

Trains In Motion

ID: 11194

 Time required
 15 minutes

Activity Overview

In this activity, students will make observations about the motion of two objects. They will compare and contrast this motion and consider how it corresponds to a graph representing distance as a function of time. As an extension, students will explore the relationship between the slope and the rate.

Topic: Linear Equations & Functions

- *Motion, distance = rate · time*
- *Slope, graphically expressing data*

Teacher Preparation and Notes

- *This activity can serve as a nice introduction to using formulas and graphs to represent a real-life situation.*
- *The student worksheet provides instructions and questions to guide the inquiry and focus the observations.*
- *Be sure to add the program to each student's graphing calculator.*
- ***To download the calculator file and student worksheet, go to education.ti.com/exchange and enter "XXXXX" in the quick search box.***

Associated Materials

- *Alg1Week05_TrainsInMotion_worksheet_TI-84.doc*
- *TRAINS (program)*

Suggested Related Activities

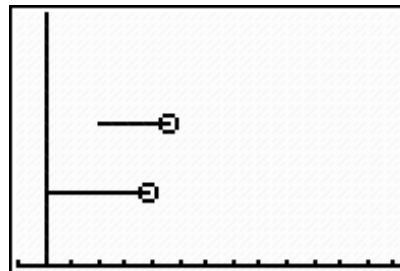
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Linear Function (TI-84) — 4419*
- *Walk This Way: Definition of Rate (TI-84) — 3971*
- *Slope as rate of change (TI-84) — 10178*
- *Tables and Linear Relationships (TI-Nspire) — 10884*

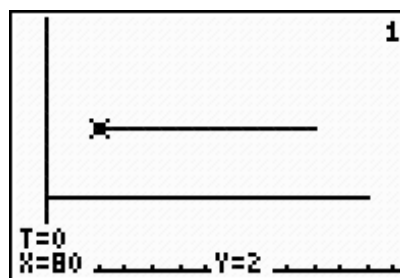
In this activity, students use the program **TRAINS** to view two graphs. Make sure that students have loaded the program before beginning the activity. The first graph is of two trains leaving a train station. The second is the distance-time graph of this motion.

Problem 1 – Observe Motion

After selecting the first option of the program **OBSERVE MOTION**, students will see two lines and a circle that travels each line. The circle represents the trains. Explain to students that even though the lines (tracks) stop, in the real world the train tracks would continue on. Also, students should pretend that there is track connecting the first train to the station.



When students press \$, three values will appear at the bottom of the screen. The **T-value** represents time and the **X-value** represents distance. Students can disregard the Y-value.



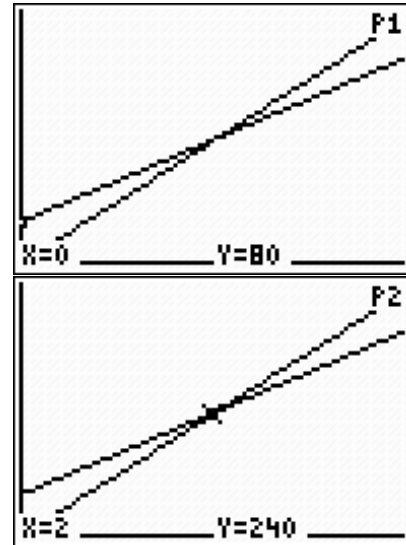
Students can press ` M to return to the Home screen after answering the questions on the worksheet. Pressing e right away will return them to the program menu.

Answers to the worksheet questions.

1. Answers will vary, but the following question should complement their answers.
2. When $t = 0$, train 1 is at 80 km.
3. Train 2 starts at the origin.
4. Train 2 is moving faster.
5. Train 2 is traveling at 120 km/hr.
6. Train 1 traveled 80 km in one hour.
7. Train 1's speed is 80km/hr.
8. They are at the same distance from the station at 240 km.
9. This occurs at 2 hours.

Problem 2 – Distance-Time Graph

After selecting the second option of the program **DIST VS TIME**, students will see two lines with positive slopes, which intersect each other.



When students press \$, two values will appear at the bottom of the screen. The **X-value** represents time and the **Y-value** represents distance. In the upper right corner of the screen, **P1** or **P2** will appear. Students will determine that P1 represents train 1 and P2 represents P2.

Students should understand that the intersection point of the two lines is the time at which the trains are equal distance from the station.

Pressing ` M will return students to the Home screen.

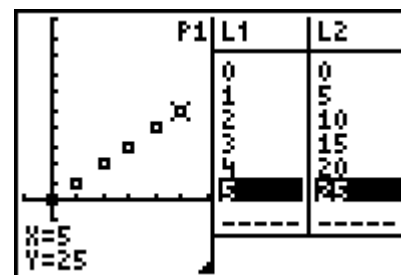
Answers to the worksheet questions.

- 10. Train 2 has a steeper slope.
- 11. The slope is the speed or *rate* of change of distance.
- 12. a) y-intercept of train 1 is 80.
b) y-intercept of train 2 is zero.
- 13. This indicates their starting location.
- 14. train 1: $d = 80t + 80$, train 2: $d = 120t$
Also acceptable would be $y = 80x + 80$ and $y = 120x$
- 15. $80t + 80 = 120t \rightarrow 80 = 40t \rightarrow t = 2$ hr

Extension: Problem 2 – List of $d = r \cdot t$ Data


This extension introduces a numeric and graphical exploration. Students begin by determining what the next time and distance values would be in the list.

- 16. 5 hr, 25km/hr



Students then are instructed to go to the data lists and change the data depending upon a different *r* value. They are instructed to observe both the graph and the data when the *r* value is changed.

17. When r gets larger, the slope gets steeper.
 When r decreases, the slope is less steep.

L1		L3	2
0	0	-----	
1	6		
2	12		
3	18		
4	24		
5	30		
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L2 = L1 * 6			