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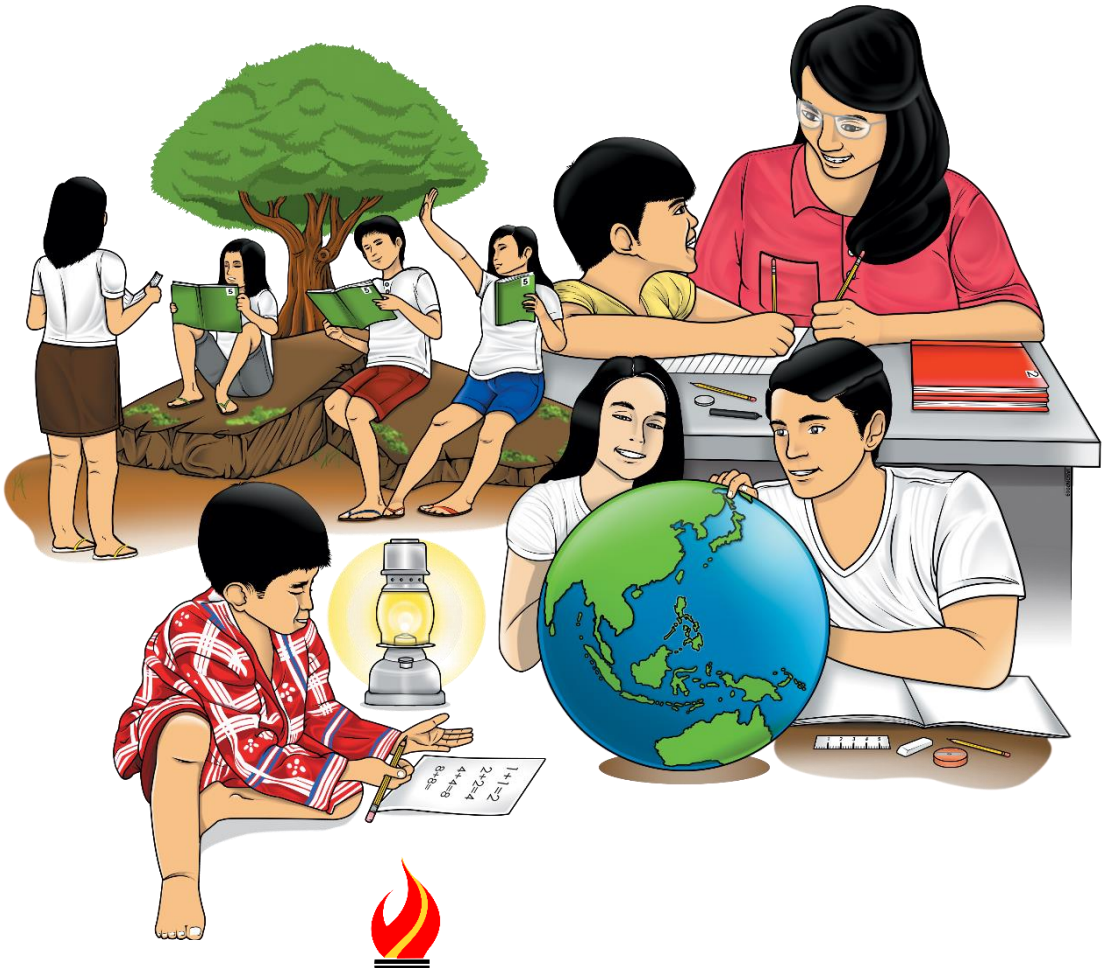
Mathematics

Quarter 3 – Module 10:
Apply the Fundamental Theorems of Proportionality to Solve Problems Involving Proportion



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Mathematics

Quarter 3 – Module 10:
Apply the Fundamental Theorems of Proportionality to Solve Problems Involving Proportion

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

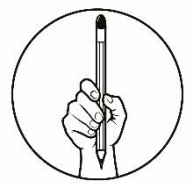
If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

The learners will be able to:

- apply the fundamental theorem of proportionality to solve problems involving proportion. **M9GE – IIIf – 37**

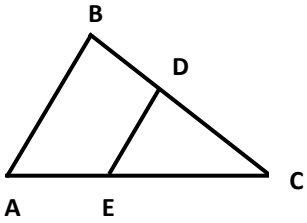


What I Know

Find out how much you already know about the basic proportionality theorem. Encircle the letter that you think is the correct answer of each item. Answer all items. After taking and checking this short test, take note of the items that you were not able to answer correctly and look for the right answer as you go through this module.

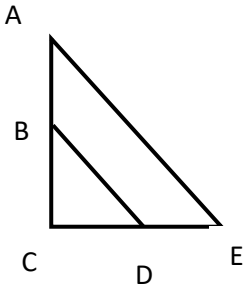
1. In the figure at the right, $\overline{AB} \parallel \overline{ED}$. Which among the following statements is/are true?

i. $\frac{|CD|}{|BD|} = \frac{|CA|}{|AE|}$ ii. $\frac{|BC|}{|CD|} = \frac{|AC|}{|AE|}$ iii. $\frac{|CD|}{|CB|} = \frac{|CE|}{|CA|}$ iv. $\frac{|AE|}{|AC|} = \frac{|CD|}{|BD|}$



A. i only
C. ii and iv
B. iii only
D. i, ii, iii and iv

For numbers 2 and 3. Given ΔACE, $\overline{BD} \parallel \overline{AE}$, $|BC| = 4x - 4\ cm$, $|CD| = 24$ cm, $|DE| = 18\ cm$ and $|BA| = 39\ cm$.



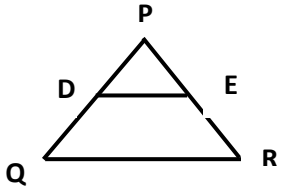
2. What is the value of x?

A. 1 B. 4 C. 14 D. 28

3. What is the value of $\frac{|BC|}{|AC|}$?

A. $\frac{3}{4}$ B. $\frac{3}{7}$ C. $\frac{4}{3}$ D. $\frac{4}{7}$

For numbers 4 and 5. Given ΔPQR, |PD| = 2 cm, |DQ| = 4 cm, |PE| = 3 cm, |ER| = 6 cm.



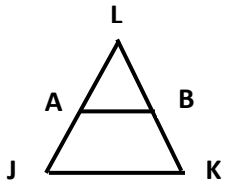
4. Find the ratio of |PE| to |PR|.

A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. $\frac{3}{2}$

5. If $\overline{DE} \parallel \overline{QR}$, which among the following ratios is equal to $\frac{|PE|}{|PR|}$?

A. $\frac{|QR|}{|DE|}$ B. $\frac{|PE|}{|ER|}$ C. $\frac{|PD|}{|PQ|}$ D. $\frac{|PD|}{|DQ|}$

For numbers 6 and 7. In ΔJKL, A and B are points on the sides $\overline{LJ}$ and $\overline{LK}$, respectively such that $\overline{AB} \parallel \overline{JK}$.



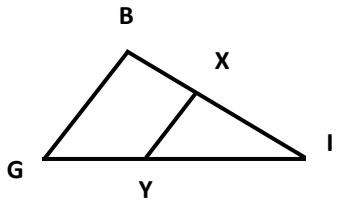
6. If $\frac{|LA|}{|AJ|} = \frac{3}{4}$ and |LK| = 15 cm, find |LB|.

A. $\frac{45}{7}$ cm B. $\frac{45}{4}$ cm C. 20 cm D. 35 cm

7. If |LA| = 8x – 7 cm, |AJ| = 5x – 3 cm, |LB| = 4x – 3 cm and |BK| = 3x – 1 cm, find the value of x.

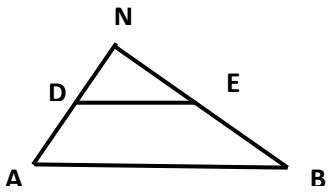
A. 1 and $-\frac{1}{2}$ B. 1 C. $-\frac{1}{2}$ D. −1

8. In ΔBIG, $\overline{XY} \parallel \overline{BG}$. Given that |BX| = 5 cm, |XI| = 6 cm, and |IY| = 8 cm, what is |YG|?



A. 3 cm B. 5 cm C. $\frac{20}{6}$ cm D. $\frac{20}{3}$ cm

9. In ΔABN, $\overline{DE} \parallel \overline{AB}$. If |DN| = x, AD| = 4 cm, |NE| = x + 1 cm and |BE| = 8 cm, what is the value of x?

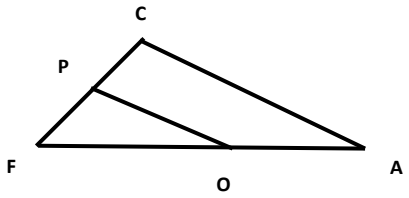


A. 4 B. 3 C. 2 D. 1

10. In the ΔAFC , $\overline{OP} \parallel \overline{AC}$. If |FP| = 2 cm, |FC| = 6 cm and |FO| = 3 cm, what is |FA|?

A. 8 cm C. 5 cm

B. 9 cm D. 12 cm



Lesson 1

BASIC PROPORTIONALITY THEOREM

Retelling the Story...

Wonder How to Apply the Theorem?

You might be thinking how this applies to you right now. Let me give you a scenario where you can actually use this theorem in real life.

Imagine that you are an engineer, and you have been hired to help finish constructing a road on a mountain. You are given a drawing of the mountain that shows where roads have already been constructed. It also shows the length of each segment of the road. There is one segment left to construct, and your job is to figure out the length of that last segment. The mountain in question is located in a distant country, and unfortunately, you can't go and physically measure the length needed. What should you do? Well, you are going to use the proportionality theorem to help you with your job.

What's In

Before going further, let us try to recall that in any proportion the product of the extremes is equal to the product of the means. In symbols, $\frac{a}{b} = \frac{c}{d}$ or $a:b = c:d$, where $b \neq 0$ and $d \neq 0$, a times d is equal to b times c, or $ad = bc$. Also, the different properties of proportion are the following:

Cross-multiplication Property

Alternation Property

Inverse Property

Addition Property

Subtraction Property

Study the examples below:

1. Solve for the value of the unknown x in the proportion $9:x = 36:8$.

   Answer: $x = 2$

2. The measures of two complementary angles have the ratio 2 to 4. Find the measure of each angle.

   Answer: *The measures of the angle and its complement are* ***30°*** *and* ***60°, respectively.***

3. There are 2.2 pounds in one kilogram. How many kilograms do you weigh when your current weight is 156 pounds?

   Answer: ***70.9 kilograms***

TRY!

A. Which of the following is/are equivalent form(s) of the proportion $\frac{x}{y} = \frac{z}{w}$?

Draw a smiling face ☺ if it is. Otherwise, draw a frowning face ☹ .

1. $wx = yz$ 2. $\frac{x}{z} = \frac{y}{w}$ 3. $\frac{w}{y} = \frac{z}{x}$ 4. $\frac{x+y}{y} = \frac{z+w}{w}$ 5. $\frac{x}{w} = \frac{z}{y}$

B. Solve the following problems.

1. Find for the value of the unknown term x of the proportion

   $x:4 = 5:10$

2. Knowing that there are 2.2 pounds in one kilogram, how many pounds do you weigh when your current weight is 65 kilograms?

3. Mix 3 liters of water with 4 lemons to make a lemonade. Now, how many liters of water should be mixed with 8 lemons?

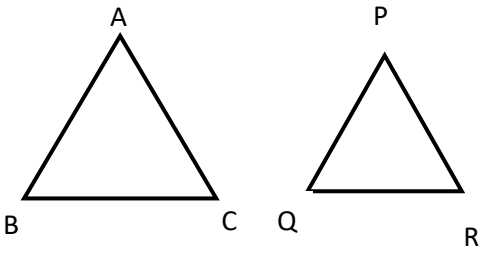
What's New

Basic Proportionality theorem was introduced by a famous Greek Mathematician, Thales, hence it is also called *Thales Theorem*. According to him, **for any two equiangular triangles, the ratio of any two corresponding sides is always the same.** Based on this concept, he gave theorem of basic proportionality. This concept has been introduced in similar triangles.

Definition of similar triangles

Two triangles are similar to each other if,

i) the corresponding angles of both triangles are congruent, and
ii) the corresponding sides of both triangles are proportional.



Thus, two triangles ΔABC and ΔPQR are similar if,

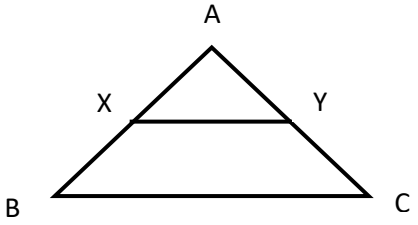
i) $\angle A \cong \angle P$, $\angle B \cong \angle Q$ and $\angle C \cong \angle R$ and

ii) $\frac{|AB|}{|PQ|} = \frac{|BC|}{|QR|} = \frac{|AC|}{|PR|}$

Basic Proportional Theorem or BPT

If a line is drawn parallel to one side of a triangle and intersects the other two sides in distinct points, then it divides the sides into segments which are proportional to these sides.

In ΔABC, if X and Y are points on $\overline{AB}$ and $\overline{AC}$, respectively such that $\overline{XY}$ is parallel to $\overline{BC}$, then $\frac{|AX|}{|AB|} = \frac{|AY|}{|AC|}$.



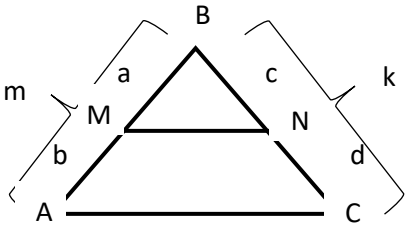
Applying the properties of proportion, the following proportions can also be obtained from the figure:

$$\frac{|AB|}{|AX|} = \frac{|AC|}{|AY|}, \qquad \frac{|AB|}{|AC|} = \frac{|AX|}{|AY|}, \qquad \frac{|XB|}{|AB|} = \frac{|YC|}{|AC|},$$

$$\frac{|AX|}{|XB|} = \frac{|AY|}{|YC|}, \qquad \frac{|AX|}{|AY|} = \frac{|XB|}{|YC|} \qquad \text{and } \frac{|AB|}{|AC|} = \frac{|XB|}{|YC|}$$

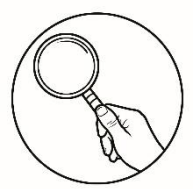
Example: Given ΔABC with $\overline{MN} \,||\, \overline{AC}$.

Formulate the possible proportions that can be derived given the triangle below following the basic proportionality theorem.



Answers:

$\frac{a}{m} = \frac{c}{k}$; $\frac{a}{c} = \frac{m}{k}$; $\frac{b}{m} = \frac{d}{k}$; $\frac{a}{b} = \frac{c}{d}$; $\frac{a}{c} = \frac{b}{d}$; $\frac{b}{d} = \frac{m}{k}$



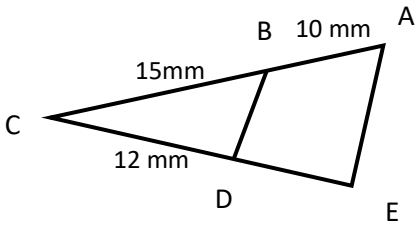
What is It

To find the missing length in a triangle, we apply the Basic proportionality theorem and the properties of proportion.

Example 1. In the given ΔACE at the right, $\overline{BD} \parallel \overline{AE}$. Find $|\mathrm{DE}|$.

Set up a proportion,

$$\frac{|AB|}{|BC|} = \frac{|ED|}{|DC|} \rightarrow \frac{10mm}{15mm} = \frac{|ED|}{12mm}$$



Solve for the missing length.

$$15(|DE|) = (10)(12)$$

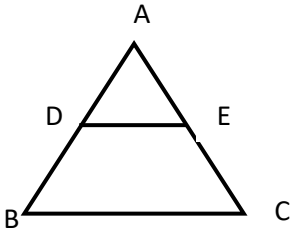
$$15|DE| = 120$$

$$|DE| = 8mm$$

Example 2. In the triangle ΔABC below, $\overline{DE} \parallel \overline{BC}$, $|AD| = 5\,cm$, $|BD| = x + 6\,cm$, $|AE| = 3\,cm$, and $|CE| = x + 3$ cm. Find $|\mathrm{AB}|$.

Set up the proportion,

$$\frac{|AD|}{|BD|} = \frac{|AE|}{|CE|} \rightarrow \frac{5}{x+6} = \frac{3}{x+3}$$



Solve the equation.

$$5(x + 3) = 3(x + 6)$$

$$5x + 15 = 3x + 18$$

$$2x = 3$$

$$x = 1.5$$

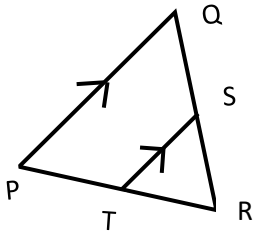
$$|\mathrm{AB}| = |AD| + |\,D\mathrm{B}| \rightarrow |\mathrm{AB}| = 5 + (x + 6)$$

$$|\mathrm{AB}| = 5 + (1.5 + 6) \rightarrow |\mathrm{AB}| = 5 + 7.5 \rightarrow |AB| = 12.5\,cm$$

Example 3. In $\Delta PQR, if\ |PT| = 3x + 1$ cm, $|TR| = 3x - 1$ cm, $|QS| = 5x - 1$ cm, and $|RS| = 4x + 1$ cm, find the value of x.

$$\frac{|PT|}{|TR|} = \frac{|QS|}{|SR|} \rightarrow \frac{3x+1}{3x-1} = \frac{5x-1}{4x+1}$$

$$(3x + 1)(4x + 1) = (3x - 1)(5x - 1)$$



$$12x^2 + 7x + 1 = 15x^2 - 8x + 1$$

$$3x^2 - 15x = 0$$

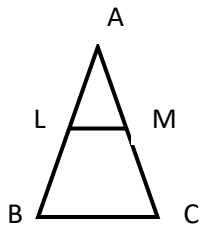
$$3x(x - 5) = 0$$

$$x = 5 \; ; \; x = 0$$

The value of x cannot be equal to zero because some of the lengths will be negative. Therefore, the value of x is 5.

Example 4. In ΔABC, L and M are points on the sides AB and AC respectively such that $\overline{LM} \parallel \overline{BC}$.

(a) If $\frac{|AL|}{|LB|} = \frac{3}{5}$ and $|\text{AC}| = 12$ cm, find $|\text{AM}|$.



$$\frac{|AL|}{|LB|} = \frac{|AM|}{|MC|}$$

Let $|AM| = x$ and $|MC| = 12 - x$

$$\frac{3}{5} = \frac{x}{12-x}$$

$$3(12 - x) = 5x$$

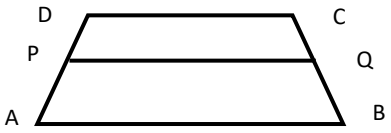
$$36 - 3x = 5x$$

$$5x + 3x = 36$$

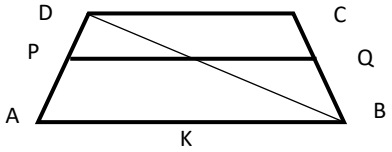
$$8x = 36$$

$$x = \frac{36}{8} \text{ or } \frac{9}{2} \text{ cm}$$

Example 5. Quadrilateral ABCD is a trapezoid in which $\overline{AB} \parallel \overline{DC}$ and P, Q are points on $\overline{AD}$ and $\overline{BC}$ respectively, such that $\overline{PQ} \parallel \overline{DC}$. If $|PD| = 18\,cm$, $|BQ| = 35\,cm$ and $|QC| = 15\,cm$, find $|AD|$.



Draw diagonal $\overline{DB}$ and label the intersection of $\overline{DB}$ and $\overline{PQ}$ as point K.



In ΔDAB, $\frac{|PD|}{|PA|} = \frac{|DK|}{|KB|}$. In ΔDBC, $\frac{|BK|}{|KD|} = \frac{|BQ|}{|QC|}$. From first proportion, $\frac{|PD|}{|PA|}$ *is equal to* $\frac{|DK|}{|KB|}$, and in the second proportion, $\frac{|BQ|}{|QC|}$ is equal to the reciprocal of $\frac{|DK|}{|KB|}$, therefore, $\frac{|PD|}{|PA|}$ is equal to the reciprocal of $\frac{|BQ|}{|QC|}$. Thus, by transitivity, we get

$$\frac{|PD|}{|PA|} = \frac{|QC|}{|BQ|} \rightarrow \frac{18}{|PA|} = \frac{15}{35}$$

$$15(|PA|) = 18(35)$$

$$|PA| = \frac{630}{15} = 42$$

Solving for $|AD|$

$$|AD| = |AP| + |PD|$$

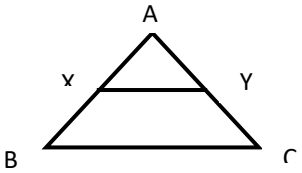
$$|AD| = 42 + 18$$

$$|AD| = 60\ cm$$

Converse of the Basic Proportionality Theorem

If a line intersects two sides of a triangle and the sides are divided into segments which are proportional, then the line is parallel to the third side.

In ΔABC, if X is a point between A and B and Y is a point between A and C and $\frac{|AX|}{|AB|} = \frac{|AY|}{|AC|}$, then $\overline{XY} \parallel \overline{BC}$.



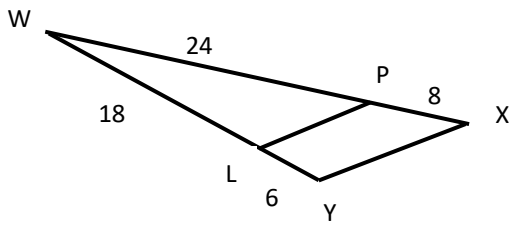
Example 6. In ΔWXY, is $\overline{LP} \parallel \overline{XY}$?

Let us verify if the ratios of the sides are proportional.

$$\frac{|WL|}{|WY|} = \frac{|WP|}{|WX|}$$

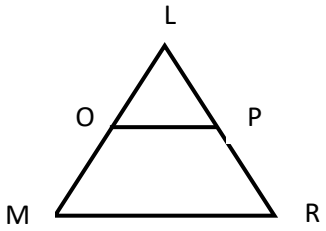
$$\frac{18}{24} = \frac{24}{32}$$

$$\frac{3}{4} = \frac{3}{4}$$



Since the ratios form a proportion, then we can say that $\overline{LP} \parallel \overline{XY}$.

Example 7. In ΔLMR, O and P are points on the sides $\overline{LM}$ and $\overline{LR}$, respectively.



For each of the following cases, show that $\overline{OP} \parallel \overline{MR}$

(a) $|LM| = 12\ cm,\ |LO| = 8\ cm, |LP| = 12\ cm\ and\ |LR| = 18\ cm.$

$$|LM| = |LO| + |OM| \qquad |LR| = |LP| + |PR|$$

$$12 = 8 + |OM| \qquad 18 = 12 + |PR|$$

$$|OM| = 12 - 8 \qquad |PR| = 18 - 12$$

$$|OM| = 4 \qquad |PR| = 6\ cm$$

$$\frac{LO}{OM} = \frac{LP}{PR}$$

$$\frac{8}{4} = \frac{12}{6}$$

$$2 = 2$$

Therefore, $\overline{OP} \parallel \overline{MR}$.

(b) $|LM| = 5.6\ cm, |LO| = 1.4\ cm, |LR| = 7.2\ cm\ and\ |LP| = 1.8\ cm.$

$$|LM| = |LO| + |OM| \qquad |LR| = |LP| + |PR|$$

$$5.6 = 1.4 + |OM| \qquad 7.2 = 1.8 + |PR|$$

$$|OM| = 5.6 - 1.4 \qquad |PR| = 7.2 - 1.8$$

$$|OM| = 4.2\ cm \qquad |PR| = 5.4\ cm$$

$$\frac{|LO|}{|OM|} = \frac{|LP|}{|PR|} \rightarrow \frac{1.4}{4.2} = \frac{1.8}{5.4}$$

$$0.33 = 0.33$$

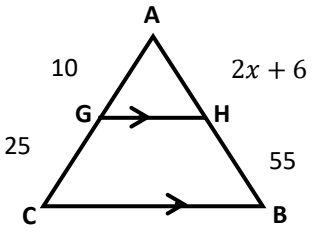
Therefore, $\overline{OP} \parallel \overline{MR}$.

TRY THIS!

I. Answer the following.

For items 1-4, find the value of x in each of the given figures.

1.



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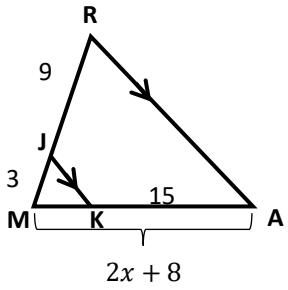
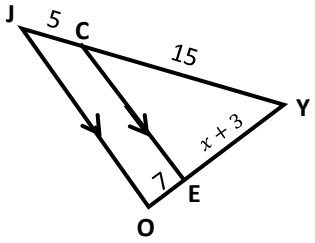


3.



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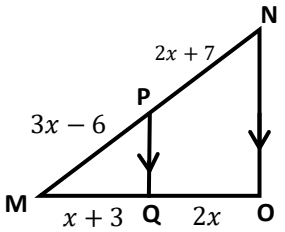
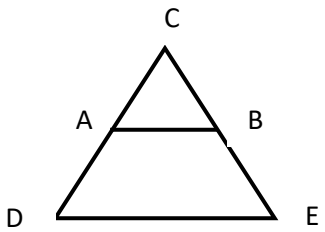


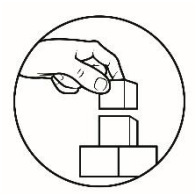
Use the figure on the right for numbers 5 and 6.



5. Given: ΔCDE, $|CA| = 16cm$; $|CB| = 25cm$; $|CD| = 20cm$; $|CE| = 30cm$. Is $\overline{DE} \parallel \overline{AB}$?

6. What value(s) of x will make $\overline{DE} \parallel \overline{AB}$ if $|CA| = x - 3\ cm$; $|CB| = 4cm$;

$|AD| = 3x - 19\ cm$ and $|BE| = x - 4\ cm$?

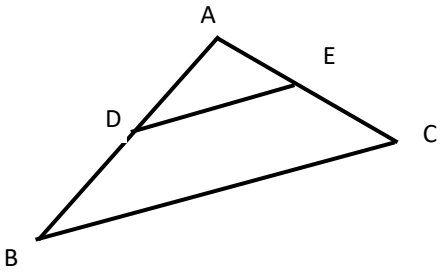


What's More

Activity 1:

Given ΔABC on the right with $\overline{DE} \parallel \overline{BC}$. Determine if each of the given proportions is true or false.

1. $\frac{|AD|}{|DB|} = \frac{|AE|}{|EC|}$
2. $\frac{|AD|}{|AB|} = \frac{|AE|}{|AC|}$
3. $\frac{|AD|}{|DB|} = \frac{|EC|}{|AE|}$
4. $\frac{|AD|}{|AB|} = \frac{|AC|}{|AE|}$
5. $\frac{|DB|}{|AB|} = \frac{|EC|}{|AC|}$
6. $\frac{|BD|}{|AD|} = \frac{|AE|}{|EC|}$
7. $\frac{|DB|}{|EC|} = \frac{|AB|}{|AC|}$
8. $\frac{|AE|}{|AD|} = \frac{|EC|}{|DB|}$
9. $\frac{|AD|}{|EC|} = \frac{|AE|}{|DB|}$
10. $\frac{|AD|}{|AE|} = \frac{|DB|}{|EC|}$

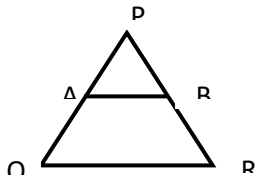


Activity 2:

Answer the following. Write your answers

1. What does the line segment (which is parallel to the third side of a triangle and which intersects the other two sides of the triangle) do to the sides of the triangle it intersects?

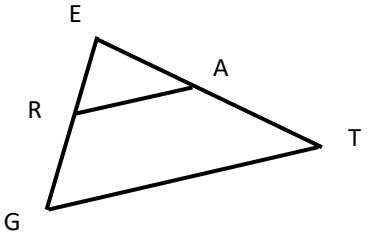
2. In $\Delta PQR, \overline{AB} \parallel \overline{QR}$. If $|QA| = 32$, $|PA| = 16$, and $|BR| = 20$, find $|PB|$.



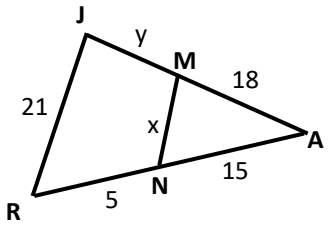
For numbers 3 and 4.

In ΔEGT, $\overline{RA} \parallel \overline{GT}$, $|EG| = 12$, $|ER| = 4$, $|RA| = 6$, and $|ET| = 24$,

3. Find |EA|.
4. Find |GT|.



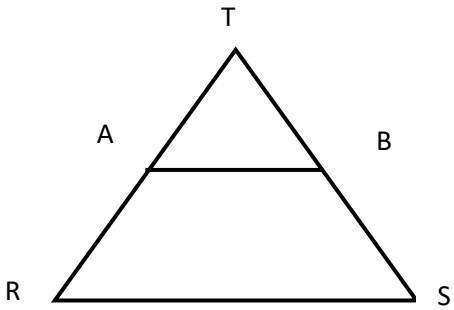
5. In ΔJAR, $\overline{MN} \parallel \overline{JR}$. Find the values of x and y.



Activity 3:

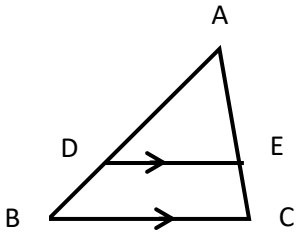
A. Find the missing length using the basic proportionality theorem.

Given ΔRST, $\overline{AB} \parallel \overline{RS}$



1. |AT| = 6mm, |BT| = 5mm, |RT| =12mm
   Find |ST| = _____
2. |AT| = 8cm, |TR| = 20cm, |ST| = 15cm
   Find |BT| =_____
3. |BT| = 7m, |BS| = 14m, |RT| = 36m
   Find |AR| = _____
4. |BT| = 4cm, |BS| = 8cm, |AT| = 5cm
   Find |TR| = _____

B. Solve for the value of x.



1. If |AD| = x + 1 m, |DB| = 2 m, |AE| = 10 m and |EC| = 5 m, then x = ____.
2. If |AD| = x + 2 m, |DB| = 4m, |AE| = 6m and |EC| = 8m, then x = ____.
3. If |AD| = 4 cm, |DB| = 6 cm, |AE| = x + 3 cm and |EC| = 7.5 cm,
   then x = ____.
4. If |AD| = 2 cm, |DB| = 6 cm, |AE| = x + 2 cm and |EC| = 9 cm,
   then x = ____.
5. If |AD| = 5 ft, |DB| = x + 2 ft, |AE| = 4 ft and |EC| = 4.8 ft,
   then x = ____.

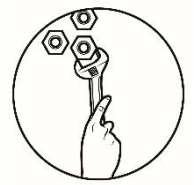
What I Have Learned

Basic Proportionality Theorem (BPT

If a line is drawn parallel to one side of a triangle and intersects the other two sides in distinct points, then it divides the sides into segments which are proportional.

Converse of the Basic Proportionality Theorem

If a line intersects two sides of a triangle and the sides are divided into segments which are proportional, then the line parallel is to the third side.



What I Can Do

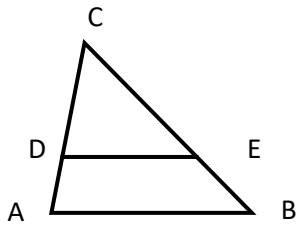
TEST YOURSELF!

Directions: Read and answer each problem carefully. Write your answer after each given problem.

1. In ΔABC, $\overline{DE} \parallel \overline{AB}$.

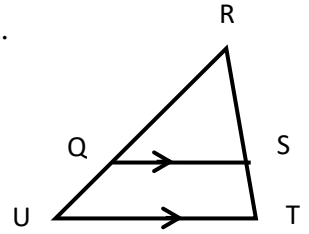
   a. Given |AC| = 12 cm, |CD| = 4 cm and |BC| = 24 cm. Find |CE|.

   b. Given |AC| = 15 m, |AD| = 3 m and |BC| = 25 m. Find |BE|.

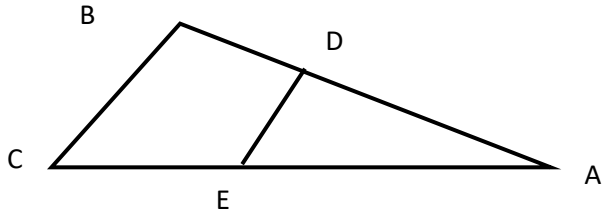


2. In ΔRUT , $\overline{QS} \parallel \overline{UT}$, |RS| = 4 ft, |ST| = 6 ft, and |QU| = 9 ft.

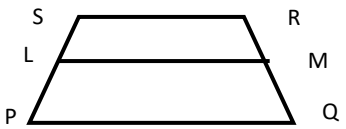
   What is the length of $\overline{RQ}$?



3. In ΔABC, $\overline{DE} \parallel \overline{BC}$, |AD| = (2x), |AB| = 20 cm, |AE| = (3x) and |EC| = 12 cm. Find |AD|.

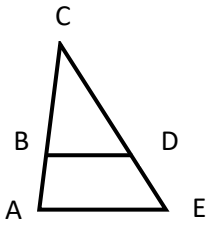


4. Quadrilateral PQRS is a trapezoid in which $\overline{PQ} \parallel \overline{SR}$ and L, M are points on $\overline{PS}$ and $\overline{QR}$ respectively, such that $\overline{LM}//\overline{SR}$. If |LS| = 15 cm, |QM| = 30 cm and |MR| = 10 cm, find |PS|.



5. In the given triangle AEC at the right, |BA| = 33 cm, |CB| = 27 cm, |CD| = 44 cm, and |DE| = 25 cm.

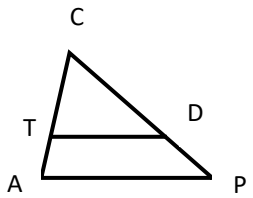
   Is $\overline{BD}$ parallel to $\overline{AE}$? Why or why not?



Assessment

Read and answer each of the following items. Encircle the letter of the correct answer.

1. In ΔCAP, if $\overline{TD} \parallel \overline{AP}$, which of the following is a proportion?

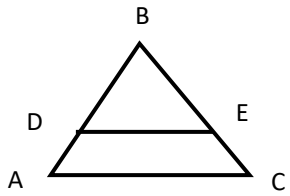


i. $\frac{|CT|}{|CA|} = \frac{|CD|}{|CP|}$ ii. $\frac{|CT|}{|TA|} = \frac{|CD|}{|DP|}$ iii. $\frac{|CD|}{|CA|} = \frac{|CT|}{|CP|}$

A. i only C. i and ii

B. ii only D. ii and iii

For numbers 2 and 3, Given ΔABC with $\overline{DE} \parallel \overline{AC}$.



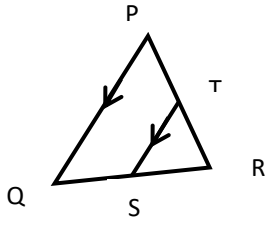
2. If |BD| = 4 m, |DA| = 6 m and |BE| = 5 m, find |EC|.

A. 4.8 m B. 7.5 m C. 15 m D. 30 m

3. Given that |BE| = 4 m, |EC| = 5 m and |BD| = 2 m, find |DA|.

A. 10 m B. 5 m C. 4 m D. 2.5 m

4. In ΔPQR at the right, compute for the value of x if |PT| = 4 cm, |TR| = 2x + 2 cm, |QS| = 7 cm, and |RS| = 7x.

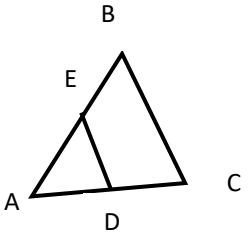


A.1 B. 7 C.5 D.14

5. What is the ratio of |PT| to |PR| in number 4?

A. $\frac{1}{4}$ B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{1}{5}$

6. In ΔBAC at the right, $\angle ADE$ is congruent to $\angle C$. If |AE| = 2 cm, |AB| = 8 cm, |AD| = 3 cm, what is |AC|?

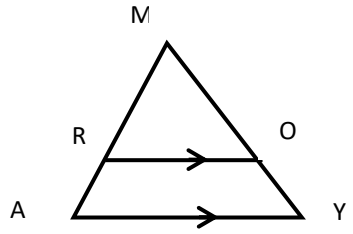


A. 2 cm B. 4 cm C. 8 cm D. 12 cm

For numbers 7 and 8. Given ΔMAY with $\overline{RO} \parallel \overline{AY}$. If |RM| = 8 cm, |RA| = 6 cm, |MO| = 4x, |OY| = 2x + 4 cm.

7. What is the value of x?

A. 2 B. $\frac{6}{5}$ C. $\frac{10}{4}$ D. 4



8. What is the length of $\overline{MY}$?

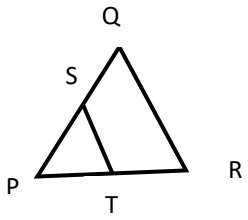
A. 28 cm B. 20 cm C. 16 cm D. 12 cm

9. In ΔPQR at the right, which of the following lengths will make $\overline{ST} \parallel \overline{QR}$?

i. |PR| = 14 m; |PT|= 6 m; |PQ|= 7 m; |PS| = 3 m

ii |PR|=12 m; |TR| = 3 m; |PQ|= 8 m; |PS| = 6 m

iii. |PT|= 6 m; |TR| = 5 m; |PS| = 9 m; |SQ| = 8 m



A. i only C. i and ii

B. ii only D. iii only

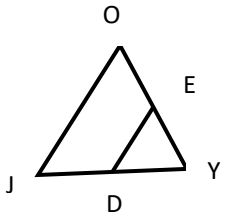
10. Which among the following statements is always true given ΔJOY at the right with $\overline{DE} \parallel \overline{JO}$?

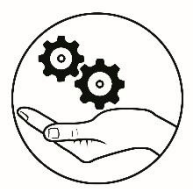
A. D and E are midpoints of sides $\overline{JY}$ and $\overline{OY}$, respectively.

B. $\frac{|JD|}{|DY|} = \frac{|EO|}{|EY|}$

C. $\frac{|YD|}{|DJ|} = \frac{|EY|}{|YO|}$

D. $|JO| = \frac{1}{2}|ED|$





Additional Activities

Let's answer the following!

A. Write the letter of the correct answer on your answer sheet.

1. If Maria needs 14 sticks of pepperoni to make 28 pizzas, how many sticks of pepperoni are needed to make 36 pizzas?

A. 24 C. 18
B. 21 D. 12

2. If a car travels 420 miles in 8 hours, how far can it travel in 12 hours with the same rate?

A. 630 miles C. 600 miles
B. 620 miles D. 540 miles

3. In a certain apartment building, the ratio of the number tenants to the number of cars is 3 : 5. If there are 30 tenants, how many cars are there?

A. 18 C. 30
B. 20 D. 50

4. A bird flies 35 meters in 10 seconds. If it keeps flying at the same rate, how long will it take it to fly 14 more meters?

A. 28 seconds C. 7 seconds
B. 14 seconds D. 4 seconds

5. Just For Feet has 3,116 boxes of shoes on 38 equal-sized shelves. If they plan on adding 9 more shelves of the same size, how many more boxes of shoes will the shelves be able to hold?

A. 783 C. 738
B. 773 D. 737

B. Reflective Learning Sheet

Directions:

1. Write a journal about BPT (Basic Proportionality Theorem).
2. It should contain the following:

**__My Learning__*: These are the things you learned about BPT.

**__My Feeling__*: These are the activities or concepts you like most and why you like them.

PROBLEM-BASED LEARNING WORKSHEET

SAVE NOW, COMPARE LATER!

"Saving money right now also allows you more choices later on, as it gives you a back-up plan in case you need one." - Zach Holz

Suppose you have saved an amount of 10-peso coins and an amount of 100-peso bills. You decided to use it to buy new pair of clothes on your birthday. The pair of clothes that you want to buy is worth 1,000 pesos. A week before your birthday, you've heard on the news about *FUND RAISING TO ACQUIRE 25,000 SURGICAL FACEMASKS FOR OUR FRONTLINERS BATTLING THE COVID-19 PANDEMIC IN THE PHILIPPINES,* so instead of buying new pair of clothes you want, you've realized that it's more important to offer a hand by donating 1,000 pesos to our front liners.

In math, we also have a way to compare one quantity to another quantity of the same units. It is called ratio. What other quantities or measurements can you compare inside the classroom?

Let's Analyze:

1. How many 10-peso coins or 100-peso bills do you need to have an exact amount of 1,000 pesos?

2. Compare the number of 10-peso coins to the number of 100-peso bills.

Answer Key

WHAT I KNOW

1. B 2. C 3. D 4. B 5. C 6. A 7. B 8. D 9. D 10. B

WHAT'S IN

A. 1. ☺ 2. ☺ 3. ☺ 4. ☺ 5. ☹

B. 1. $x = 2$ 2. 143 pounds 3. 6 liters

WHAT IS IT

1. 8 2. 6 3. 18 4. 7 5.No 6. 11,8

WHAT'S MORE

Activity 1:

1. True 2. True 3. False 4. False 5. True

6. False 7. True 8. True 9. False 10. True

Activity 2

1. It cuts the side into two proportional segments.

2. $PB = 10$ 3. $EA = 8$ 4. $GT = 18$ 5. $x = 15.75$, $y = 6$

Activity 3

A. 1. 10 2. 6 3. 24 4. 15

B. 1. 3 2. 1 3. 2 4. 1 5. 4

References

- https://www.cuemath.com/similar-triangles/basic-proportionality-theorem/
- https://byjus.com/maths/basic-proportionality-theorem/
- https://www.onlinemath4all.com/practice-questions-on-basic-proportionality-theorem.html
- https://www.onlinemath4all.com/basic-proportionality-theorem-practice-questions-worksheet.html
- https://spiral.ac/sharing/p1xv27r/triangles-5-basic-proportionality-theorem
- https://www.ck12.org/book/cbse-maths-book-class-10/section/6.4/
- Velayo, M.M. (2015). *Mathematics 9: The Easy Strategies*. Philbooks Publication & Trading, Corp. Cainta, Rizal
- Nivera, G. C and Lapinid, M. R (©2013). *Grade 9 Mathematics: Patterns and Practicalities.* Don Bosco Press, Inc.
- Moise and Downs. *Geometry (Metric Edition) . Addisson Wesley Publishing Company*

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