

What time is it?



DAVID DE LOSSY/THINKSTOCK

We live in an increasingly digital world filled with modern technology that is quickly replacing most of our analog world, and yet some tools from the past, such as the analog clock, remain. In this problem scenario, students will try to determine the passage of elapsed time using images from watch faces that have only hour hands.

Problem scenario

On the weekend, I decided to have an afternoon nap. Just before I went to sleep, I looked at an old pocket watch and saw this. [Point out the first image of a pocket watch shown on the student activity sheet on p. 267.]

When I woke up, I looked at the pocket watch again and saw this. [Show the second image of a pocket watch and ask, “What are some questions you are thinking about?” (See the activity sheet for additional questions.)]

Classroom setup

Before presenting the problem to your students, you will need to gather some materials:

- A large piece of paper for each pair or group of students to record their solutions
- Pens or markers
- Pictures of the clock images on **page 267**
- A digital camera or a smartphone or tablet with a camera

Present the problem scenario to your students using the pictures as props that can be left on display in the classroom for reference. You may need to define what a pocket watch is. Consider having students develop questions from this context, such as “What time was it when you went to sleep?” “What time was it when you woke up?” and “How long did you sleep?” Have your students turn to an “elbow partner” to discuss which questions they will answer today. Ask one student to share today’s questions with the rest of the class to ensure understanding of the task. Organize students in pairs or triads to solve the problem. Distribute the activity sheet or paper for students to record their answers.

As students are working, walk around the classroom and observe the strategies they

are using to solve the problem. You may want to take some pictures with a digital camera, a smartphone, or a tablet to help gather evidence of students' thinking during the solution process. Try not to tell students how to do the math, but use questions to stimulate their thinking, such as the following:

- Is that the minute hand or the hour hand? How do you know?
- About what time did I fall asleep? How do you know?
- Can you find out exactly what time I fell asleep?
- Where would the hand point if the time was exactly 1:30?
- What do you think each one of those little lines means?
- About what time did I wake up? How do you know?
- About how long did I sleep?

Where's the math?

Some people may wonder why we continue to teach students how to tell time using the analog clock if our world is becoming digital. Others support the inclusion of this topic in the math curriculum, citing the continued existence of analog clocks in our world. The analog clock provides a representation of time that allows for quick visual calculations of future times based on fractional amounts that would require computation with a digital clock.

This problem context offers students the opportunity to explore the structure and organization of an analog clock by challenging students to determine the exact time using only the hour hand. To find the answer, students must use prior knowledge of an analog clock to determine which hand is present on the watch and what unit that hand represents. They will also need to use fractional understanding of the division of time in hours and minutes on the watch face to determine the exact time.

Most students will begin determining the hour by noticing which hours the hand is between. As they attempt to find a more precise time, many students will extend the hour hand using a ruler to determine its location in relation to the halfway point between the hours. In an effort to find the exact time, some students may try to determine the number of minutes that pass each time the hour hand moves to the next minute mark on the watch.



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When the class has solved the problem, select students to share their solutions with the whole class. Begin by focusing on different solutions for the time you fell asleep. For example, one solution might suggest the time was 1:07, mistakenly assuming the hour hand would signify both the hour and the number of minutes. Another solution might suggest that it was about 1:30, and a third solution might propose that it was not quite 1:30. Continue with discussions about solutions for the second clock and the elapsed time for the nap.

As you display the solutions, you could ask questions of the class to prompt discussion:

- Do you have any questions about this solution?
- Which answer is correct?
- Why do you think it has to be between 1:00 and 1:30?
- Is there a way we could find out exactly what time it was?

- How many marks are between the hours?
- How much time passes between each mark?
- How did these students figure out how long I slept?

As class members share ideas, create a list on the board or on chart paper to record students' thinking.

Extensions and modifications

Provide students who finish early with the challenge of determining how many minutes or how many seconds the nap lasted. Alternatively, you could present an additional question that asks students to draw the hour hand on a blank watch face for a specific time.

Determining the approximate times on each watch face may appropriately challenge some students. Other students may need the support of an analog clock manipulative that has both the hour and minute hands.

Share your students' work

Try this problem in your classroom. We are interested in how your students responded to the problem, which problem-solving strategies they used, and how they explained or justified their reasoning. Send your thoughts and reflections—including information about how you posed the problem, samples of students' work, and photographs showing your problem solvers in action—by **March 1, 2015**, to Problem Solvers department editor Ed Enns, Waterloo Region District School Board, Learning Services, 51 Ardelet Avenue, Kitchener, ON N2C 2R5, or email him at ed_enns@wrdsb.on.ca. Selected submissions will be published in a subsequent issue of *TCM* and acknowledged by name, grade level, and school name unless you indicate otherwise.

Edited by **Ed Enns**, an elementary school learning services consultant with the Waterloo Region District School Board in Canada. Each month, this section of the Problem Solvers department features a new challenge for students. Readers are encouraged to submit problems to be considered for future columns. Receipt of problems will not be acknowledged; however, those selected for publication will be credited to the author. Find submission guidelines for all departments at www.nctm.org/tcmdepartments.

Show off your students!

Each month, the Problem Solvers department features a challenging mathematics problem for you to try with your students. Take notes as your students tackle the problem, and then share with us any insights you gain from observing their efforts. Department editors compile teacher reflections and student results, which appear in the Problem Solvers: Solutions section of a subsequent issue of the journal.

Sharing your students' work makes a valuable contribution to the journal, and it is fun to see your input in print. Details about how to contribute appear under the heading **Share your students' work** in the Problem Solvers: Problem section of each issue.



Name _____



What Time Is It?

Just before I took a nap, I looked at an old pocket watch and saw this (the picture on the left). When I woke up, I looked at the pocket watch again and saw the second clock.



1. What time was it when I fell asleep?

2. What time was it when I woke up?

3. How long did I sleep?