

Slopes and Rate of Change

Engineers are responsible for many of the designs we see every day. When we see homes being re-built in the hurricane-ravaged areas of the United States, we realize that engineers are responsible for making the homes safe. We hope that the homes' new designs will help to avoid destruction in the future.

Have you ever wondered why some roofs are steep, or why some ramps are gradual? Looking at the slope can help us to understand the reasons.

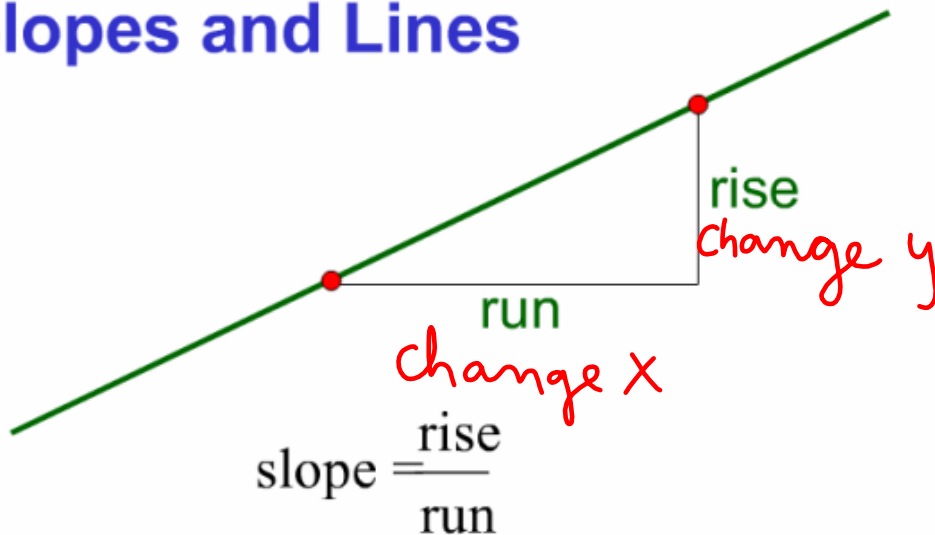
Slopes (or *steepness*) of lines are seen everywhere.



They often refer to the slope as a percentage.

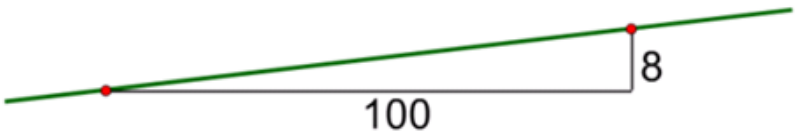
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Slopes and Lines



The slope of a line is the **steepness** of the line.

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A grade of 8% would mean for every run of 100 units, there is a rise of 8 units.

$$\begin{aligned} \text{Slope} &= \frac{\text{Rise}}{\text{Run}} \\ &= \frac{8}{100} \\ &= 0.08 \times 100 \quad \downarrow \text{to get } \% \\ &= 8\% \end{aligned}$$

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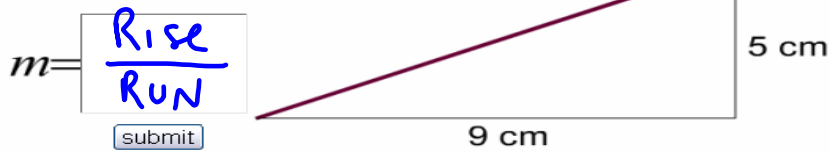
The Steepness of ramps is very important for people in wheelchairs.
What is the slope of this wheelchair ramp?



$$\begin{aligned} \text{Slope} &= \frac{\text{Rise}}{\text{Run}} \\ &= \frac{1}{12} \end{aligned}$$

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Determine the slope of the line.



We use the letter m because in French the word for “to go up” is *monter*.

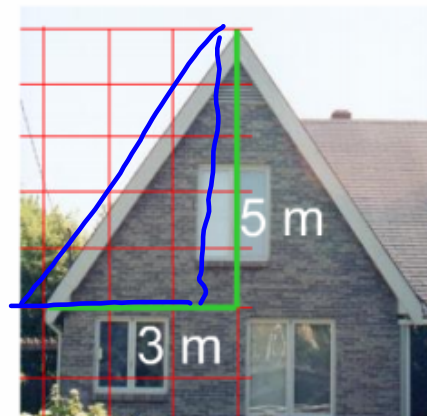
Because the slope is a ratio, there are no units such as cm or cm².

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Determine the slope (*pitch*) of the roof.

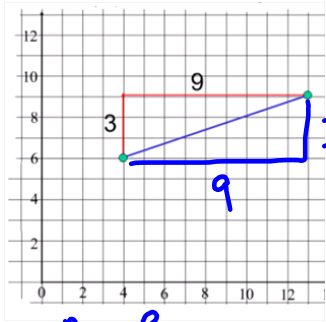
$$m = \frac{\text{Rise}}{\text{Run}}$$

$$= \frac{5}{3}$$

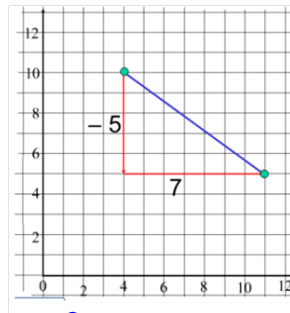


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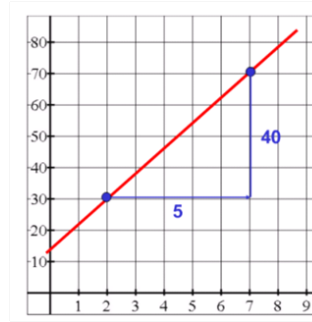
More Practice: Determine the slope of each of these lines



$$m = \frac{\text{Rise}}{\text{Run}} = \frac{3}{9} = \frac{1}{3}$$

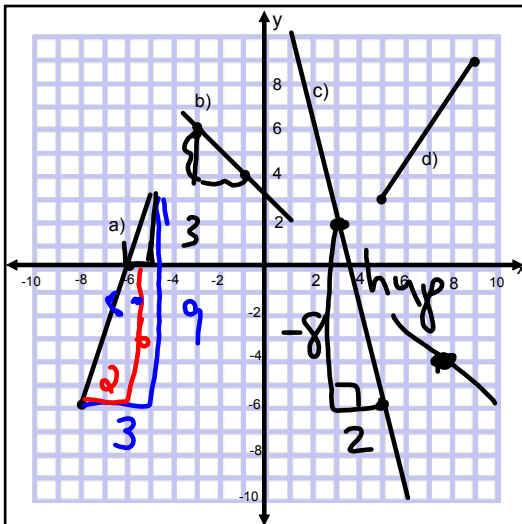


$$m = \frac{\text{Rise}}{\text{Run}} = \frac{-5}{7}$$



$$m = \frac{\text{Rise}}{\text{Run}} = \frac{40}{5} = 8$$

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Using the dots on each line, (create a triangle and) determine the rate of change in each case.

$$a) \text{ ROC} = \frac{\text{rise}}{\text{run}} = \frac{9}{3} = \frac{6}{2} = \frac{3}{1}$$

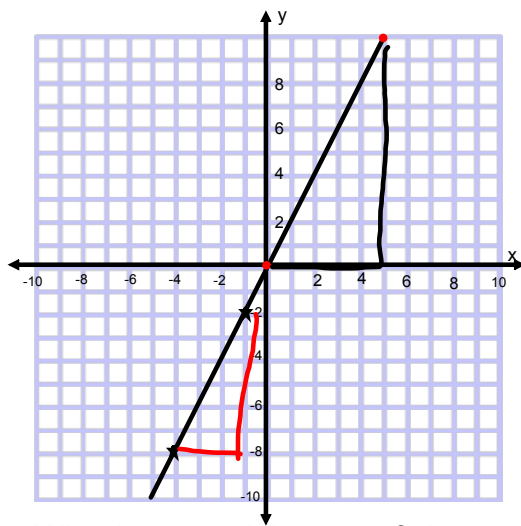
$$b) \text{ ROC} = \frac{\text{rise}}{\text{run}} = \frac{-2}{2} = \frac{-1}{1}$$

$$c) \text{ ROC} = \frac{\text{rise}}{\text{run}} = \frac{-4}{1}$$

$$d) \text{ ROC} = \frac{\text{rise}}{\text{run}} = \frac{4}{2} = \frac{2}{1}$$

How many points do you think you need to create a line?

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Using the dots calculate the slope of the line

$$m = \frac{\text{rise}}{\text{run}}$$

Using the stars calculate the slope of the line

$$m = \frac{\text{rise}}{\text{run}}$$

What happened the rate of change with the above line?

Will this always happen?

TIPS:

- Do we need the line, or is there another way to calculate the slope (ROC)?
- Plot point A (2,3) is plotted on the grid. Draw a line segment AB with a slope of . What are possible coordinates of B?

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