10 Cars Are Washed In 75 Minutes By Dave. Joe Can Wash 6 Cars In 30 Minutes. Find How Long It Would Take

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When it comes to understanding work rates and solving time-based problems, many people find these scenarios both interesting and challenging. For example, consider a situation where Dave washes 10 cars in 75 minutes, and Joe can wash 6 cars in 30 minutes. The question arises: how long would it take for both of them working together to wash a certain number of cars? In this article, we will explore how to approach and solve this problem step by step, providing clear explanations and methods that can be applied to similar work-rate problems.

Understanding the Problem

Before diving into calculations, it's crucial to understand what the problem asks and what information is provided.

Given Data

- Dave washes 10 cars in 75 minutes.
- Joe washes 6 cars in 30 minutes.

Objective

Find how long it would take for Dave and Joe to wash a specific number of cars together, or generally, how long they would take to wash any number of cars when working simultaneously.

Calculating Individual Work Rates

The key to solving work rate problems is understanding each person's or machine's rate of work.

Dave's Work Rate

To find Dave's work rate:

- Rate = Number of cars washed / Time taken
- Rate of Dave = 10 cars / 75 minutes = 2/15 cars per minute

Thus, Dave washes approximately 0.1333 cars per minute.

Joe's Work Rate

Similarly, Joe's work rate:

- Rate = 6 cars / 30 minutes = 1/5 cars per minute
- Rate of Joe = 1/5 cars per minute = 0.2 cars per minute

Joe washes 0.2 cars per minute.

Combining Work Rates

When two or more people work together, their work rates add up.

Total Work Rate of Dave and Joe

- Total rate = Dave's rate + Joe's rate
- Total rate = 2/15 + 1/5
- Convert to common denominator: 2/15 + 3/15 = 5/15 = 1/3 cars per minute

So, together, Dave and Joe can wash 1/3 cars per minute.

Calculating Time for a Given Number of Cars

Once the combined work rate is known, calculating the time for a certain number of cars becomes straightforward.

Example: How Long Will It Take to Wash 15 Cars?

- Time = Number of cars / combined rate
- Time = 15 / (1/3) = 15 3 = 45 minutes

Therefore, working together, they can wash 15 cars in 45 minutes.

Understanding the Original Scenario: 10 Cars in 75 Minutes by Dave

This specific data point is useful for verifying our calculations.

Check Dave's Rate

- Dave's rate = 10 cars / 75 minutes = 2/15 cars per minute

This confirms our earlier calculation.

Finding How Long It Would Take for Both to Wash a Specific Number of Cars

Suppose we want to determine the time it takes for Dave and Joe to wash a different number of cars together.

Example: How Long for 20 Cars?

- Time = 20 / (1/3) = 20 3 = 60 minutes

It would take 60 minutes to wash 20 cars together.

General Formula for Work Rate Problems

To solve similar problems efficiently, it's helpful to understand the general formula.

Formula

- Time = Number of cars / (Work rate of all workers combined)

Where the combined work rate is the sum of individual work rates:

- Combined rate = sum of each worker's rate

Additional Examples and Practice Problems

To deepen understanding, here are some additional scenarios.

Example 1: How Long for 18 Cars?

- Time = 18 / (1/3) = 18 3 = 54 minutes

Example 2: If Dave works alone, how long to wash 10 cars?

- Time = 10 / (2/15) = 10 (15/2) = 75 minutes

This confirms that Dave alone would take 75 minutes to wash 10 cars, matching the original data point.

Factors That Affect Work Rate Problems

While the above calculations assume constant work rates, real-world factors can influence results.

Variables to Consider

- Efficiency and fatigue over time
- Different types or sizes of cars
- Equipment or tools used in washing
- Working conditions and environment

Conclusion: Applying the Work Rate Method

Understanding how to calculate individual work rates and combine them allows you to solve various time and work-related problems effectively. In the case of Dave and Joe washing cars, knowing their rates enables you to determine how long it would take them working together to complete any given number of cars. Whether you're tackling homework problems, planning work schedules, or just curious about efficiency, mastering these concepts provides valuable skills for numerous real-world applications.

Summary of Key Steps

1. Calculate individual work rates by dividing the number of cars by the time taken.
2. Add individual rates to find combined work rate.
3. Use the formula: Time = Number of cars / combined work rate to find the total time.
4. Apply the method to various scenarios to build confidence and understanding.

By following these steps, you can confidently solve work rate problems involving multiple workers and different tasks, just like determining how long it would take Dave and Joe to wash a fleet of cars together.

Frequently Asked Questions

How many cars can Dave wash in 75 minutes?

The problem states that Dave washes 10 cars in 75 minutes, so he washes 10 cars in that time frame.

What is Joe's car washing rate per minute?

Joe can wash 6 cars in 30 minutes, so his rate is 6 cars / 30 minutes = 0.2 cars per minute.

How long would it take Joe to wash 10 cars at his rate?

At 0.2 cars per minute, washing 10 cars would take 10 / 0.2 = 50 minutes.

How does Dave's washing rate compare to Joe's?

Since Dave washes 10 cars in 75 minutes, his rate is 10 / 75 ≈ 0.133 cars per minute, which is slower than Joe's 0.2 cars per minute.

If both work together, how long would it take them to wash 10 cars?

Combined rate = 0.133 + 0.2 = 0.333 cars per minute. Time to wash 10 cars = 10 / 0.333 ≈ 30 minutes.

What is the key concept used to solve this problem?

The key concept is calculating individual rates and combining them to find the total time for a given number of cars.

Can we determine how long it takes Dave to wash a single car?

Yes, since he washes 10 cars in 75 minutes, his rate is 10/75 = 2/15 cars per minute, so time per car is 1 / (2/15) = 15/2 = 7.5 minutes.

Additional Resources

10 Cars Are Washed In 75 Minutes By Dave. Joe Can Wash 6 Cars In 30 Minutes. Find How Long It Would Take

Understanding how long it takes different individuals to complete tasks such as washing cars can seem straightforward at first glance but quickly reveals layers of complexity when examined closely. This problem, involving rates of work, is a classic example used to illustrate the principles of combined work rates and time calculations. It offers valuable insights into how productivity varies among individuals and how to accurately determine the time required for a group task based on individual efficiencies. In this article, we will analyze the problem comprehensively, explore the underlying mathematical concepts, and provide step-by-step solutions with detailed explanations.

Introduction to Work Rate Problems

Defining Work Rate and Its Significance

At the core of this problem lies the concept of work rate, which measures how much work an individual can accomplish per unit of time. When dealing with tasks such as washing cars, if a person can wash a certain number of cars in a given time, their work rate can be expressed as cars per minute or cars per hour. Understanding and manipulating these rates allows us to determine combined work times, compare efficiencies, and plan workloads effectively.

For example, if Dave washes 10 cars in 75 minutes, his work rate is:

- Work Rate of Dave = Total Cars / Total Time = 10 / 75 = 2/15 cars per minute

Similarly, for Joe:

- Work Rate of Joe = 6 / 30 = 1/5 cars per minute

Knowing these individual rates is critical to solving combined work problems.

The Importance of Consistent Units

Before proceeding with calculations, it's essential to ensure that all units are consistent. Typically, work rates are expressed per minute or per hour, and total work is measured in the number of cars. Converting all measurements to a common time base simplifies the calculations and reduces errors.

Analyzing the Given Data

Data Summary

Let's briefly restate the problem with the given data:

- Dave washes 10 cars in 75 minutes.
- Joe washes 6 cars in 30 minutes.
- The question: How long would it take for them to wash a certain number of cars together?

While the problem explicitly mentions the time taken by Dave and Joe individually, it is vital to understand what specific task we are analyzing. The key is to find the combined rate and then determine the time for a specific number of cars or the same task.

Calculating Individual Work Rates

Let's compute the work rates for Dave and Joe:

- Dave's work rate:

$$
R_D = \frac{10 \text{ cars}}{75 \text{ minutes}} = \frac{2}{15} \text{ cars per minute}
$$

- Joe's work rate:

$$
R_J = \frac{6 \text{ cars}}{30 \text{ minutes}} = \frac{1}{5} \text{ cars per minute}
$$

Expressed as decimals for clarity:

- Dave: approximately 0.1333 cars per minute
- Joe: 0.2 cars per minute

This means Joe is faster than Dave per unit time, which impacts the combined work rate.

Calculating Combined Work Rate

Adding Individual Rates

When two workers work together independently, their combined work rate is simply the sum of their individual rates:

$$
R_{combined} = R_D + R_J
$$

Substituting the values:

$$
R_{combined} = \frac{2}{15} + \frac{1}{5} = \frac{2}{15} + \frac{3}{15} = \frac{5}{15} = \frac{1}{3} \text{ cars per minute}
$$

This indicates that when working together, Dave and Joe can wash 1/3 of a car per minute.

Interpreting the Combined Rate

The combined rate of 1/3 cars per minute suggests that:

- Time to wash 1 car:

$$
T_{1} = \frac{1}{R_{combined}} = \frac{1}{1/3} = 3 \text{ minutes}
$$

- Time to wash 10 cars:

$$
T_{10} = 10 \times 3 = 30 \text{ minutes}
$$

This calculation assumes both are working simultaneously and continuously.

Applying the Results to the Original Problem

Understanding the Context

The key question is: If Dave can wash 10 cars in 75 minutes, and Joe can wash 6 cars in 30 minutes, how long would it take for both to wash the same number of cars together?

Given the combined work rate, we can determine how long it takes to wash any specified number of cars, for example, 10 cars, using the combined rate.

Calculating the Time for 10 Cars

From the previous section, the combined rate is 1/3 cars per minute.

- Time to wash 10 cars:

$$
T_{10} = \frac{\text{Number of cars}}{\text{Combined rate}} = \frac{10}{1/3} = 10 \times 3 = 30 \text{ minutes}
$$

This indicates that, working together, Dave and Joe can wash 10 cars in 30 minutes.

Verifying with Individual Data

Interestingly, the sum of individual work times for 10 cars:

- Dave:

$$
T_D = \frac{\text{Number of cars}}{\text{Dave's rate}} = \frac{10}{2/15} = 10 \times \frac{15}{2} = 75 \text{ minutes}
$$

- Joe:

$$
T_J = \frac{10}{1/5} = 10 \times 5 = 50 \text{ minutes}
$$

Since Dave alone takes 75 minutes, Joe alone takes 50 minutes, but together, they take only 30 minutes, demonstrating the efficiency gained through teamwork.

Extending the Analysis: How Long Would It Take for Different Numbers of Cars?

General Formula for Combined Work Rate

The previous calculations can be generalized. If an individual has a work rate R and the other R', then the total time T to wash N cars together is:

$$
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$$
T = \frac{N}{R + R'}
$$

This formula allows for flexible calculations depending on the number of cars and the individuals' efficiencies.

Examples of Different Scenarios

- Washing 15 cars:

$$
T = \frac{15}{1/3} = 15 \times 3 = 45 \text{ minutes}
$$

- Washing 20 cars:

$$
T = 20 \times 3 = 60 \text{ minutes}
$$

These calculations illustrate how increased workload impacts total time, and how cooperation speeds up task completion.

Implications and Practical Applications

Efficiency Improvements Through Teamwork

The analysis underscores the significant efficiency gains achievable through collaborative work. While individual work rates provide a baseline, combining efforts reduces the total time required for tasks. This concept is applicable across many industries, from manufacturing to service sectors, where teamwork leads to productivity enhancements.

Work Rate Problems in Real-World Contexts

Understanding work rates is essential beyond theoretical exercises. For example, in project management, estimating how long a team will take to complete a task requires analyzing individual contributions and their synergy. In logistics, combining the capacities of different vehicles or personnel to optimize delivery and service times relies on similar principles.

Limitations and Assumptions

While the calculations assume constant work rates and perfect cooperation, real-world factors such as fatigue, varying skill levels, and environmental conditions can affect actual performance. Therefore, these models serve as idealized estimates and planning tools rather than precise predictors.

Summary and Conclusions

This detailed exploration into the problem of washing cars highlights several key points:

- Work rate calculation is fundamental to solving combined work problems.
- Adding individual work rates provides the combined rate for teamwork scenarios.
- The time to complete a task can be calculated as the total work divided by the combined rate.
- Teamwork significantly reduces completion time, especially when individual efficiencies are combined effectively.
- The models and formulas discussed are versatile and applicable beyond the specific example, providing valuable insights into productivity and efficiency planning.

The problem of determining how long it takes for Dave and Joe to wash cars together not only reinforces core concepts of work rate mathematics but also demonstrates practical applications in real-world task management. The understanding gained from such problems helps improve efficiency strategies, optimize resource allocation, and foster collaborative efforts in various fields.

Final Thoughts

Mathematics offers powerful tools for analyzing and optimizing work processes. By breaking down tasks into rates and applying fundamental

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