

## Finding the Equation of a Straight-line passing through two points

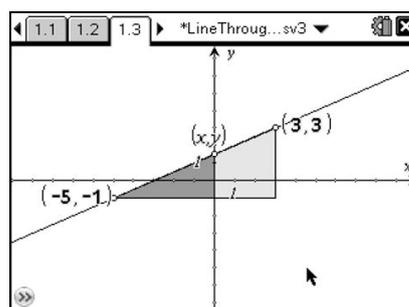
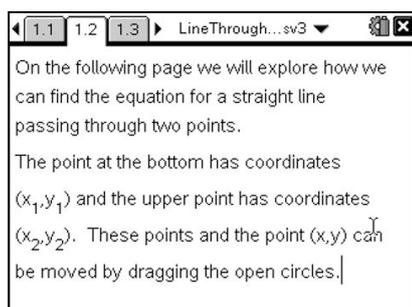
### Introduction

**Mathematical Content:**  
Equations of Straight Lines  
Similar Triangles

**Technical TI-Nspire Skills:**  
Manipulating Points  
Questions & Answers

Being able to find the equation of a straight line that passes through two given points is an important skill that crops up in many areas of mathematics. This activity helps students understand the method for finding the formula that gives the equation of this straight line:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1}$$



The task begins by encouraging students to look at the relationship between the larger light-grey triangle formed by two given points and a smaller darker-grey triangle formed by a general point on the line and the first point. Students should explore the situation by dragging the two given points that determine the line and the general point  $(x, y)$  on the line. This should encourage students to observe that the two triangles are mathematically similar.

In the second part of the activity students can use the formula to find the equation of two particular points and use the TI-Nspire to check their answer in two different ways.

## Finding the Equation of a Straight-line passing through two points Student Worksheet

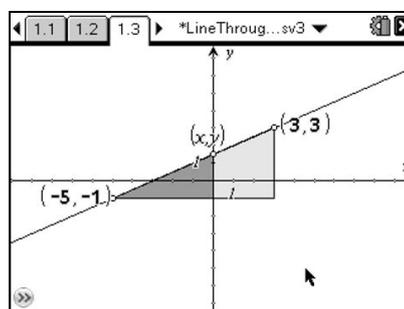
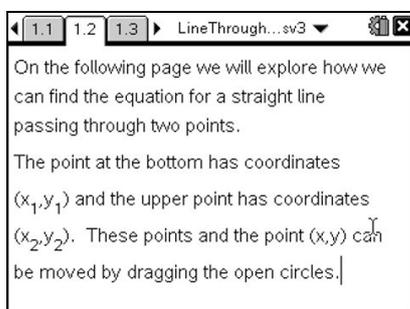
*In this task you will explore how you can find the equation of straight line that passes through two points.*

To complete this task you need to open the **LineThrough2Points.tns**. The activity begins with an introductory page. To move to the next page press **(ctrl) ▶**.

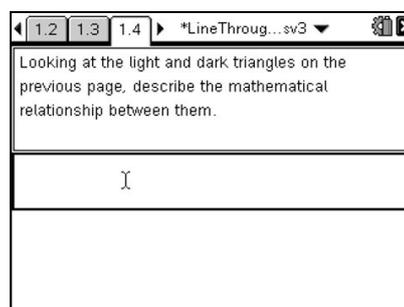
### Task 1:

On page 1.2 you will find instructions describing the task to be completed on the following pages. On page 1.3 you will see a straight line joining two points with given coordinates and a general point with variable coordinates  $(x,y)$ . These points have been used to define two triangles. In this task you are encouraged to explore the relationship between the larger light-grey triangle formed by two given points and a smaller darker-grey triangle formed by the general point and the first point.

Explore the situation by re-positioning the two given points that define the line and then sliding the general point  $(x,y)$  along the line.

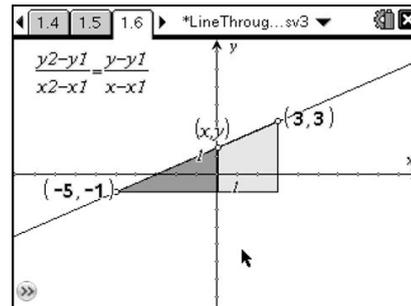


On page 1.4 you are asked to describe the mathematical relationship that remains true of the two triangles no matter where you drag the three movable points.



Page 1.5 summarises the relationship you should have found and outlines how this may be useful to help you find the equation of the line.

On page 1.6 you can again look at the equation of the line with addition of the result outlined on the previous page. This should help you understand how you might be able to use this result to find the equation of the straight line.



## Task 2:

The results you found in the previous task can now be applied to a particular example. You may need to complete this on paper

### Notes:

The calculator screen shows an example problem: "Suppose a line passes through  $(-5, -1)$  and  $(3, 3)$ ." Below this is the point-slope formula:  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1}$ . The text continues: "Substitute the appropriate values into this formula to find the equation of the line and rearrange it into  $y = mx + c$  form."

When you are happy that you have an answer you can enter it on Page 1.8, and then check your answer by pressing and selecting "Check Answer".

Finally on Page 1.9 you can check the equation of the line graphically. Move the points to  $(-5, -1)$  and  $(3, 3)$  and the TI-Nspire will display the equation of the line.

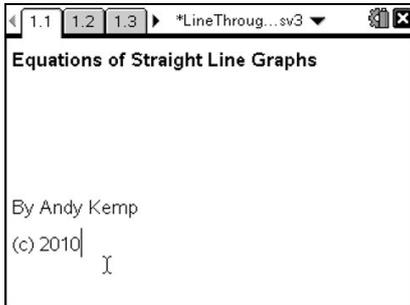
The calculator screen displays the question: "What is the equation of the line which passes through  $(-5, -1)$  and  $(3, 3)$ ?" Below the question is a blank input field with a cursor.

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## Detailed Notes for teachers

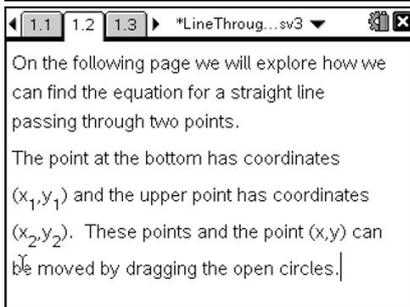
These notes briefly describe the content of each page and draw attention to any important elements

Page  
1.1



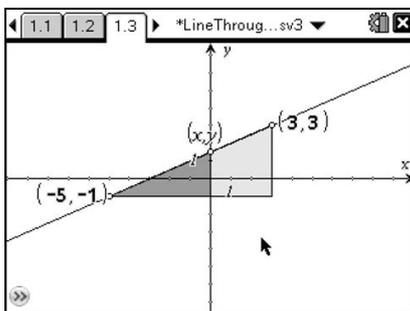
This first page is the title page.

Page  
1.2



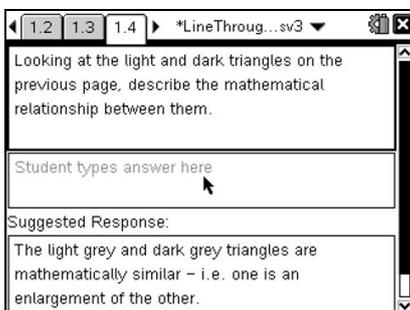
This page outlines instructions for Page 1.3.

Page  
1.3



On this page there is a line that passes through two points whose coordinates are displayed. These points are movable though, for simplicity, they have been restricted to move only to points with integer coordinates. There is a third general point on the line. Students are encouraged to explore moving these points around and to identify that the two triangles are similar.

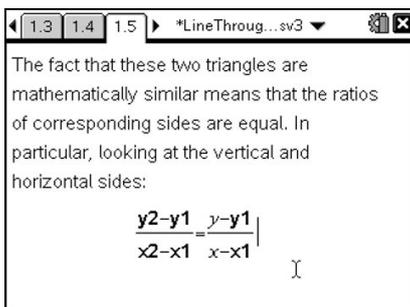
Page  
1.4



On this page students are encouraged to express the relationship they found on Page 1.3.

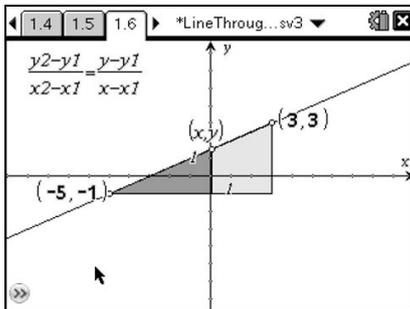
When the student has entered an answer, it can be checked by pressing  2 to select "Check Answer".

Page  
1.5



On this page the student is reminded of one of the properties of mathematical similarity – ratios of corresponding sides are equal.

Page 1.6



Students can look again at the graphical representation and see how the equation presented on Page 1.5 is related to the two triangles.

Page 1.7

Example:  
Suppose a line passes through  $(-5, -1)$  and  $(3, 3)$ .

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1}$$

Substitute the appropriate values into this formula to find the equation of the line and rearrange it into  $y = mx + c$  form.

On this page students are encouraged to use the result they have found to find the equation of the line passing through two particular points.

Page 1.8

What is the equation of the line which passes through  $(-5, -1)$  and  $(3, 3)$ ?

Students are encouraged to write the equation of the straight line through the two points,  $(-5, -1)$  and  $(3, 3)$ .

Page 1.9

Suggested Response:

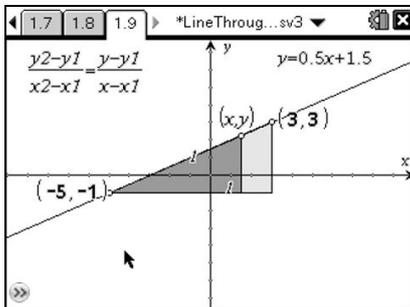
Using the previous result:

$$\frac{3 - (-1)}{3 - (-5)} = \frac{y - (-1)}{x - (-5)}$$
$$\frac{1}{2} = \frac{y + 1}{x + 5}$$
$$\frac{1}{2}(x + 5) = y + 1$$

So,  $y = \frac{1}{2}x + 1\frac{1}{2}$

The student should hopefully respond:  $y = \frac{1}{2}x + 1\frac{1}{2}$

When the student has entered an answer, it can be checked by pressing **menu** **2**.



On the final page the calculated equation of the line is displayed. Students can move the points to check their answer from page 1.8.

There is also the opportunity to get a dynamic feel for how the equation of the line changes as the defining points are moved.