## Distance Rate and Time

## Cambridge IGCSE

**Note:** This is not a unique concept and has a simple formula to guide answering questions involving the topic. However, it is so misunderstood by students that it worth a brief exploration on our part.

The first issue is that sometimes students are taught three separate formulas, depending on what information is provided and which is missing. While this is done to alleviate possible algebraic mistakes, this prevents students from developing those algebraic skills and also makes the relationships between distance, rate, and time, unclear.

### Big Idea

The formula $D = rt$, is something that students can easily see as be literally valid. How far a car travels depends on how fast it is going and the duration of time. Because of this relationship, we can discover a value if we know two others.

### Key Knowledge

The basic skill required is the ability to substitute values and perform simple inverse operations. There are two other abilities that often come into play. The first is the ability to read and understand at a level that allows the translation of English into math. This is the most elusive of the skills. The second is the ability to translate between units.

### Pro-Tip

Start by writing the formula, $D = rt$. After understanding the situation and identified possible pitfalls, the algebra will be easy. Just plug the appropriate information into the formula and solve for what is needed.

A good lesson will create cognitive dissonance by exposing misconception. Nearly everything we teach in math is in some way familiar and related to a potential misconception. To make the most of this with a topic like Distance, Rate, and Time, which is a review topic for most U.S. students, it is best to allow and encourage students to engage in a series of problems initially. Allow them to make mistakes, or pursue methods that are inefficient.

After students make their mistakes perhaps show examples of correct and efficient work and allow them to compare what they did to exemplary work. After realization that there is a better way, you can explore the "right" way and students will see its value.

Here's how you can do this.

Start class with a small handout of the three problems below.

Instructions. Answer each question and show your work.

1. Roberto is driving a semi-truck that is 12 meters in length. He is traveling at 72 kilometers per hour and crosses a 60 meter bridge. How long, in seconds, does it take Roberto to cross the bridge?

2. Brenda is driving from Boston to Atlanta. The trip will take about two days. She leaves Boston on Tuesday morning at 6:30 AM. She drives an average speed of 72 miles per hour before stopping for the night at 5:15 PM. How far did she travel on day one?

3. On the second day, Brenda leaves at 6:45 AM and travels the final 383 miles at an average of 68 miles an hour. At what time did she arrive in Atlanta?

Once students have tried all of the problems work through each problem individually in a way that causes students to think about efficiency and correctness. A good way to do this is to use a document camera to compare various approaches. Have students discuss which was right and why, and if there were possible improvements in approach for either approach.

After working through each of these problems have students summarize what they learned about these types of problems in their notes. Then have them attempt another problem, or set of problems. An example follows. The example problem is perhaps crude, but mathematically sound, visual, and for students, engaging.

1. People on the internet claim that fluid from a sneeze travels 100 miles per hour. Show that 100 miles per hour is 1.42 meters per second, correct to three significant figures.

2. If a student sneezes from his desk without covering his nose, and the student in front of him is 82 centimeters away, how long does it take before the nasal fluid strikes the student?

If you wish to guide students on the problem perhaps ask: What is it about the problem that might be forgotten if a student starts calculation too quickly?