

**Subject:** Mathematics

**Level:** S.2

**Topic:** Coordinate Geometry of Straight Lines

**Sub-topic:** Introduction to Slope / Gradient of a Straight Line

**Background information:**

This activity is to be used in the second lesson of the topic on Coordinate Geometry of Straight Lines. Students have learnt the concepts of ratio and similarity of figures in S1. In the first lesson of this topic, students have learnt the distance formula between two points on the rectangular coordinate plane.

**Learning objectives**

1. Content:

Students should be able to

- i. explain the concept of steepness of staircases
- ii. explain the concept of the slope of a straight line

2. Language objectives

Students should be able to

- i. state the steepness of staircases using the following sentence patterns:  
*Since the \_\_\_\_\_ in diagram \_\_\_\_\_ is the greatest among all diagrams, but the \_\_\_\_\_ is the same, the staircase in Diagram \_\_\_\_\_ is the steepest.*  
  
*The ratio of the \_\_\_\_\_ and the \_\_\_\_\_ is the largest, so the staircase in Diagram \_\_\_\_\_. is the \_\_\_\_\_.*
- ii. state the slope of a straight line using the following sentence pattern:  
*The slope of a straight line is the ratio of the vertical rise and the horizontal run.*

## Steepness of a staircase

### Instructions for teachers

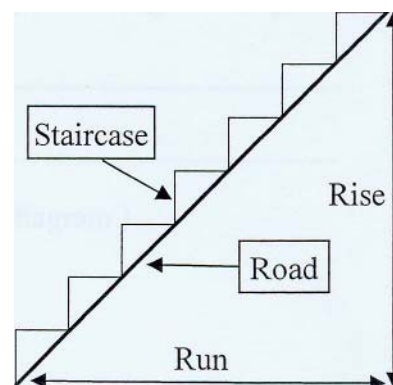
1. Students are divided into 8 groups of 5. Students of the same group work on the same worksheet. So two groups work on Worksheet 1.1, two groups work on Worksheet 1.2 and so on. Each student will only work on one of the Worksheets 1.1 to 1.4 .

2. Students each finishes the tasks in the Worksheet they are given. They need to observe the characteristics of the staircases in the worksheet, compare the steepness of the staircases and determine the factors affecting the steepness.

3. When students finish their worksheet, they are reformed into 10 groups of 4. Each new group is made up of 4 students each having done a different worksheet. Each student will have a copy of Worksheet 1.5. Each member reports the results found in their own worksheet using the sentence structures given in Worksheet 1.5 to help them. They share their ideas and compare their results to find out the definition of slope.

4. The teacher invites a representative of some 3 groups to present their findings to the whole class. Other students can comment. The teacher leads students to reach the conclusion that the Rise and the Run are the two factors that determine the steepness of the staircases. In Worksheet 1.1, as the Rise of all staircases is the same, the staircase with the smallest Run is the steepest one. In Worksheet 1.2, as the Run is the same, the staircase with the greatest Rise is the steepest one. In Worksheet 1.3, the staircases are of the same steepness because they have the same Rise and Run. In Worksheet 1.4, students need to use the ratio of Rise:Run to compare the steepness because the Rise and the Run of each staircase is different. The greater the ratio, the steeper the staircase.

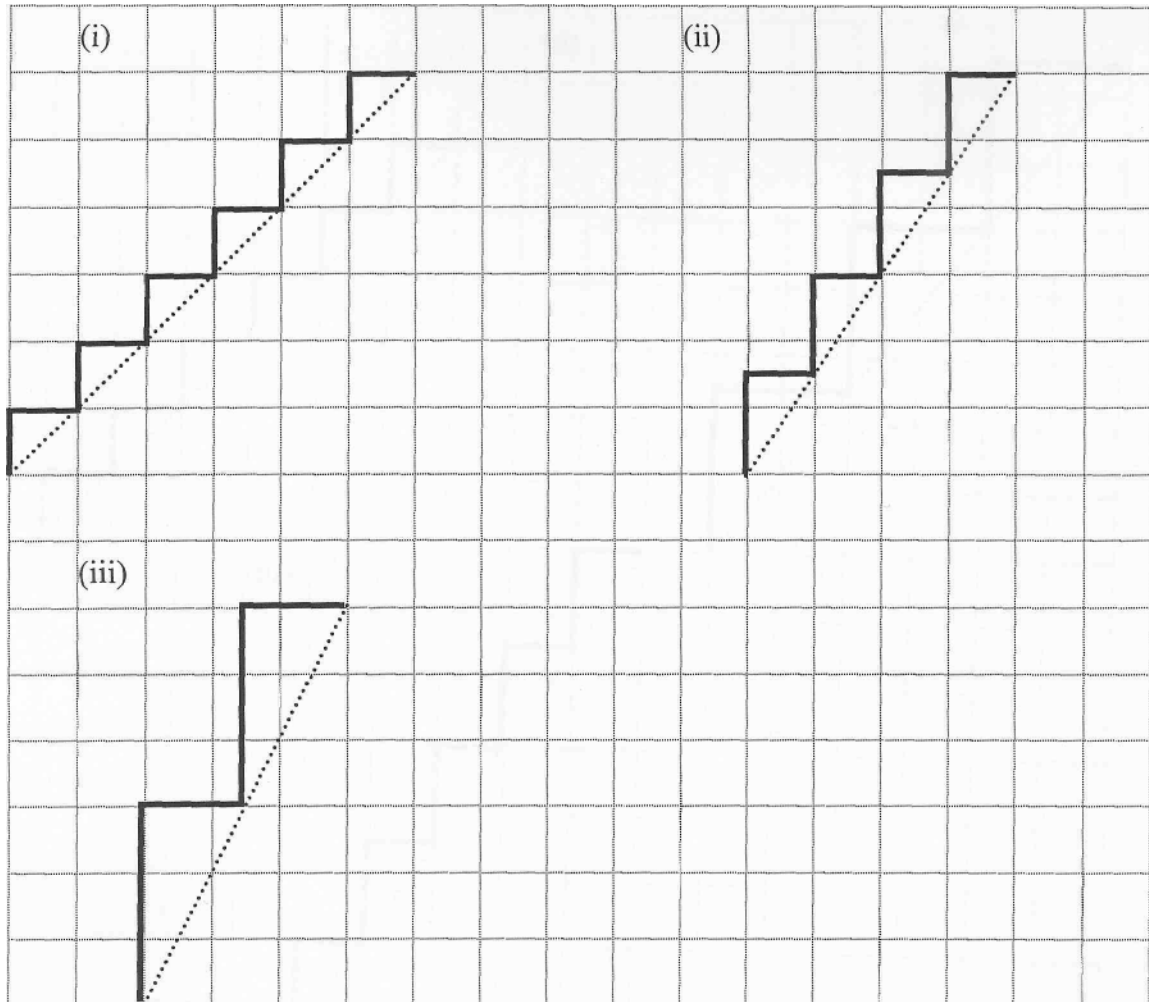
5. The teacher then shows the figure on the right to show that the steepness of the road is the same as the steepness of the staircase built on the road because they have the same Rise and Run. Finally, the teacher introduces the term "slope" of a road and of a straight line and explains its meaning to students.



**S.2 Mathematics**  
**Coordinate Geometry of Straight Lines**  
**Worksheet 1**

Name: \_\_\_\_\_ No.: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Worksheet 1.1: Investigation of the steepness of a staircase**



(a) Which staircase is the steepest? Which is the least steep? Explain your answers. Which staircase is the most difficult to climb? Why?

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(b) How do you determine the result in (a)? Please state any factor(s) affecting the steepness.

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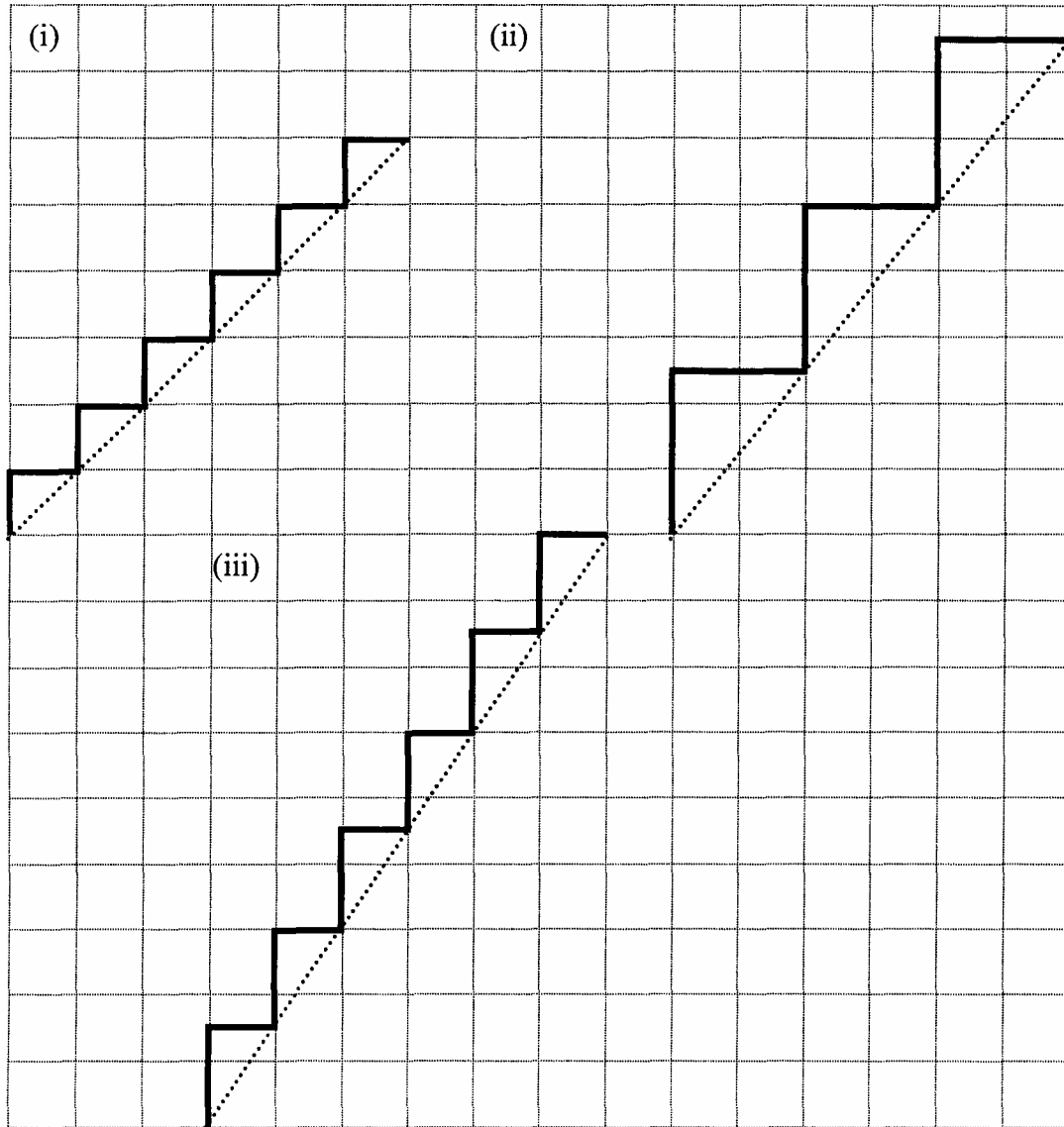
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(Hint: Consider the vertical rise and the horizontal run in each diagram.)

**S.2 Mathematics**  
**Coordinate Geometry of Straight Lines**  
**Worksheet 1**

Name: \_\_\_\_\_ No.: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Worksheet 1.2: Investigation of the steepness of a staircase**



(a) Which staircase is the steepest? Which is the least steep? Explain your answers. Which staircase is the most difficult to climb? Why?

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(b) How do you determine the result in (a)? Please state any factor(s) affecting the steepness.

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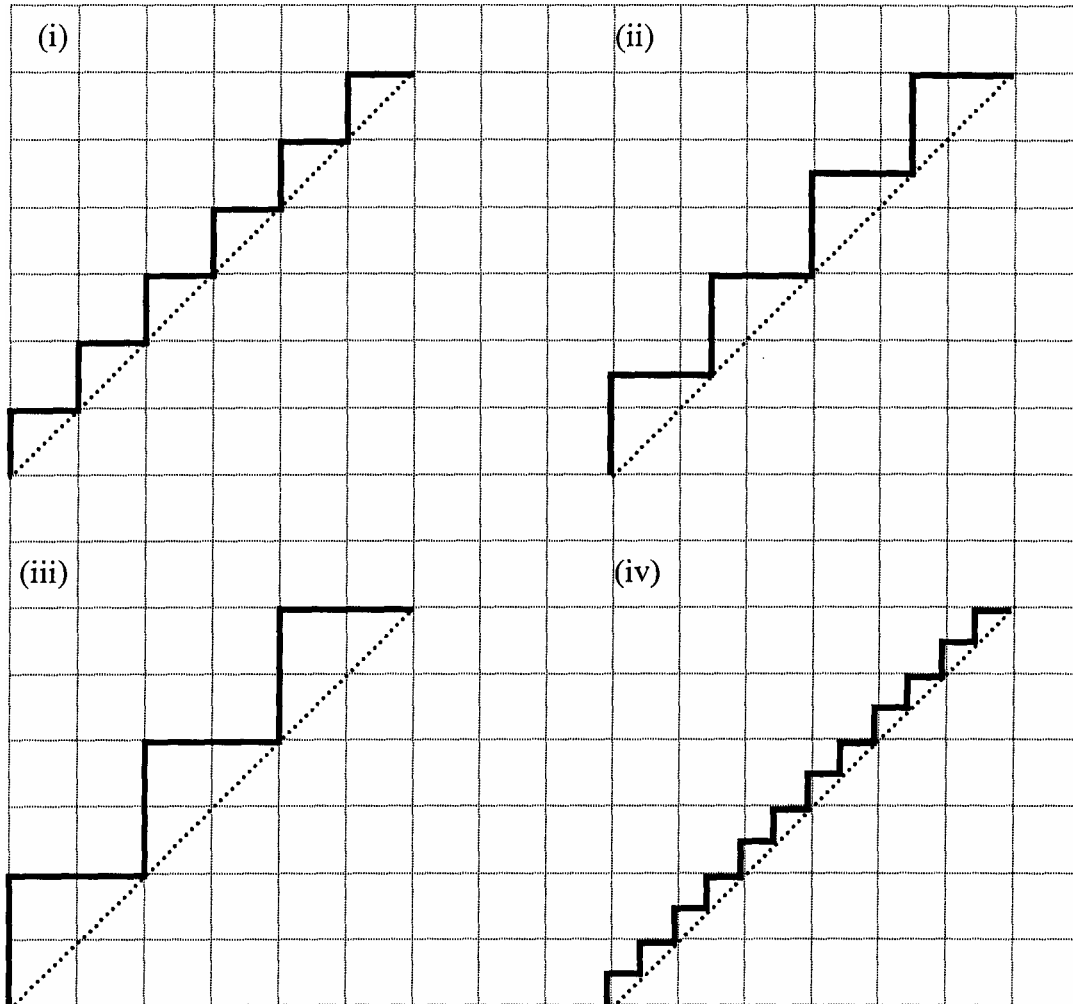
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(Hint: Consider the vertical rise and the horizontal run in each diagram.)

**S.2 Mathematics**  
**Coordinate Geometry of Straight Lines**  
**Worksheet 1**

Name: \_\_\_\_\_ No.: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Worksheet 1.3: Investigation of the steepness of a staircase**



- (a) Which staircase is the steepest? Which is the least steep? Explain your answers.  
Which staircase is the most difficult to climb? Why?

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- (b) How do you determine the result in (a)? Please state any factor(s) affecting the steepness.

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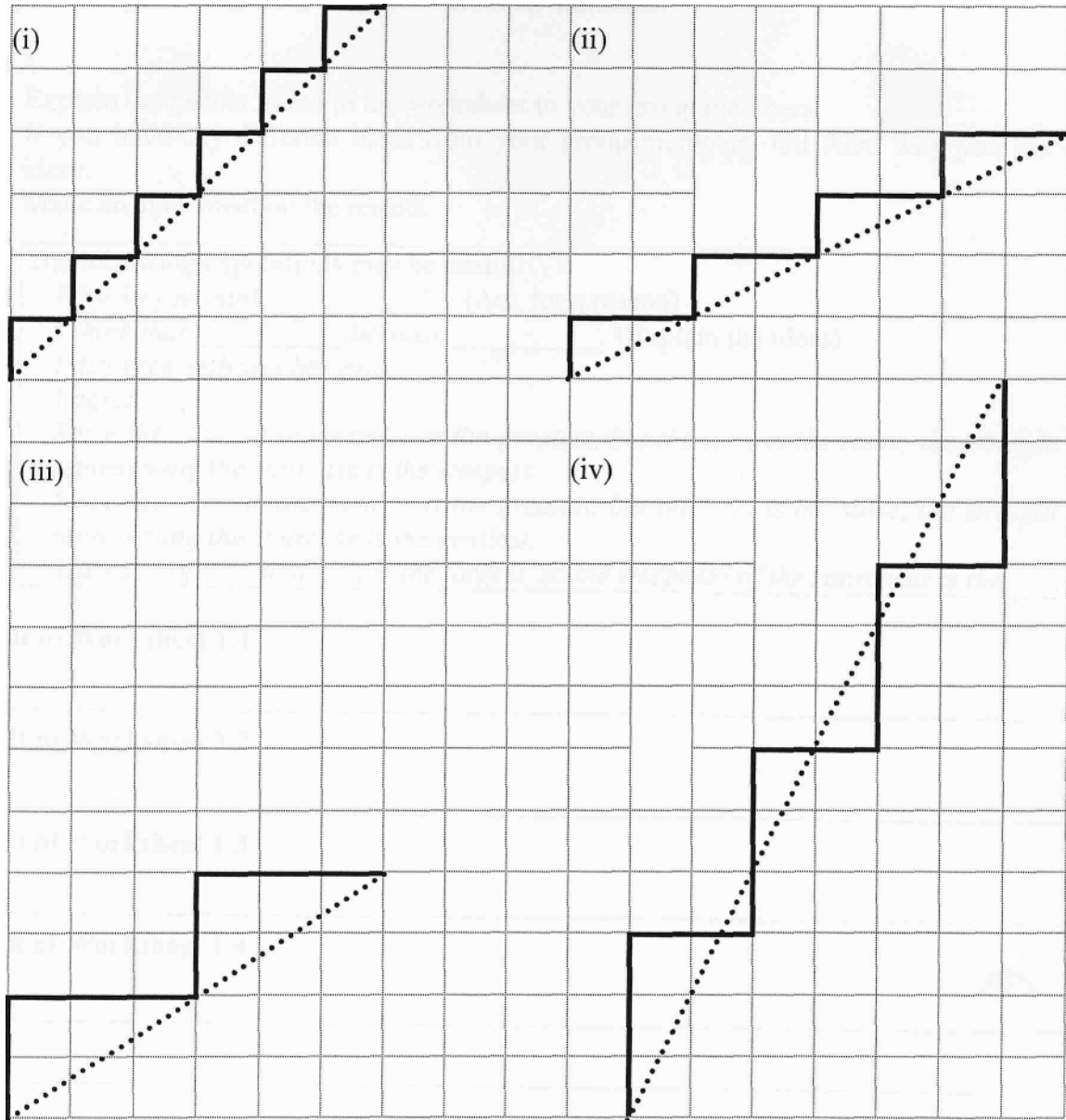
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(Hint: Consider the vertical rise and the horizontal run in each diagram.)

**S.2 Mathematics**  
**Coordinate Geometry of Straight Lines**  
**Worksheet 1**

Name: \_\_\_\_\_ No.: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Worksheet 1.4: Investigation of the steepness of a staircase**



(a) Which staircase is the steepest? Which is the least steep? Explain your answers. Which staircase is the most difficult to climb? Why?

\_\_\_\_\_

\_\_\_\_\_

(b) How do you determine the result in (a)? Please state any factor(s) affecting the steepness.

\_\_\_\_\_

\_\_\_\_\_

(Hint: Consider the ratio of the vertical rise and the horizontal run in each diagram.)

**S.2 Mathematics**  
**Coordinate Geometry of Straight Lines**  
**Worksheet 1**

Name: \_\_\_\_\_ No.: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Worksheet 1.5: Investigation of the steepness of a staircase**

Complete Task A and Task B.

**Task A**

1. Explain your answers to your group members.
2. When you and your group members disagree on any ideas, the group has to agree on a result.

The following expressions may be useful:

*Why do you think \_\_\_\_\_? (Ask for a reason)*

*I think that \_\_\_\_\_ because \_\_\_\_\_. (Explain the ideas)*

*I disagree with you because \_\_\_\_\_.*

*I agree.*

*Since the \_\_\_\_\_ in diagram \_\_\_\_\_ is the greatest among all diagrams, but the \_\_\_\_\_ is the same, the staircase in Diagram \_\_\_\_\_ is the steepest.*

*Since the \_\_\_\_\_ in diagram \_\_\_\_\_ is the greatest among all diagrams, but the \_\_\_\_\_ is the same, the staircase in Diagram \_\_\_\_\_ is the gentlest.*

*The ratio of the \_\_\_\_\_ and the \_\_\_\_\_ is the largest, so the staircase in Diagram \_\_\_\_\_ is the \_\_\_\_\_.*

Result of Worksheet 1.1

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Result of Worksheet 1.2

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Result of Worksheet 1.3

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Result of Worksheet 1.4

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**Task B**

1. After discussion, write down the factors that determine the steepness of a staircase.  
\_\_\_\_\_ and \_\_\_\_\_ will affect the steepness of a staircase.
2. From the results of what you found, write down the definition of the steepness of a staircase.

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