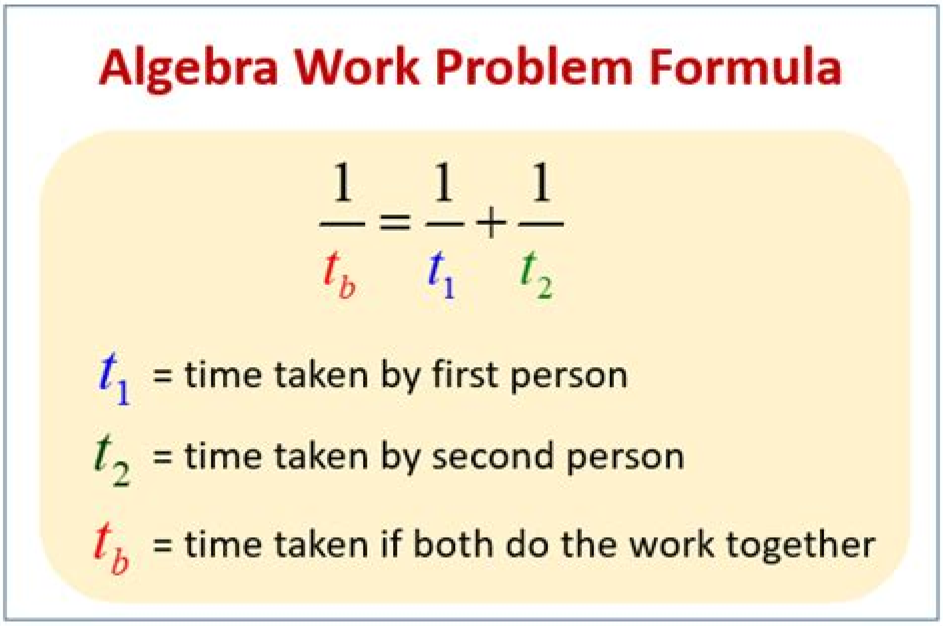
Work Word Problems With Solutions



Algebra Work Problem Formula

$$\frac{1}{t_b} = \frac{1}{t_1} + \frac{1}{t_2}$$

t_1 = time taken by first person
t_2 = time taken by second person
t_b = time taken if both do the work together

Work word problems can often be a source of confusion for students learning mathematics. They require not only an understanding of mathematical concepts but also the ability to translate real-world scenarios into mathematical equations. This article will explore various types of work word problems, provide step-by-step solutions, and offer tips for solving them effectively.

Understanding Work Word Problems

Work word problems typically involve scenarios where individuals or groups complete tasks at different rates. These problems can often be expressed using the formula:

$$\text{Work} = \text{Rate} \times \text{Time}$$

Where:
- Work is the total work done (often measured in tasks completed).
- Rate is the speed at which work is completed (tasks per unit of time).
- Time is the duration for which work is done.

When dealing with work problems, it's essential to identify all parties involved, their respective rates, and how long they work together or separately.

Types of Work Problems

Work problems can be categorized into several types:

1. Single Worker Problems: Involves one person completing a task.
2. Multiple Worker Problems: Involves two or more people working together.
3. Combined Work Problems: Involves individuals working together and then separately.
4. Rate Change Problems: Involves changes in work rates over time.

Each type requires a slightly different approach to solve.

Single Worker Problems

In single worker problems, the focus is on one individual completing a task.

Example Problem:
A painter can paint a room in 5 hours. How long will it take him to paint 3 rooms?

Solution:
1. Determine the rate of work. The painter paints 1 room in 5 hours. Therefore, his rate is:
$$ \text{Rate} = \frac{1 \text{ room}}{5 \text{ hours}} = 0.2 \text{ rooms/hour} $$

2. Calculate the time needed to paint 3 rooms:
$$ \text{Time} = \frac{\text{Work}}{\text{Rate}} = \frac{3 \text{ rooms}}{0.2 \text{ rooms/hour}} = 15 \text{ hours} $$

Thus, it will take the painter 15 hours to paint 3 rooms.

Multiple Worker Problems

In multiple worker problems, two or more individuals work together to complete a task.

Example Problem:
If Alice can complete a job in 10 hours and Bob can complete the same job in 15 hours, how long will it take them to complete the job if they work together?

Solution:
1. Calculate their rates:
- Alice's rate:
$$ \text{Rate}_A = \frac{1 \text{ job}}{10 \text{ hours}} = 0.1 \text{ jobs/hour} $$
- Bob's rate:

\[\text{Rate}_B = \frac{1 \text{ job}}{15 \text{ hours}} \approx 0.0667 \text{ jobs/hour} \]

2. Combine their rates:
\[\text{Combined Rate} = \text{Rate}_A + \text{Rate}_B = 0.1 + 0.0667 = 0.1667 \text{ jobs/hour} \]

3. Calculate the time to complete the job together:
\[\text{Time} = \frac{1 \text{ job}}{0.1667 \text{ jobs/hour}} \approx 6 \text{ hours} \]

So, working together, Alice and Bob can complete the job in approximately 6 hours.

Combined Work Problems

Sometimes, workers may start together but finish separately.

Example Problem:
John can complete a task in 8 hours, and Sarah can complete the same task in 12 hours. If they work together for 2 hours and then John leaves, how long will it take Sarah to finish the task?

Solution:
1. Calculate their rates:
- John's rate:
\[\text{Rate}_J = \frac{1 \text{ task}}{8 \text{ hours}} = 0.125 \text{ tasks/hour} \]
- Sarah's rate:
\[\text{Rate}_S = \frac{1 \text{ task}}{12 \text{ hours}} \approx 0.0833 \text{ tasks/hour} \]

2. Calculate the work completed in 2 hours:
\[\text{Work in 2 hours} = 2 \text{ hours} \times (\text{Rate}_J + \text{Rate}_S) \]
\[= 2 \times (0.125 + 0.0833) \approx 0.4167 \text{ tasks} \]

3. Calculate the remaining work:
\[\text{Remaining Work} = 1 - 0.4167 \approx 0.5833 \text{ tasks} \]

4. Calculate the time for Sarah to finish the remaining work:
\[\text{Time} = \frac{0.5833 \text{ tasks}}{0.0833 \text{ tasks/hour}} \approx 7 \text{ hours} \]

Thus, after John leaves, it will take Sarah approximately 7 hours to finish the task.

Rate Change Problems

In rate change problems, the work rate may change over time, which adds a layer of complexity.

Example Problem:
A machine can produce 100 widgets in 4 hours. After 2 hours, the machine breaks down, and it takes 1 hour to repair it. After the repair, the machine works at half its original speed. How many widgets does it produce in total?

Solution:
1. Determine the original rate of production:

$$ \text{Rate} = \frac{100 \text{ widgets}}{4 \text{ hours}} = 25 \text{ widgets/hour} $$

2. Calculate the production in the first 2 hours:

$$ \text{Widgets produced in 2 hours} = 2 \text{ hours} \times 25 \text{ widgets/hour} = 50 \text{ widgets} $$

3. After 2 hours, the machine breaks down for 1 hour, during which no widgets are produced.

4. After repair, the new rate is half of the original:

$$ \text{New Rate} = \frac{25 \text{ widgets/hour}}{2} = 12.5 \text{ widgets/hour} $$

5. Determine how much time remains for production:
- Total time = 4 hours,
- Time spent = 2 hours (production) + 1 hour (repair) = 3 hours,
- Remaining time = 1 hour.

6. Calculate widgets produced in the remaining hour:

$$ \text{Widgets produced after repair} = 1 \text{ hour} \times 12.5 \text{ widgets/hour} = 12.5 \text{ widgets} $$

7. Total widgets produced:

$$ \text{Total} = 50 + 12.5 = 62.5 \text{ widgets} $$

Therefore, the machine produces a total of 62.5 widgets.

Tips for Solving Work Word Problems

To effectively solve work word problems, consider the following strategies:

- Read Carefully: Understand the problem thoroughly before attempting to solve it. Identify key information and what is being asked.

- Identify Rates: Establish the rate for each worker or machine involved in the problem.

- Use the Formula: Remember the work formula \(\text{Work} = \text{Rate} \times \text{Time} \) to set up your equations.

- Break it Down: If the problem is complex, break it down into smaller parts that are easier to manage.

- Check Your Work: After solving, revisit the problem to ensure that your answer makes sense in the context of the question.

Work word problems can be challenging, but with practice and the right strategies, anyone can become proficient in solving them. Understanding how to set up the equations correctly and apply the work formula is crucial for success in these types of problems.

Frequently Asked Questions

If a worker can complete a task in 8 hours, how much of the task can they complete in 2 hours?

The worker can complete 1/4 of the task in 2 hours.

Two workers can finish a job in 12 hours together. How long will it take for one worker to finish the job alone?

It will take one worker 24 hours to finish the job alone.

If a factory produces 300 units in 5 hours, what is the production rate in units per hour?

The production rate is 60 units per hour.

A team of 4 people can complete a project in 10 days. How long will it take for 2 people to complete the same project?

It will take 20 days for 2 people to complete the project.

If a machine can process 100 items in 10 minutes, how many items can it process in 1 hour?

The machine can process 600 items in 1 hour.

A painter can paint a house in 15 hours. How much of the house can they paint in 5 hours?

The painter can paint 1/3 of the house in 5 hours.

If 3 engineers can complete a software project in 6 weeks, how many engineers are needed to complete it in 4 weeks?

5 engineers are needed to complete the project in 4 weeks.

A gardener can plant 50 flowers in 2 hours. How many flowers can they plant in a full 8-hour workday?

The gardener can plant 200 flowers in an 8-hour workday.

If a delivery truck can deliver 200 packages in 4 hours, how many packages can it deliver in 1 hour?

The delivery truck can deliver 50 packages in 1 hour.

A writer can produce 1000 words in 2 hours. How many words can they write in a 5-hour session?

The writer can produce 2500 words in a 5-hour session.

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