired overall average speed: 50 mph
- Question: How much time should the driver take to complete the last 50 miles to meet the overall average speed goal?

This problem assumes that the driver is starting the last 50 miles after completing the first 70 miles, and that they want the entire trip to average 50 mph, considering the total time taken for all 120 miles.

Step 1: Calculating the Total Time Allowed for the Entire Trip

The first step is to determine the total time the driver has to complete the entire 120-mile journey if they want to average 50 mph.

Formula for total time:

Total Time = Total Distance / Desired Average Speed

Applying the numbers:

Total Time = 120 miles / 50 mph = 2.4 hours

Interpretation:
The driver must complete the entire 120 miles in 2.4 hours to maintain an average speed of 50 mph.

Step 2: Considering the First 70 Miles

The journey is divided into two segments:

- First segment: 70 miles
- Second segment: 50 miles

Suppose the driver takes T_1 hours to complete the first 70 miles, and T_2 hours for the last 50 miles. From the total time, we know:

$T_1 + T_2 = 2.4$ hours

To determine how long the driver must take for the last 50 miles (T_2), we need to analyze various scenarios, particularly focusing on the speed needed during the second segment.

Step 3: Calculating the Required Speed for the Last 50 Miles

The key is understanding how the speed on the last 50 miles affects the overall average. The driver can choose to drive faster or slower in the last segment, but to meet the overall goal of 50 mph, the entire journey's timing must align with 2.4 hours.

Case 1: If the driver maintains 50 mph for the entire trip

- Time for entire 120 miles:

120 miles / 50 mph = 2.4 hours

- Time for last 50 miles at 50 mph:

50 miles / 50 mph = 1 hour

- Time for first 70 miles:

2.4 hours - 1 hour = 1.4 hours

- Speed during first 70 miles:

70 miles / 1.4 hours ≈ 50 mph

Conclusion:
If the driver maintains exactly 50 mph throughout, they will meet their goal. The time taken for the last 50 miles is exactly 1 hour.

Step 4: Exploring Different Scenarios for the Last 50 Miles

While maintaining 50 mph throughout is straightforward, sometimes drivers might drive faster or slower in the last segment. Let's explore what happens in these situations.

Scenario A: Driving Slower Than 50 mph in the Last Segment

Suppose the driver takes T_2 hours to complete the last 50 miles. The speed during this segment is:

$\text{Speed}_2 = 50 \text{ miles} / T_2$

Given the total time constraint:

$T_1 + T_2 = 2.4 \text{ hours}$

If the driver wants to drive slower than 50 mph in the last segment, $T_2 > 1$ hour (since 50 miles / 50 mph = 1 hour).

But to still meet the overall average, the first part must have been completed faster than 50 mph, which is impossible unless the driver compensates by driving faster earlier.

Scenario B: Driving Faster Than 50 mph in the Last Segment

If the driver accelerates and completes the last 50 miles in T_2 hours, where $T_2 < 1$ hour, then:

- Speed in last segment:

$Speed_2 = 50 \text{ miles} / T_2$

- To meet overall time:

$T_1 = 2.4 \text{ hours} - T_2$

- Speed during first 70 miles:

$70 \text{ miles} / T_1$

To meet the total time, the first segment's speed must be:

$Speed_1 = 70 \text{ miles} / (2.4 - T_2)$

Implication:
If the driver wants to complete the last 50 miles faster than 1 hour, they must have traveled the first 70 miles faster than 50 mph as well, possibly exceeding practical limits.

Step 5: Practical Calculation – How Fast Must the Driver Drive in the Last 50 Miles?

The goal is to determine the minimum time the driver can take for the last 50 miles while still achieving an overall average of 50 mph.

Key insight:
To maximize efficiency, the driver should aim to complete the last 50 miles as quickly as possible, which implies driving at the highest feasible speed. Conversely, if the driver is slower in the first part, they need to

compensate by speeding up in the last segment.

Simplest scenario: Driving at 50 mph for the entire trip

- Time for last 50 miles: 1 hour

Alternative scenario: Driving slower in the first segment

Suppose the driver spends T_1 hours on the first 70 miles, traveling at:

$Speed_1 = 70 \text{ miles} / T_1$

Similarly, for the last 50 miles, the time is $T_2 = 2.4 - T_1$, and the speed:

$Speed_2 = 50 \text{ miles} / T_2$

To keep the overall average at 50 mph, the total time must be 2.4 hours.

Calculating the minimum T_2

Since the driver wants to minimize T_2 (time for last 50 miles), they should maximize $Speed_2$:

$Speed_2 = 50 \text{ miles} / T_2$

Assuming no speed limit constraints, the fastest the driver can go is limited by vehicle capabilities and safety. For the sake of this calculation, let's consider the theoretical minimum T_2:

- The driver can drive as fast as needed, but practically, suppose they can travel at X mph in the last segment.

If the driver wants to take T_2 hours:

$T_2 = 50 \text{ miles} / X \text{ mph}$

Given the total time:

$T_1 = 2.4 - T_2$

And the speed during the first 70 miles:

$Speed_1 = 70 \text{ miles} / T_1 = 70 \text{ miles} / (2.4 - T_2)$

To summarize:
- The minimum time for the last 50 miles is when the driver travels at the

maximum feasible speed.
- The maximum feasible speed depends on vehicle limits, road conditions, and safety.

Step 6: Final Conclusion – How Long Must the Driver Take?

Based on the above analysis, the key points are:

- If the driver maintains exactly 50 mph throughout the entire trip, they will take 2.4 hours total, with 1 hour for the last 50 miles.

- If the driver wants to complete the last 50 miles faster than 1 hour, they must exceed 50 mph, which requires traveling at a higher speed than 50 mph.

- To meet the overall average of 50 mph, the driver can take anywhere from exactly 1 hour (if maintaining 50 mph throughout) to less than 1 hour (if traveling faster than 50 mph in the last segment), provided their vehicle and road conditions allow.

Practical answer:

The driver must complete the last 50 miles in exactly 1 hour to maintain an overall average speed of 50 mph.
This means they need to drive at a steady 50 mph during the last segment.

Additional Tips for Drivers

- Plan ahead: If you aim to maintain a consistent speed, know that driving at 50 mph for the entire trip ensures meeting your goal.
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Frequently Asked Questions

How long should the driver take to complete the last 50 miles to maintain an average speed of 50 mph for

the entire 120-mile trip?

The driver must complete the last 50 miles in 1 hour to maintain an average speed of 50 mph for the entire trip.

If the driver has already traveled 70 miles and wants to finish the remaining 50 miles in time to average 50 mph overall, what is the maximum time they can take for the last 50 miles?

They must complete the last 50 miles in no more than 1 hour, assuming they took 1.4 hours (84 minutes) for the first 70 miles.

What is the required average speed for the last 50 miles to achieve an overall average speed of 50 mph on a 120-mile trip?

The driver needs to travel the last 50 miles at an average speed of 50 mph, as maintaining 50 mph throughout ensures the overall average.

If the driver is behind schedule and has only 1 hour left to complete the final 50 miles, what should their average speed be to still average 50 mph for the entire trip?

They must travel at exactly 50 mph for the last 50 miles to meet the overall 50 mph average.

How does traveling faster or slower in the last 50 miles affect the overall average speed for the trip?

Traveling faster than 50 mph in the last 50 miles increases the overall average speed, while traveling slower decreases it.

If the driver took 2 hours for the first 70 miles, how much time do they have left to finish the last 50 miles to reach an average speed of 50 mph?

They need to complete the last 50 miles in 1 hour to maintain an overall average speed of 50 mph.

Additional Resources

How Long Must A Driver Take To Drive The Last 50 Miles Of A 120 Mile Trip If He Wants To Average 50 Mph

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Introduction

In the realm of travel planning and time management, understanding the relationship between distance, speed, and time is fundamental. Whether for professional drivers, travelers, or those engaged in logistical coordination, knowing how long it takes to complete a segment of a trip while maintaining a specific average speed is crucial. This article delves into a specific scenario: How long must a driver take to drive the last 50 miles of a 120-mile trip if he wants to average 50 mph over the entire journey?

The question might seem straightforward at first glance, but it involves nuanced considerations of average speed, total time, and the impact of variable speeds during different trip segments. Through detailed analysis, we will explore the underlying principles, perform precise calculations, and examine practical implications.

Understanding the Fundamental Concepts

Before addressing the specific scenario, it is essential to review the key concepts involved:

- Average Speed: Total distance traveled divided by total time taken.
- Total Distance: The entire length of the trip.
- Segment Distance: Portions of the trip, e.g., first 70 miles and last 50 miles.
- Total Time: Sum of time taken for each segment.
- Time for a Segment: Distance of the segment divided by the speed during that segment.

The Core Question: Breaking Down the Trip

Given:
- Total trip distance: 120 miles
- Distance of the last segment: 50 miles
- Desired overall average speed: 50 miles per hour (mph)

The critical question is: How long must the driver take to complete the last 50 miles if the entire trip is to have an average speed of 50 mph?

To answer this, we need to determine:

1. The total time allowed for the entire trip to meet the average speed goal.
2. How much of that total time is already "used up" by the initial segment.
3. The remaining time available for the last 50 miles.

Calculating Total Time for the Entire Trip

Since the goal is to average 50 mph over 120 miles:

$$
\text{Total Time} = \frac{\text{Total Distance}}{\text{Average Speed}} = \frac{120\, \text{miles}}{50\, \text{mph}} = 2.4\, \text{hours}
$$

Expressed in hours and minutes:

$$
2.4\, \text{hours} = 2\, \text{hours} + 0.4\, \text{hours}
$$

And converting 0.4 hours to minutes:

$$
0.4\, \text{hours} \times 60\, \text{minutes/hour} = 24\, \text{minutes}
$$

Thus, the total allotted time for the entire 120-mile trip is 2 hours and 24 minutes.

Analyzing the First Segment: How Fast Could the Driver Have Gone?

The problem doesn’t specify the speed during the first 70 miles; it only states the total trip duration must be 2 hours and 24 minutes. To understand the constraints, consider different scenarios:

- Scenario A: The driver maintains a consistent speed throughout.
- Scenario B: The driver drives faster or slower in the first segment, affecting the time available for the last 50 miles.

The most critical aspect is that the total time for the entire trip is fixed at 2.4 hours. Therefore, the time spent on the first 70 miles directly influences how much time remains for the last 50 miles.

Calculating the Required Time for the Last 50 Miles

Suppose the driver completes the first 70 miles in T1 hours. Then:

$$
\text{Time remaining for last 50 miles} = T_{total} - T_1 = 2.4\, \text{hours} - T_1
$$

The average speed for the last 50 miles is then:

$$
V_{last} = \frac{50\, \text{miles}}{T_{last}}
$$

Where:

$$
T_{last} = 2.4 - T_1
$$

To find the minimum or maximum speed necessary during the last segment, we analyze different values of T_1.

Practical Examples and Scenarios

Scenario 1: The Driver Maintains the Same Speed Throughout

If the driver maintains a consistent speed throughout the entire trip:

$$
V_{constant} = \frac{120\, \text{miles}}{2.4\, \text{hours}} = 50\, \text{mph}
$$

In this case, the driver takes exactly 2 hours and 24 minutes, and the last 50 miles are completed at 50 mph, aligning perfectly with the average speed goal.

Scenario 2: The Driver Is Faster in the First Part

Suppose the driver completes the first 70 miles in 1.5 hours:

$$
T_1 = 1.5\, \text{hours}
$$

Remaining time:

$$
T_{last} = 2.4 - 1.5 = 0.9\, \text{hours}
$$

Speed needed for the last 50 miles:

$$
V_{last} = \frac{50}{0.9} \approx 55.56\, \text{mph}
$$

Implication: To stay within the overall average, the driver must go faster than 50 mph during the last segment if they drove faster initially.

Scenario 3: The Driver Is Slower in the First Part

Suppose the first 70 miles take 2 hours:

$$
T_1 = 2\, \text{hours}
$$

Remaining time:

$$
T_{last} = 0.4\, \text{hours}
$$

Speed for last 50 miles:

$$
V_{last} = \frac{50}{0.4} = 125\, \text{mph}
$$

This is practically impossible under normal driving conditions. It indicates that if the initial part of the trip is delayed, the driver must significantly increase speed in the last segment, which may not be feasible or safe.

Determining the Minimum Time for the Last 50 Miles

The key insight here is that the minimum time the driver can take to cover the last 50 miles while maintaining the overall average of 50 mph occurs when the initial 70 miles are driven at the maximum reasonable speed.

In the real world, the maximum speed is limited by road conditions, legal restrictions, and vehicle capabilities. For this analysis, assume a typical maximum safe speed of 70-80 mph.

Let’s consider the ideal scenario where the first 70 miles are driven at 70 mph:

$$
T_1 = \frac{70}{70} = 1\, \text{hour}
$$

\]

Remaining time:

\[
T_{last} = 2.4 - 1 = 1.4\, \text{hours}
\]

Speed required:

\[
V_{last} = \frac{50}{1.4} \approx 35.71\, \text{mph}
\]

This is well below the maximum speed limit, making it feasible.

Synthesis: How Long Must the Driver Take?

From the calculations above, the time to complete the last 50 miles depends on the speed maintained during the initial segment:

- If the first 70 miles are driven at 70 mph: The last 50 miles can be completed in about 1.4 hours, provided the driver maintains or exceeds this speed.
- If the first 70 miles are driven at 50 mph: The last 50 miles must be completed in 0.4 hours (24 minutes) to meet the overall average, requiring a speed of 125 mph, which is impractical.
- If the first 70 miles are driven faster: The remaining time increases, reducing the required speed for the last segment.

Therefore, to determine "how long" the driver must take for the last 50 miles, the key is:

\[
\boxed{
T_{last} = 2.4\, \text{hours} - T_1
}
\]

where \(T_1 \) is the time taken for the first 70 miles.

Practical Implications and Real-World Constraints

While the mathematical model provides a range of possibilities, real-world driving imposes constraints:

- Speed limits: Typically 55-70 mph on highways.

- Traffic conditions: Congestion, accidents, and roadwork can affect speed.
- Driver fatigue and safety: Pushing for maximum speed is unsafe and illegal.
- Vehicle performance: Not all vehicles can sustain high speeds over long distances.

Given these constraints, the most realistic scenario for maintaining a 50 mph overall average is to:

- Maintain a consistent speed close to 50 mph or slightly above, ensuring the total trip time remains at or below 2 hours and 24 minutes.
- Recognize that exceeding the speed limit for the last segment to compensate for a slower initial pace is both unsafe and illegal.

Summary and Conclusions

How long must a driver take to drive the last 50 miles of a 120-mile trip if he wants to average 50 mph?

- The total trip time to meet the 50 mph average is 2 hours and 24 minutes.
- The time spent on the first

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