

Determine the rise and run using roof pitch theory

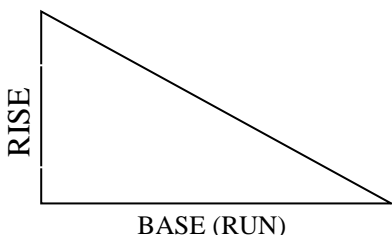
Program Task: Determine the rise or the run using roof pitch theory.

Program Associated Vocabulary:
BASE, PITCH, SCALE, RATIO, RISE, RUN

Program Formulas and Procedures:

When building a roof structure, carpenters need to determine the total rise of a given roof. By knowing the measurement of the run and the pitch of the roof, the carpenter can determine the total rise of the roof.

The unit run indicated at the base of the triangle is always 12". The unit rise is the number of inches that the rafter rises vertically for every 1' of run. The unit rise is specified on the elevation drawings of the blueprints.



Example:

If a house is to be built with a 7/12 roof pitch and the run of the house is 15', what is the total rise of the roof?

Steps:

1. Identify the proportional relationship and label the units:

$$\frac{\text{RISE}}{\text{RUN}} = \frac{7''}{12''}$$

2. Set up the proportional relationship, using a variable for the missing value.

$$\frac{7''}{1'} = \frac{\text{total rise}}{15' \text{ run}}$$

3. Cross multiply.

$$(7)(15) = 1x \rightarrow 105'' = 1x$$

4. Divide by the coefficient.

$$\frac{105''}{1} = x \rightarrow 105'' = x$$

$$\text{TOTAL RISE} = 105'' \div 12 = 8.75'$$

$$0.75 \times 12 = 9''$$

$$8' 9''$$

Write functions or sequences that model relationships between two quantities

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

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

Math Associated Vocabulary:
RATIO, PROPORTION, CROSS MULTIPLY, SCALE, COEFFICIENT

Formulas and Procedures:

A proportion states that two ratios are equal.

$$\frac{a}{b} = \frac{c}{d}$$

Example:

Girls outnumber boys 5 to 3. If there were 21 boys in the class, how many girls would one expect to find?

Steps:

1. Identify the proportional relationship and label the units:

$$5 \text{ girls to } 3 \text{ boys} : \frac{5 \text{ girls}}{3 \text{ boys}}$$

2. Set up the proportional relationship, using a variable for the missing value.

$$\frac{5 \text{ girls}}{3 \text{ boys}} = \frac{x \text{ girls}}{21 \text{ boys}}$$

3. Cross multiply.

$$(5)(21) = 3x \rightarrow 105 = 3x$$

4. Divide by the coefficient.

$$\frac{105}{3} = x \quad x = 35$$

One would expect to find 35 girls.

Instructor's Script – Comparing and Contrasting

The carpentry example on page one is an excellent use of proportional relationships to solve problems. It also provides the opportunity to discuss why the rise in inches is placed over the run in feet. Since the actual run is measured in feet and the run expressed in the pitch or slope is always equal to 12 inches, it is easier to convert this value to 1 foot to make the units consistent.

Common Mistakes Made By Students

Students do not write each ratio consistently. For example, students may write hours/minutes = minutes/hours.

Conversions of units: In many cases, the student must convert between units before setting up the proportion. For example, if one ratio is money per hour and the student must use that ratio to set up a proportion to solve for money in a given number of days, the student must convert the number of days to hours before.

Floor plans and drawings usually contain fractional measurements. Students have difficulty computing measurements that contain a fraction in the inches. i.e. 4' 3 $\frac{1}{2}$ "

CTE Instructor's Extended Discussion

Carpenters use proportional relationships when reading blue prints, floor plans, or architectural drawings. Although carpenters often use an architect's scale to convert measurements from a blueprint to actual measurements, they still need to understand proportional relationships.

Carpentry (46.0201) T-Chart

Problems	Career and Technical Math Concepts	Solutions
1. If a roof is built with an 8/12 pitch and the total rise is 52", what is the dimension of the run?		
2. A house will be built with a 5/12 roof pitch and the run of the house is 17'6". What is the total rise of the roof?		
3. The scale on the plans is ¼ in. = 1 ft. If a wall is to be built 24 ft. long, how long will it be on the plans?		
Problems	Related, Generic Math Concepts	Solutions
4. One oil change takes ¼ hr. How many changes can be done in an hour?		
5. Luke can print 5 posters in 15 minutes. How many can he print in one hour?		
6. Mark works 35 hours and makes \$420. How much does he make if he works 25 hours at the same rate?		
Problems	PA Core Math Look	Solutions
7. Vincent buys 4 burgers for \$ 20. What is the cost of 10 burgers?		
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?		
9. Margie can buy 7 shirts for \$ 94.50. What would it cost if she only bought 4?		

Problems	Career and Technical Math Concepts	Solutions
1. If a roof is built with an 8/12 pitch and the total rise is 52", what is the dimension of the run?	$\frac{8''}{1'} = \frac{52''}{\text{run}}$	$\rightarrow (8)(\text{Run}) = 52 \rightarrow \text{Run} = 6.5' = 6' 6''$
2. A house will be built with a 5/12 roof pitch and the run of the house is 17'6". What is the total rise of the roof?	$\frac{5''}{1'} = \frac{\text{total rise}}{17'6'' \text{ run}}$	$\rightarrow (5)(17.5) = \text{total rise} = 87.5'' = 87 \frac{1}{2}''$
3. The scale on the plans is $\frac{1}{4}$ in. = 1 ft. If a wall is to be built 24 ft. long, how long will it be on the plans?	$\frac{\frac{1}{4} \text{ in.}}{1 \text{ ft.}} = \frac{x \text{ in.}}{24 \text{ ft.}}$	$\rightarrow \frac{1}{4}(24) = 1x \rightarrow x = 6 \text{ in.}$
Problems	Related, Generic Math Concepts	Solutions
4. One oil change takes $\frac{1}{4}$ hr. How many changes can be done in an hour?	$\frac{\frac{1}{4} \text{ hr.}}{1 \text{ oil change}} = \frac{1 \text{ hr.}}{x \text{ oil changes}}$	$\rightarrow \frac{1}{4}x = 1 \rightarrow (4)\frac{1}{4}x = 1(4) \rightarrow x = 4$
5. Luke can print 5 posters in 15 minutes. How many can he print in one hour?	$\frac{5 \text{ posters}}{15 \text{ min.}} = \frac{x \text{ posters}}{60 \text{ min.}}$	$\rightarrow 15x = 5(60) \rightarrow 15x = 300 \rightarrow x = 20$
6. Mark works 35 hours and makes \$420. How much does he make if he works 25 hours at the same rate?	$\frac{35 \text{ hrs.}}{\$420} = \frac{25 \text{ hrs.}}{\$x}$	$\rightarrow 35x = 425(25) \rightarrow 35x = 10,500 \rightarrow x = \300.00
Problems	PA Core Math Look	Solutions
7. Vincent buys 4 burgers for \$ 20. What is the cost of 10 burgers?	$\frac{4}{\$20} = \frac{10}{\$x}$	$\rightarrow 20(10) = 4x \rightarrow 200 = 4x \rightarrow x = \50
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?	$\frac{27 \text{ pairs}}{1 \text{ case}} = \frac{x \text{ pairs}}{12 \text{ cases}}$	$\rightarrow 1x = 27(12) \rightarrow x = 324 \text{ pairs}$
9. Margie can buy 7 shirts for \$ 94.50. What would it cost if she only bought 4?	$\frac{7 \text{ shirts}}{\$94.50} = \frac{4 \text{ shirts}}{\$x}$	$\rightarrow 7x = 94.50(4) \rightarrow 7x = 378.00 \rightarrow x = \54