

# 6.2

## Comparing Slopes

### Try These

**You will need**

- a ruler

Write each ratio in lowest terms.

i) 18:24

= 3:4

ii) 36:4

= 9:1

iii) 3:15

= 1:5

iv) -10:4

= -5:2

The symbols below are used throughout North America. They warn skiers and snowboarders about the steepness and difficulty of ski runs. Pablo is a ski instructor in Lake Louise.

green circle



blue square



black diamond



Grade: 6% to 25% wide, groomed

Grade: 25% to 40% groomed

Grade: > 40% may not be groomed

- Pablo laid a grid over a photo of the mountain.
- The new ski run has coordinates (50, 780) and (1140, 1160) on Pablo's grid.

What symbol should Pablo use to mark this ski run?

- 1 What is the grade of the new ski run?

$$\begin{aligned} \text{Slope: } \frac{y_2 - y_1}{x_2 - x_1} &= \frac{1160 - 780}{1140 - 50} \\ &= \frac{380}{1090} \\ &= 0.348... \end{aligned}$$

Grade: 0.348... × 100% = 34.8... %, or about 35 %

- 2 The mountain should be marked with the blue square.

### REFLECTING

Gwen is just learning to ski. Is this new ski run the easiest grade she could try? Explain.

### Example 1

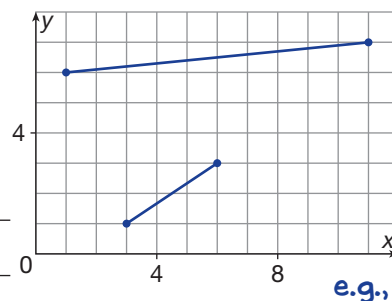
Lidia is designing a house in Manitou. Each year about 110 cm of snow falls in Manitou. Lidia has a plan with a roof pitch of 1:10 and another with a pitch of 2:3. Which pitch would you suggest?

## Solution

A. Draw line segments to represent both roofs on the grid. Which pitch is steeper? The 2:3 pitch is steeper.

B. Should Lidia use the flatter or the steeper pitch? Explain.

e.g., Lidia should use the steeper pitch so that less snow piles up on the roof.



C. An architect's guideline suggests a pitch of at least 5:12 for houses in Manitou. Which pitch would you suggest?

The steeper 2:3 pitch meets the guideline.

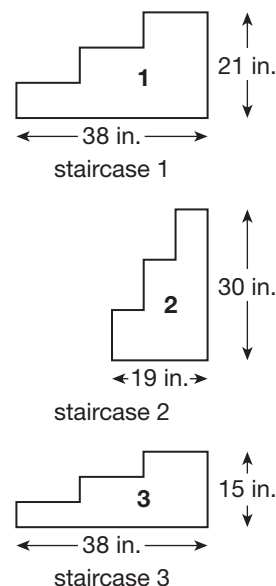
## Example 2

Milo is a carpenter in Regina. For a project, he suggests staircases with a maximum grade of 80%. Compare these staircase designs.

## Solution

A. Complete this chart to the nearest percent for each grade.

	Rise	Run	Grade
staircase 1	<u>21</u> in.	38 in.	$\frac{21 \text{ in.}}{38 \text{ in.}} = 0.552... \times 100\%$ $\doteq$ <u>55</u> %
staircase 2	30 in.	19 in.	$\frac{30 \text{ in.}}{19 \text{ in.}} = 1.578... \times 100\%$ $\doteq$ <u>158</u> %
staircase 3	15 in.	38 in.	$\frac{15 \text{ in.}}{38 \text{ in.}} = 0.394... \times 100\%$ $\doteq$ <u>39</u> %



B. Order the staircases from least to greatest steepness.

3, 1, 2

C. Which of the designs fit Milo's suggestion? Explain.

staircases 1 and 3 The grade is less than 80%.

D. How could you change the design that does not meet Milo's suggestion so that it does?

e.g., Change the rise of staircase 2 to 15 in.

## Practice

1. Circle the steeper slope or grade for each pair.

a) 22%, -0.43

$$\underline{-0.43} \times 100\% = \underline{-43\%}$$

b) Rise = 0.3 m and run = 0.5 m,

Rise = 15 in. and run = 24 in.

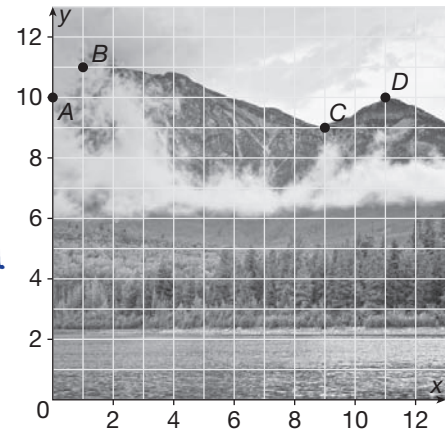
$$\frac{0.3 \text{ m}}{0.5 \text{ m}} = \underline{0.6}, \quad \frac{15 \text{ in.}}{24 \text{ in.}} = \underline{0.625}$$

2. Tien has this photograph of Pyramid Mountain near Jasper. He claims that section  $AB$  is steeper than  $CD$ . Show that he is correct.

e.g.,  $AB$ : slope is  $\frac{11 - 10}{1 - 0} = \frac{1}{1}$ , or 1

$CD$ : slope is  $\frac{10 - 9}{11 - 9} = \frac{1}{2}$

$1 > \frac{1}{2}$  Section  $AB$  is steeper.



3. Doris pours concrete to make driveways. A customer wants a driveway with a grade between 3% and 3.5% and a rise of 9 in.

### Hint

Use the charts inside the back cover.

- a) What is the minimum run of the driveway, in feet and inches? What is the maximum run?

e.g.,  $\frac{3}{100} = \frac{9 \text{ in.}}{x}$

$\frac{3.5}{100} = \frac{9 \text{ in.}}{x}$

$100x \frac{3}{100} = 100x \frac{9 \text{ in.}}{x}$

$100x \frac{3.5}{100} = 100x \frac{9 \text{ in.}}{x}$

$\frac{3x}{3} = \frac{900 \text{ in.}}{3}$

$\frac{3.5x}{3.5} = \frac{900 \text{ in.}}{3.5}$

$x = \underline{300} \text{ in.},$

$x = \underline{257.142...} \text{ in.},$

or 25 ft

or about 21 ft 5 in.

The minimum run is about 21 ft 5 in. The maximum run is 25 ft.

- b) What is the difference between the two runs in Part a)?

Difference in runs: about 300 in. - 257 in. = 43 in. The difference is about 3 ft 7 in.

### REFLECTING

For Question 3, does the slope with the maximum grade have the minimum or maximum run? Why?

4. a) Predict which line segments have negative slopes.

*AB and CD have negative slopes.*

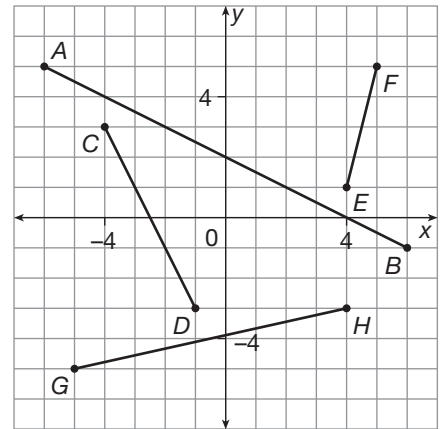
- b) What is the slope of each line segment on the grid?

$$AB: \text{slope} = \frac{-6}{12}, \quad CD: \text{slope} = \frac{-6}{3},$$

$$\text{or } \frac{-1}{2} \quad \text{or } -2$$

$$EF: \text{slope} = \frac{4}{1}, \quad GH: \text{slope} = \frac{2}{9}$$

$$\text{or } 4$$



- c) Which line segment is steepest? Explain why.

*EF is steepest. e.g., Because the rise divided by run is the greatest.*

5. Compare the grade of the main roof section to the grade of the smaller roof section. What is the difference between the percents?

Main roof section:

$$m = \frac{7 - 4}{6 - 1} = \frac{3}{5}, \text{ or } 60\%$$

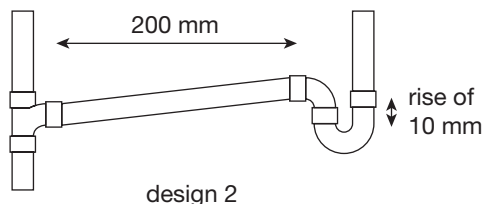
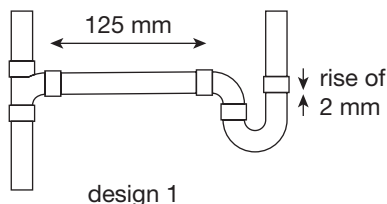
Smaller roof section:

$$m = \frac{6 - 4}{10 - 8} = 1, \text{ or } 100\%$$



*The main roof section is less steep. The difference is 40%.*

6. Dwayne is a plumber. He is installing a new drain system. The drop must be at least 6 mm for every 300 mm of pipe length. This will leave a little water in the trap to prevent methane gas from flowing through the pipes and into the building.



- a) Calculate the slopes of the designs. Which is steeper?

$$\text{Design 1: } \frac{2 \text{ mm}}{125 \text{ mm}} = 0.016 \quad \text{Design 2: } \frac{10 \text{ mm}}{200 \text{ mm}} = 0.05 \quad \text{Design 2 has a steeper slope.}$$

- b) Which design meets Dwayne's requirements?

$$\text{Minimum slope: } \frac{6 \text{ mm}}{300 \text{ mm}} = 0.02 \quad \text{Design 2 meets Dwayne's minimum requirements.}$$

### REFLECTING

What are the different ways you can express a slope? When might you use each?