

Elapsed Time

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Summary	A variant of the train crash problem is used to address questions about elapsed time. The task is to determine where a train is, given a certain time.
Goals	<ol style="list-style-type: none">1. Work with non-integer values of elapsed time (e.g. $3\frac{1}{2}$ hours, 1.25 hours).2. Plug such values into algebraic expressions, obtaining answers in (non-integer values of) position.
Materials	Overheads, Handouts
Keywords	Contextualized Situations Fractions Full Class Discussion Function Representations Interpretation of Algebraic Expressions Interpretation of Stories Linear Functions Production of Tables
Hints	Make certain that students appreciate the kind of units being considered at each moment in a computation. They also should be able to nimbly move between the world of algebraic expressions to the world of the trains.



Activity Plan:

This class has three parts. In Part I, we discuss time intervals: (a) on analog clock-faces; (b) as digital expressions (hours and minutes); (c) as hours and minutes elapsed; (d) and as fractions (mixed or not) of hours. Students work on handouts involving multiple ways to express elapsed time.

In Part II, we deal with the multiplication of (fractional values of) elapsed time by speed, giving results in km. The handout they work on has them inserting various time intervals into the formulas for positions of train A (see problem from previous lesson).

For homework (Part III), they do problems similar to the ones in Parts I and II. (Train B is used for the homework).


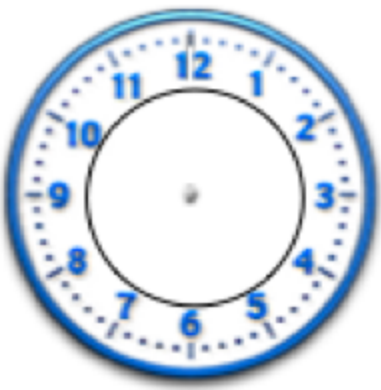
Part I: Elapsed Time: Fractional Parts of Hours [40 min; uses Handout pages 2 & 3]

1. Discuss Elapsed Time With the Class [15 min.]

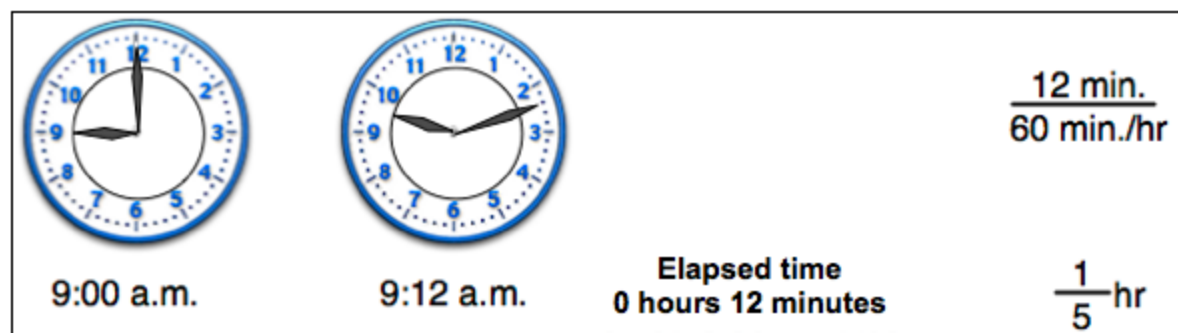
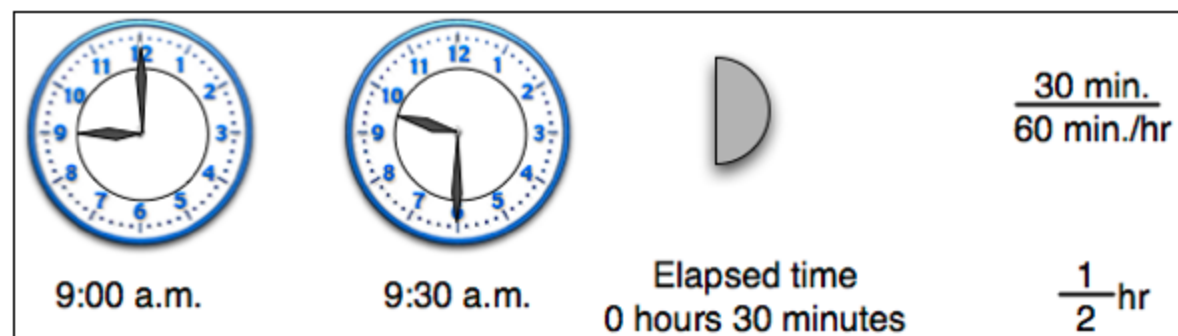
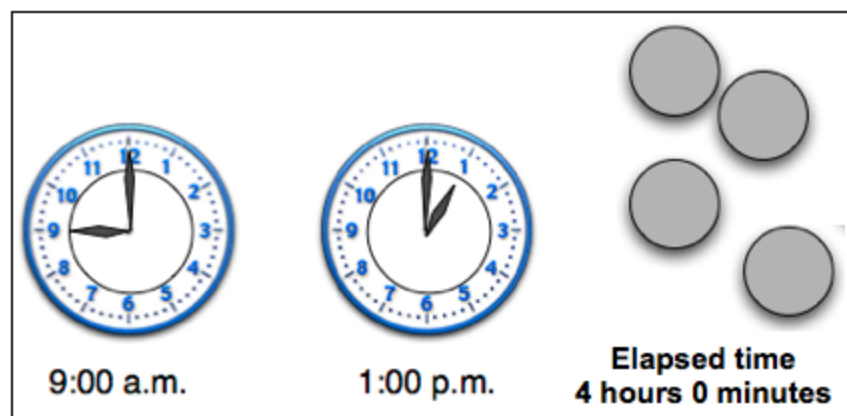
During the last lesson, several students were puzzled about fractional (and decimal) expressions of elapsed time. This introduction will address the issues with fractional expressions. However, it cannot fully 'solve' all of the matters that might arise, and we will not consider decimal expressions.

Go over several intervals to make sure that students can move among the diverse representational forms.

This is the template (see Overhead 1, Page 1) that you may wish to have multiple copies of.

Start Time	End Time	Elapsed Time
		

The examples below show some items you may wish to discuss using Overhead 1 (Page 1). But in the lesson, elicit times and values from students; don't provide all the values.



2. Distribute & then discuss Handout (Pages 2 & 3) [25 min.]

Display Handout (Pages 2 & 3) and go over the instructions. Students are to fill in the table using times of their own.

When they are done, collect the handouts and discuss various issues that arose: things kids were unsure of, how to get from hours, minutes to fractional values, etc.

Part II. Using Elapsed Time in a Formula [40 min; uses Handout Page 5]

1. Recall the formulas for the trains (10 min.)

Remind students of the train problem from Lesson 5-13, shown on Overhead 2 (Page 4). Today we're going to focus on the formulas that were used in the example.

Train A $a(h) = 25 + 50h$

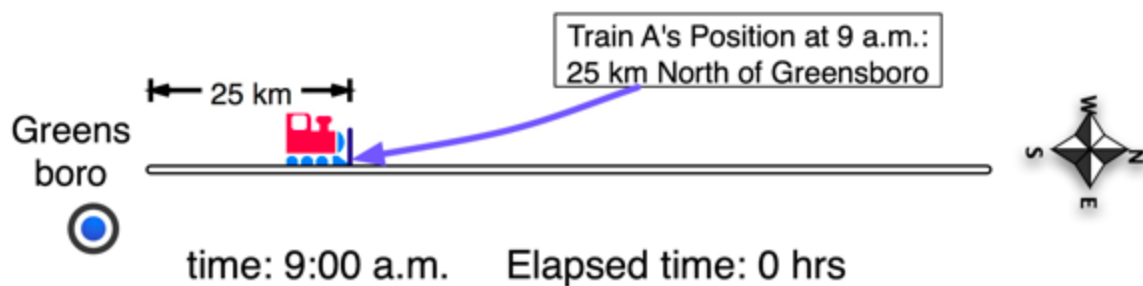
Train B $b(h) = 175 - 70h$

Here are some questions to consider discussing with students.

- *What units are associated with the 25, h, 50, and a(h)*
- *When you know the value of a(h) what does it tell you?*
- *How do you figure out where a train is?*

2. Explain handout (Page 5), and discuss (calculating position from elapsed time—25 min.)

Go over the new, horizontal diagram of the trains so that the students know that it refers to the same trains as in 5-13. However, this week we assume they do not crash.



Before handing out the worksheet/handout (Page 5), use the overhead (Page 5) to go through the first two examples, namely, the cases where the elapsed times are 1 and 1 ½ hours.

The first case is relatively straightforward.

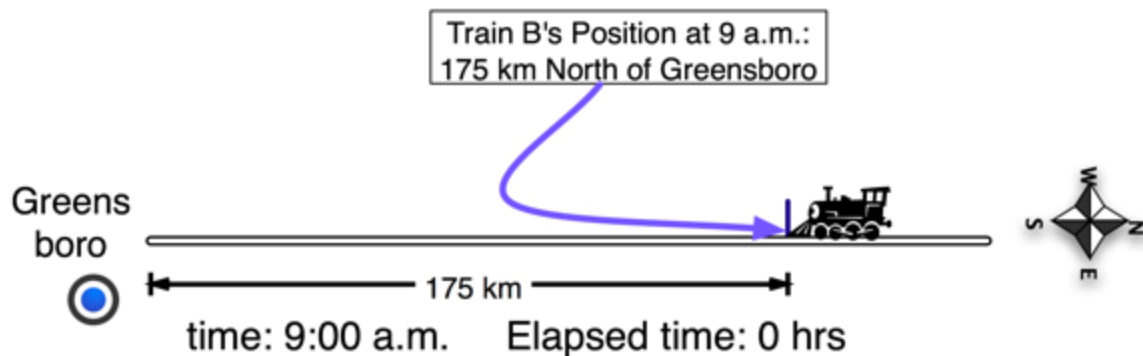
The second, as shown, involves breaking up the multiplication by 50 km/hr into two parts (first by one, then by one half). It therefore makes use of the distributive law.







Elapsed [hours, minutes]	Elapsed [hrs]	Position $25 + 50h$	Position [km]	Position [km]
1h 0 min	1 h	$25 + 50 \times (1)$	$25+(50 \times 1)$	$25+(50)=$
1h 30 min	$1\frac{1}{2}$ h	$25 + 50 \times (1\frac{1}{2})$	$25+(50 \times 1)+(50 \times \frac{1}{2})$	

Discuss the results kids got in their tables. Make sure they understand what the answer in the last column means.

Part III. Homework [10 min; uses Handout Page 6 —Homework]

- Exactly like Handout Page 5. However, this we are considering the path of Train B.











Start Time	End Time	Elapsed Time
		
		
		

Overhead and Handout: Time Elapsed









(Page 2)

Name: _____ Date: _____

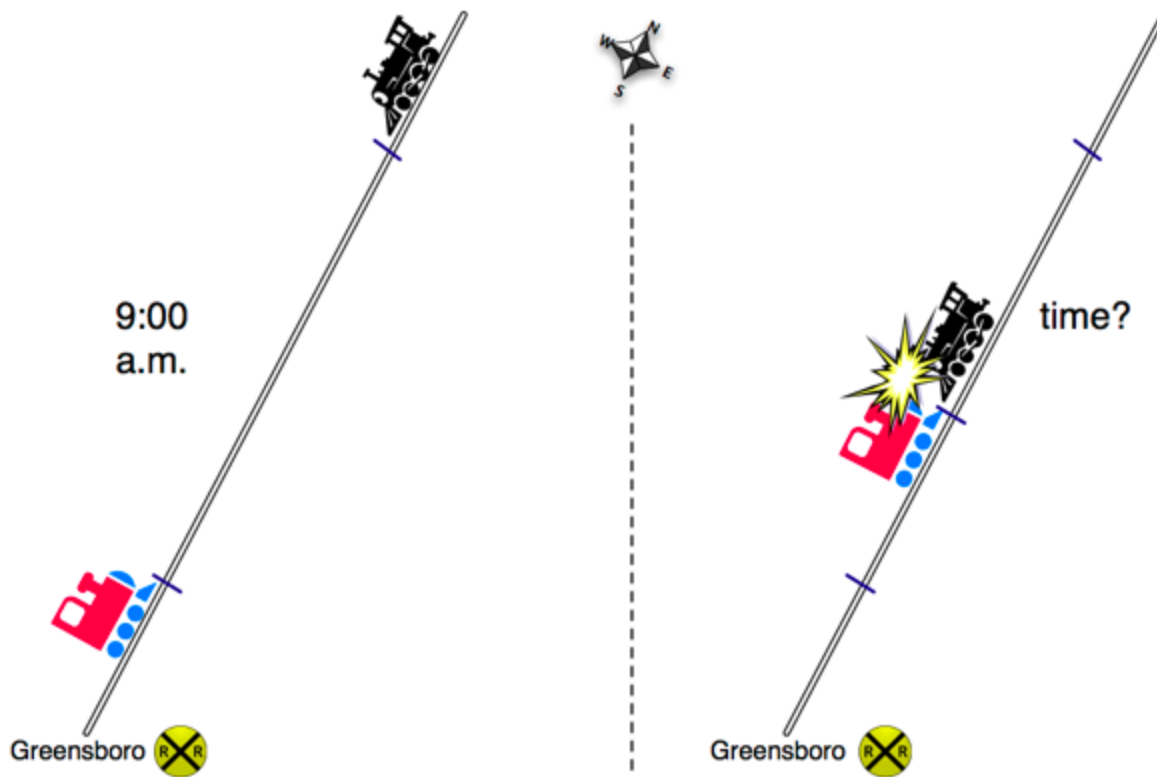
Start Time	End Time	Elapsed [hours, minutes]	Elapsed [hrs]
 10:15 a.m.	 11:30 a.m.	1h 15 min	$1\frac{15}{60}$ h $1\frac{1}{4}$ h $\frac{5}{4}$ h
 11:15 a.m.	 11:30 a.m.		$\frac{1}{4}$ h
 10:00 a.m.	 11:00 a.m.		h
 10:00 a.m.	 11:00 a.m.		h

Overhead and Handout: Time Elapsed**(Page 3)**

Name: _____ Date: _____

Start Time	End Time	Elapsed [hours, minutes]	Elapsed [hrs]
 10:15 a.m.	 11:30 a.m.		
			
			
			

Overhead 2: Formulas for Obtaining Position from Elapsed Time (Page 4)



Formula For Train A:

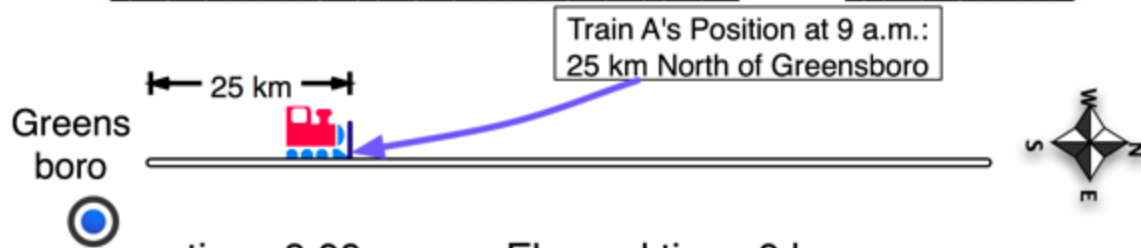
$$a(h) = 25 + 50h$$

Formula for Train B:

$$b(h) = 175 - 70h$$

Overhead and Handout: Using Time Elapsed to Find Position of Train (Page 5)

Name: _____ Date: _____



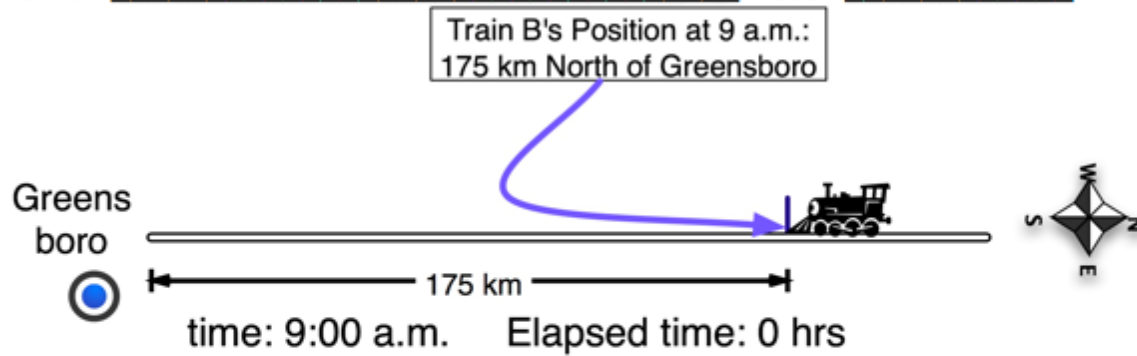
$$a(h) = 25 + 50h$$

Elapsed time [hrs,min]	Elapsed time [hrs]	Position $25 + 50h$	Position [km]	Position [km]
0h	0 h			
1h 0 min	1 h	$25 + 50 \times (1)$	$25+(50 \times 1)$	$25+(50)=$
1h 30 min	$1\frac{1}{2}$ h	$25 + 50 \times (1\frac{1}{2})$	$25+(50 \times 1)+ (50 \times \frac{1}{2})$	
2h	2 h	$25 + 50 \times (2)$		
2h 30 min	$2\frac{1}{2}$ h			
3h		$25 + 50 \times ()$		
3h 30 min				
4h				

Homework: Position of Train B

(Page 6)

Name: _____ Date: _____



$$b(h) = 175 - 70h$$

Elapsed time [hours, minutes]	Elapsed time [hrs]	Position $175 - 70h$	Position [km]	Position [km]
0h	0 h			
0h 30 min	$\frac{1}{2}$ h	$175 - 70 \times (\frac{1}{2})$	$175 - (70 \times \frac{1}{2})$	$175 - 35 =$
1h	1h	$175 - 70 \times ()$		
1h 30 min	$1\frac{1}{2}$ h	$175 - 70 \times (1\frac{1}{2})$	$175 - (70 \times 1) - (70 \times \frac{1}{2})$	
2h	2 h	$175 - 70 \times (2)$		
2h 30 min	$2\frac{1}{2}$ h	$175 + 70 \times ()$		
3 h	3 h			