

Determine roof pitch = Write functions or sequences that model relationships between two quantities

Program Task: Given the run of the roof and the total rise determine the roof pitch of a shed roof.

Program Associated Vocabulary:

PITCH, RIDGE, PLUMB, RISE, RUN, BASE, SPAN, RAFTER LENGTH

Program Formulas and Procedures:

To determine the pitch for a roof the carpenter must first determine the rise and the run. The total rise will be in inches and the total run will be in feet. This will determine the pitch/slope of the roof rafter.

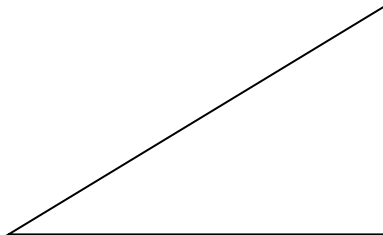
$$\text{Pitch} = \frac{\text{Rise (in inches)}}{\text{Run (in feet)}} = \text{Rise per foot}$$

If the run of a roof is 1' and the total rise is 4" the roof pitch would be 4"/1' but is known as 4-12 because there are 12" in a foot.

If the run of a roof is 2' and the total rise is 12", the roof pitch would be 12"/2', but is known as 12'/24" = 6-12.

If the run of a roof is 3' and the total rise is 24", the roof pitch would be 24"/3', but is known as 24'/36" = 8-12.

Pitch is always written with a run of 12.



Rise = 87 1/2"

Run = 14'

$$\text{Pitch} = \frac{\text{Rise (in inches)}}{\text{Run (in feet)}} = \text{Rise per foot}$$

$$\text{Pitch} = \frac{87.5}{14}$$

Rise per foot = 6.25

Pitch = 6.25-12

PA Core Standard: CC.2.2.HS.C.3

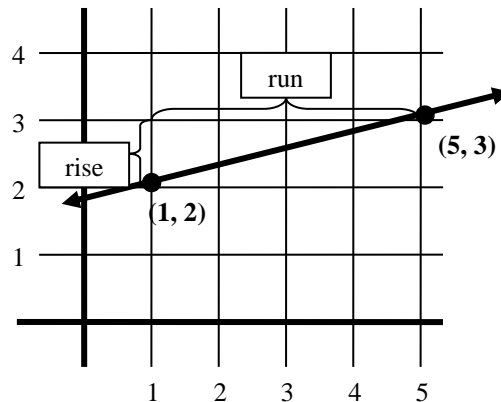
Description: Write functions or sequences that model relationships between two quantities.

Math Associated Vocabulary:

SLOPE, RISE, RUN, RATE OF CHANGE, LINE, ΔX , ΔY

Formulas and Procedures:

$$\text{slope} = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{\text{Rise}}{\text{Run}} = \frac{\Delta Y}{\Delta X}$$



To find the slope of the line above:

Step1: Label your coordinates (x_1, y_1) and (x_2, y_2) .

Note: It does not matter which coordinate you select to represent (x_1, y_1) and (x_2, y_2)

For our example, we'll make $(x_1, y_1) = (1, 2)$ and $(x_2, y_2) = (5, 3)$

Step 2: Substitute values into the formula and solve.

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 2}{5 - 1} = \frac{1}{4}$$

Note: Slope is written as a fraction in simplest form.

Instructor’s Script - Comparing and Contrasting

Pitch and slope are very similar. They both represent rise divided by run.

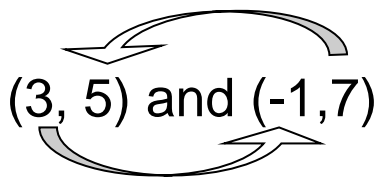
There are three major differences between pitch and slope:

1. Pitch is always positive whereas slope can be negative or positive.
2. Slope requires you to find the rise and run by subtracting the y and x values while the rise and run for pitch are given.
3. The answers are written differently. For pitch, you divide the rise in inches by the run in feet, take your answer and put a -12 after it to get a 2-12, 4-12 pitch. For slope, you reduce the fraction so 2-12 would really be 1/6, and 4-12 would really be 1/3.

Common Mistakes Made By Students

Often students forget that the y-coordinates go in the numerator and the x-coordinates go in the denominator.

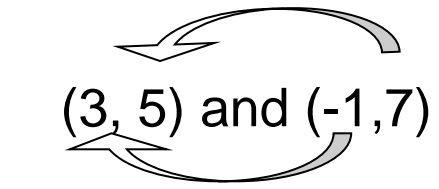
Students will often not subtract consistently among y and x values. For instance, for the slope of a line passing through the points (3, 5) and (-1,7):



$$\frac{7-5}{3-(-1)} \text{ or } \frac{5-7}{-1-3}$$

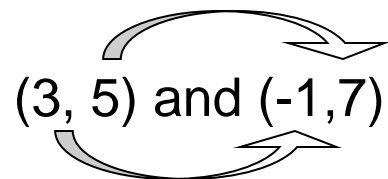
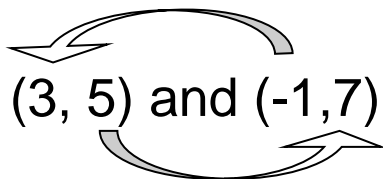
INCORRECT

instead of the correct answer:



$$\frac{7-5}{-1-3} \text{ or } \frac{5-7}{3-(-1)}$$

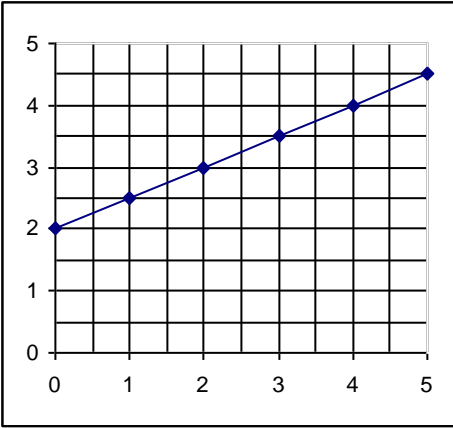
CORRECT

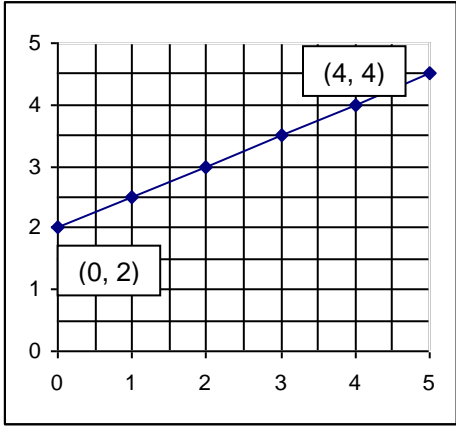


CTE Instructor’s Extended Discussion

Roof rafters have four key parts that are needed for layout: run, total rise, pitch and diagonal. If carpenters know at least the run and the pitch, they will be able to determine the total rise and the measurement of the rafter (diagonal). If they know the measurement of the run and the total rise they can determine the pitch of the roof and the measurement of the rafter.

It is important to remember that rise ÷ run = pitch.

Problems	Career and Technical Math Concepts	Solutions
1. A carpenter needs to rebuild a porch roof, he knows the run of the porch is 10' and the rise is 60", what pitch was the existing porch roof?		
2. A pitch greater than an 8/12 will require the use of roof jacks when installing shingles, you need to determine the pitch of a roof with a 66" rise and a 16' 6" run to see if roof jacks are required? What is the pitch of the roof and are roof jacks required?		
3. Determine the pitch of a roof with a 16' rise and a 24' run.		
Problems	Related, Generic Math Concepts	Solutions
4. A ramp increases from ground level to a height of 5 feet over a span of 20 feet. What is the slope (rate of change) of the ramp?		
5. Determine the slope of the line graphed at the right:		
6. A sidewalk increases from ground level to a height of 3 feet over a span of 40 feet. What is the slope (rate of change) of the sidewalk?		
Problems	PA Core Math Look	Solutions
7. Find the slope of a line passing through the points (3, 5) and (2, 1).		
8. Find the slope of a line passing through the points (-2, 1) and (4,-5).		
9. Find the slope of a line passing through the points (4, 2) and (-5, 6).		

Problems	Career and Technical Math Concepts	Solutions
1. A carpenter needs to rebuild a porch roof, he knows the run of the porch is 10' and the rise is 60", what pitch was the existing porch roof?	$\frac{60}{10} = 6$ 6-12 pitch	
2. A pitch greater than an 8/12 will require the use of roof jacks when installing shingles, you need to determine the pitch of a roof with a 66" rise and a 16' 6" run to see if roof jacks are required? What is the pitch of the roof and are roof jacks required?	$\frac{66}{16.5} = 4$ 4-12 pitch 4-12 pitch < 8-12 pitch No roof jacks are required.	
3. Determine the pitch of a roof with a 16' rise and a 24' run.	$16' \times 12 = 192''$ $\frac{192''}{24'} = \text{pitch}$ 8-12 pitch	
Problems	Related, Generic Math Concepts	Solutions
4. A ramp increases from ground level to a height of 5 feet over a span of 20 feet. What is the slope (rate of change) of the ramp?	$\frac{5}{20} = \frac{1}{4}$	
5. Determine the slope of the line graphed at the right:		$m = \frac{4 - 2}{4 - 0}$ $m = \frac{2}{4} = \frac{1}{2}$
6. A sidewalk increases from ground level to a height of 3 feet over a span of 40 feet. What is the slope (rate of change) of the sidewalk?	$\frac{3}{40}$	
Problems	PA Core Math Look	Solutions
7. Find the slope of a line passing through the points (3, 5) and (2, 1).	$\frac{5-1}{3-2} = \frac{4}{1} = 4$ or $\frac{1-5}{2-3} = \frac{-4}{-1} = 4$	
8. Find the slope of a line passing through the points (-2, 1) and (4,-5).	$\frac{-5-1}{4-(-2)} = \frac{-6}{6} = -1$ or $\frac{1-(-5)}{-2-4} = \frac{6}{-6} = -1$	
9. Find the slope of a line passing through the points (4, 2) and (-5, 6).	$\frac{6-2}{-5-4} = \frac{4}{-9} = -\frac{4}{9}$ or $\frac{2-6}{4-(-5)} = \frac{-4}{9} = -\frac{4}{9}$	