**Topic D: Similar Triangles**

**Similar Triangles**

**Similar triangles:** triangles that have the same shape and proportions, but may have different sizes.

**The symbol “ ” is used for triangle; the symbol “<” is used for angle.**

**Sides and angles in a triangle :**

* + Sides are labeled with lower case letters.
  + Angles (<) are labeled with uppercase letters.

**Corresponding (matching) angles and corresponding sides** of two similar triangles:

*ABC XYZ* “”means “is similar to”*.*

*A X*

*c b z y*

*B a C Y x Z*

* + The corresponding angles of two similar triangles are equal.

< *A* = < *X* < *B* = < *Y*  < *C* = < Z

* + The corresponding sides of two similar triangles are proportional in length.
    - Side***a*** corresponds to side ***x****.*
    - Side***b*** corresponds to side ***y****.*
    - Side***c*** corresponds to side ***z****.*

**The formula for similar triangles**:

 This includes three proportions:

*y* 

*c* 

*z* 

*b* 

   *a x*

**Solving Similar Triangles**

**Example:** Find the value of the missing side in the following figures (the two triangles are

similar).

**1)** *c* =3m *z* = 5m

*a* 

*b? y* = 6m *x* = 3m

or *b* and y are corresponding sides.

*c* and z are corresponding sides.

 3.6m Multiply both sides by 6m.

**2)**

*c*  

*c =* 5m

*b* = ? 

*z*  

*b* =?

*z =* 3m 

*y =* 6m 

*y*  

or  *b* and y are corresponding sides.

*c* and *z* are corresponding sides.

10 m Multiply both sides by 6 m.

**3)**

5cm

7cm 

6cm

*a* = ?

4cm

*a* and 4cm are corresponding sides.

6cm and 7cm are corresponding sides.

3.43 cm Multiply both sides by 4cm.

**Unit 9: Summary**

**Ratio, Proportion, and Percent**

**Ratio, rate and proportion:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Representation** |  | **Example** |
| **Ratio** | *a* to *b* or *a*:*b* or | with the same unit. | 5 to 9 or 5:9 or |
| **Rate** | *a* to *b* or *a*:*b* or | with different units. | 3 to 7 or 3:7 or |
| **Proportion** |  | an equation with a ratio/rate on each side. | , |
| **Note:** the units for both numerators must match and the units for both denominators must match. | | | |

**Unit rate:** A rate in which the number in the **second term (denominator**) is 1.

**Solving a proportion:**

* Cross multiply: multiply along two diagonals. 
* Solve for the unknown.

**Percent (%):** one part per hundred, or per one hundred.

**Converting between percent, decimal and fraction:**

|  |  |  |
| --- | --- | --- |
| **Conversion** | **Steps** | **Example** |
| **Percent Decimal** | Move the decimal point two places to the left, then remove %. | 31% = 31.% = 0.31 |
| **Decimal Percent** | Move the decimal point two places to the right, then insert %. | 0.317 = 0. 317 = 31.7 % |
| **Percent Fraction** | Remove %, divide by 100, then simplify. | 15% = |
| **Fraction Percent** | Divide, move the decimal point two places to the right, then insert %. |  |
| **Decimal Fraction** | Convert the decimal to a percent, then convert the percent to a fraction. |  |

**Grade and pitch**

* Grade (or slope, pitch, incline etc.): the slope of a straight line is the rate of change in height over a distance. It is a measure of the “steepness” or incline” of a line.
* **The grade or slope formula:**

Vertical distance

Rise

Run

Horizontal distance

|  |
| --- |
| **Formula** |
| Grade or |

**Two methods to solve percent problems**

* Percent proportion method
* Translation (translate the words into math symbols.)

**Percent proportion method:**

With the word “**is**”

or

With the word “of”

**Translation method** (translate the words into mathematical symbols):

* What *x* : the word “what” represents an unknown quantity x.
* Is = : the word “is” represents an equal sign.
* of ×: the word “of” represents a multiplication sign.
* % to decimal: always change the percent to a decimal.

**Percent increase or decrease:**

|  |  |
| --- | --- |
| **Application** | **Formula** |
| **Percent increase** | , |
| **Percent decrease** | , |

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**Similar ( ) triangles:** triangles that have the same shape and proportions, but may be of different sizes.

**Sides and angles in a triangle:**

* + Sides are labeled with lower case letters.
  + Angles (<) are labeled with uppercase letters.

**Corresponding angles and corresponding (matching) sides:**

*ABC XYZ* means “is similar to*”*,

*A X*

*c b z y*

*B a C Y x Z*

1st triangle 2nd triangle

* + The corresponding angles of two similar triangles are equal.

< *A* = < *X* < *B* = < *Y*  < *C* = < Z

* + The corresponding sides of two similar triangles are proportional in length.
    - Side***a*** corresponds to side ***x****.*
    - Side***b*** corresponds to side ***y****.*
    - Side***c*** corresponds to side ***z****.*

**Solve similar triangles**:

 This includes three proportions:

  

*b* 

*y* 

*z* 

*c* 

*a* 

*x* 

**Unit 9: Self-Test**

**Ratio, Proportion, and Percent**

**Topic A**

1. Write the following as a ratio or rate in lowest terms.

# 15 nickels to 45 nickels.

# 24 kilometers to 88 kilometers.

# 350 people for 1500 tickets.

# 0.33 centimetres to 0.93 centimetres.

# 160 kilometres per 740 minutes.

1. Determine the grade (%) of a road that has a length of 2,500 m

and a vertical height of 3.5m.

1. What is the grade (%) of a river that drops 9 meters over a

distance of 720 meters?

1. A train travelled 459 km in 6 hours. What is the unit rate?
2. A 4 L bottle of milk sells for $4.47. A 2 L bottle of the same

milk sells for $3.43. What is the best buy?

1. An 8-pound bag of apples costs $7.49. A 6-pound bag of the

same apples costs $5.99. What is the best buy?

**Topic B**

1. Write the following sentence as a proportion.
2. 5 teachers is to 110 students as 15 teachers is to 330 students.
3. 24 hours is to 1,940 kilometers as 12 hours is to 985 kilometers.
4. 4 liters of juice cost $7.38, how much do 2 liters cost?
5. Todd’s height is 5.44 feet, and his shadow is 8.5 feet long. A

building’s shadow is 25 feet long at the same time. How

high is the building?

1. Sarah earns $4,500 in 30 days. How much does she earn

in 120 days?

**Topic C**

1. What is 45% of 260?
2. 36 is 12% of what number?
3. A product increased production from 2,800 last year to 3,920

this year. Find the percent increase.

1. A product was reduced from $199 to $159.  What percent

reductionis this?

1. Find the value of the missing side in the following figures

(the two triangles are similar).

**a)** *c* = 4 cm *z* = 7. 4 cm

*a* = ?

*b* 

*y* =9.6 cm *x* = 5.55 cm

**b)**

*c =* 7m

*b* =?

*y =* 8m 

*z =* 5m 

**c)**

*x* = ?

8 cm 

6 cm 7 cm

4 cm