Activity 7

Producing the Resources

Geometry: Ratio & Proportion and Similarity

What is this resource is about

In this learning experience you will learn how ratio and proportion together with similarity is used to geometry. Ratio and proportion play an important part in geometry as it is in algebra. You will learn how we can use our algebraic knowledge in manipulating ratio and proportion in solving geometric problems.

Algebra plays an important role in solving geometric problems. Our knowledge of ratio and proportion together with our knowledge of parallel lines and sum of angles of triangles will help us to show that triangles are **similar**.

This activity is based on the principle that two triangles will be called similar if their two pairs of corresponding angles (used most of the time) are equal or their corresponding sides are in the same proportion.

You will then learn how to use prove similarity using ratios of corresponding sides of triangles and/or their pairs of corresponding angles (two pairs most of the time).

In this learning experience you will:

- Work as effectively as you can, as individuals and/or as groups.
- Draw up different triangles and specify the ratios of their corresponding sides.
- Measure and calculate some ratios of sides of triangles and/or to prove whether triangles are similar or not, based on your findings.
- Use equiangular and proportional triangles to prove similarity.
- Make general conclusion about similar triangles.
- Investigate the right-angled triangle in relation to similarity.

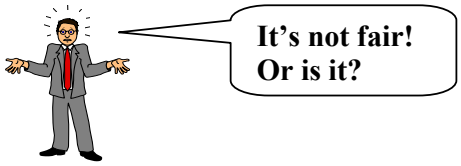
Are they similar?

Activity 1 (Mind teasers)

It's not fair! Or is it?

In this activity you will be using some of the properties of ratio and proportion to come out with the suitable solutions to the problems.

Learners:



- Divide into groups
- Choose a group leader
- Discuss the following problems in your group
- Group leader reports back at the end

Problem 1:
Mandla is paid R100 per day. Zama's pay per day is R50. Is it fair?

Problem 2:
Mother pours cool drink for the twins, Sipho and Siphokazi. She pours the one glass full and the other glass only half. Is it fair?

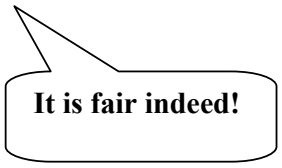
Problem 3:
Madiba's family bill for rates and taxes on their city council's tax invoice is R240 per month. The same bill for family Malombo is R180. Is it fair?

Problem 4:
Msomi's family monthly medical aid contribution is R400 while family Msweli's is R200. Is it fair?

Are these pictures equal or similar?

Activity 2 (Mind teasers)

It is fair indeed!



Learners:

- Stay in your groups
- Discuss the same problems again
- Make new conclusions and group leaders report back.

Problem 1:
Mandla is paid R100 per day. He works from 8:00 to 17:00 and has a one-hour lunch break. Zama's pay per day is R50. She works from 7:30 to 12:30. Is it fair?

Problem 2:
Mother pours cool drink for the twins, Sipho and Siphokazi. The one is a big glass and takes 200ml, while the other glass takes only 100ml. She pours the small glass full and the other glass only half. Is it fair?

Problem 3:
Madiba's family bill for rates and taxes on their city council's tax invoice is R240 per month. Their stand is $400m^2$. They have a big house with two bathrooms and a maid's room. The same bill for family Malombo is R180. Their stand is $300m^2$ and they have a small house. Is it fair?

Problem 4:
Msomi's family monthly medical aid contribution is R400. Mr Msomi has a wife and 4 children that benefits from the fund. Mr Msweli's monthly medical aid contribution is R200. Mr Msweli has a wife and one child that benefits from the fund. Is it fair?

What is the conclusion?

Indeed it is fair. Figures can be misleading if you do not look at the whole picture.

This is one and the same picture!
Meaning the same person in different positions

Activity 3: Equal Ratios

Direct proportion

The teacher will help to explain the following:

Ratios are to do with proportions. For example: If you make a jug of guava juice with 2 cups of guava concentrate and 5 cups of water, you are mixing ingredients in the ratio of two to five. We write it as 2:5. You can increase all the ingredients as long as you do it in the same proportion.

- You can make 2 jugs with 4 cups of concentrate and 10 cups of water.
  (4:10 = 2:5 or as a fraction: $\frac{4}{10} = \frac{2}{5}$)
- You can make half a jug with 1 cup of concentrate and 2 cups of water.
  (1:2½ = 2:5 or $\frac{1}{2\frac{1}{2}} = \frac{2}{5}$)
- You can make 3 jugs with 6 cups of concentrate and 15 cups of water.
  (6:15 = 2:5 or $\frac{6}{15} = \frac{2}{5}$)

As long as the ratio stays 2:5, you can increase or decrease, as you like!

The ratio 2:5, or $\frac{2}{5}$, in this problem, is called the constant of proportionality.

This is an example of direct proportion.

We always write a ratio in the simplest form!

NB: That's why problems 1 – 4 (activity 2) were actually quite fair. The constant of proportionality in each problem was the same. E.g. 100:8 = 50:4 in problem 1.

Learner:

- Do on your own in your workbook
- You may use a calculator

Wow!!

The following table shows the sizes and prices of washing powder. Mother wants value for money, but she doesn't know which offer to buy. Can you help her?

Size	**Small 200g**	**Medium 500g**	**Large 1,2kg**	**Economy 2kg**	**Special Offer 2x200g**
Price	**R4, 90**	**R7, 50**	**R13, 00**	**R25, 00**	**R7, 00**
$\frac{Price}{Amount}$					

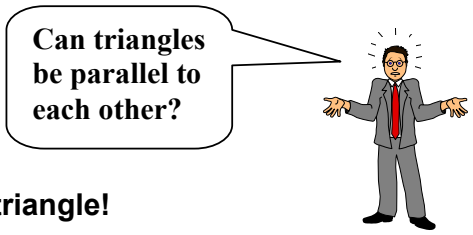
1. Calculate the ratio of price over amount (equal amount) for each size, and
2. Do you think the "Special Offer" is really worthwhile? Explain!
3. State which offer will yield to the best value for money (the cheapest)?

Activity 4 Parallel Lines

What kinds of triangles are formed?

Learners:

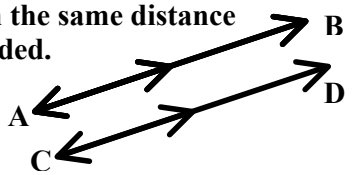
- Do on your own in your workbook
- Use rulers and/or protractors
- You may use a calculator



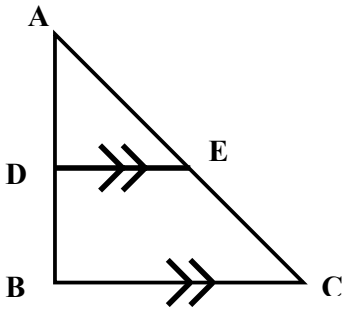
1. If a parallel line is drawn to one side of a triangle!

Parallel lines are lines that never cross, they stay in the same distance From each other, no matter how far they are extended.
Parallel lines are indicated by arrows, e.g. AB||CD

We show it in a drawing with arrows



1. Draw five different sizes of triangles on your workbook
2. Draw a line parallel to one side in each triangle
3. Measure the ratios formed by the two sides:



3.1 $\frac{AD}{DB}$ and $\frac{AE}{EC}$

3.2 $\frac{AD}{AB}$ and $\frac{AE}{AC}$

3.3 $\frac{AB}{DB}$ and $\frac{AC}{EC}$

4. What can you say about the sides of the two triangles formed?
5. What do you observe from the ratios formed?
6. What can you conclude from your observation?

General conclusion:

If a line is drawn parallel to one side of a triangle, it divides the other two sides proportionally.

What can you say about the three pairs of sides of the triangles?
(They also give the same ratio)

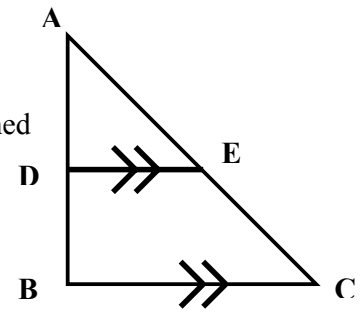
2. Are the Three angles equal?

Triangles with equal angles are called Equiangular!!!!!!!!!!!!!!!!

1. Consider five different sizes of triangles you have drawn on your workbook
3. Also consider the parallel lines you have drawn to one side in each triangle
4. In all cases two triangles have been formed
5. Name pairs of triangles formed in each case

   In this example:

   ΔADE and ΔABC



6. Measure the pairs of corresponding angles formed

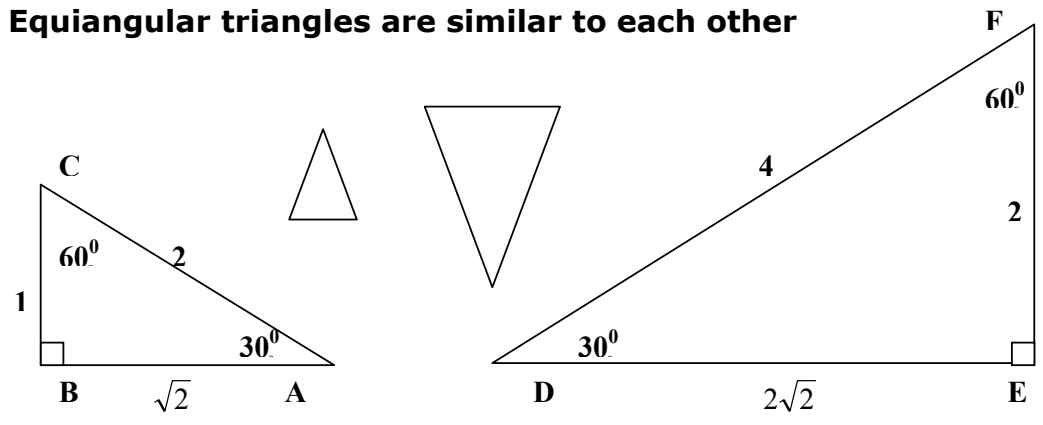
   In this example:

   $\angle ADE$ and $\angle ABC$

   $\angle AED$ and $\angle ACB$

7. What can you say about the angles of the two triangles formed in all five cases?
8. What can you conclude from your observation?
9. What can you say about the angles opposite the line you have drawn in relation to both triangles formed?

Equiangular triangles are similar to each other



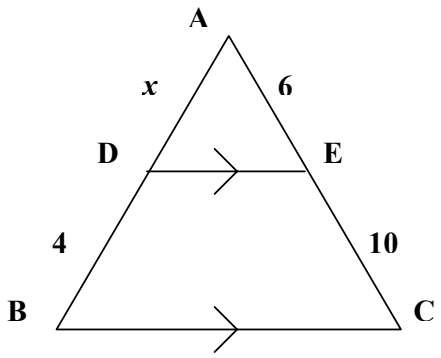
3. The missing link.

Consider all what you have done above in the above activities. Link it in one way or another as you see it fit in the following activity.

1. In the diagram alongside complete:

   1.1 $\frac{AD}{DB} =$

   1.2 Calculate x



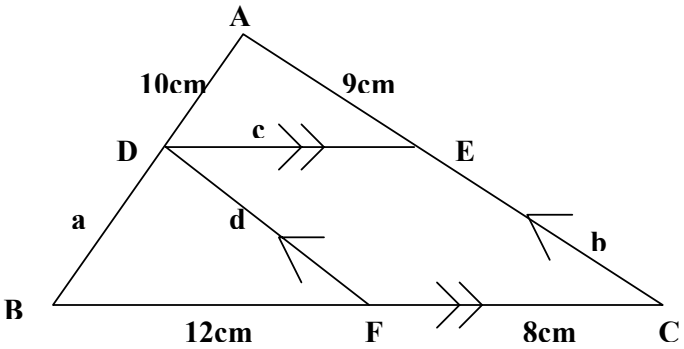
2. In the figure:
   With reasons, calculate:

   2.1 **a**

   2.2 **b**

   2.3 **c**

   2.4 **d**



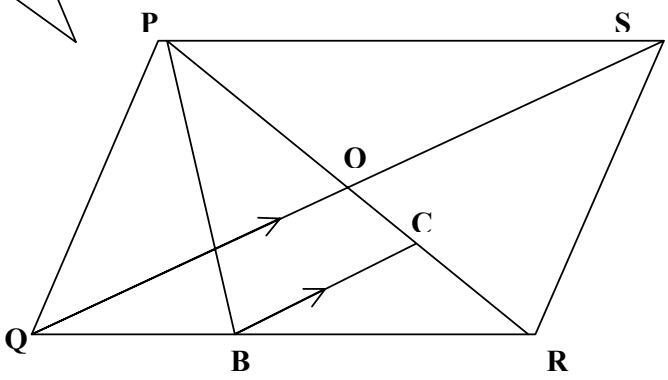
Remember diagonals of a parallelogram?

3. In the figure:

   PQRS is a parallelogram

   QS || BC and $\frac{QB}{BR} = \frac{2}{3}$

   Calculate: $\frac{PO}{OC}$



NB: Leave your answer in fraction form

4. Given: (similar is represented by |||)

$\hat{A} = A\hat{C}B = x$ and 3PT = 2TQ

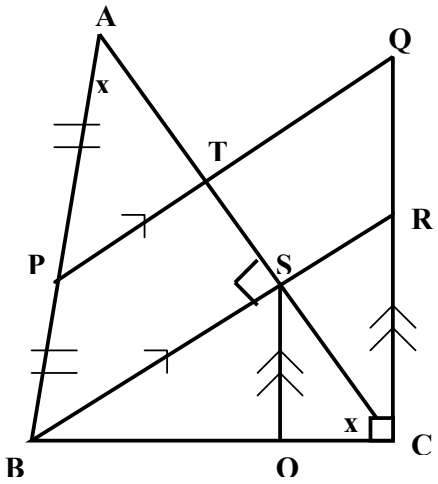
Determine:

4.1 PT:BS

4.2 CS:ST

4.3 BO:OC

4.4 Prove that $\Delta APT \,|||\, \Delta RBC$



5. For enrichment: How far can you go?

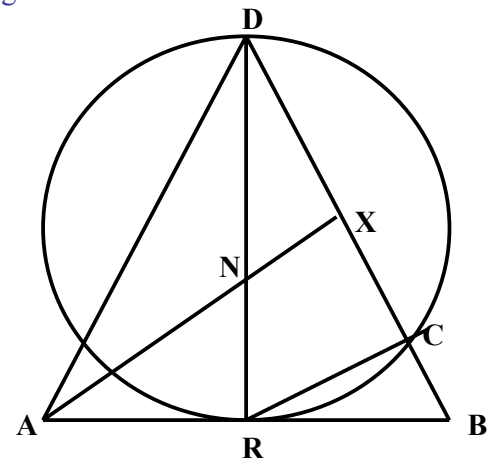
In the figure: ARB is a tangent and AR = RB.

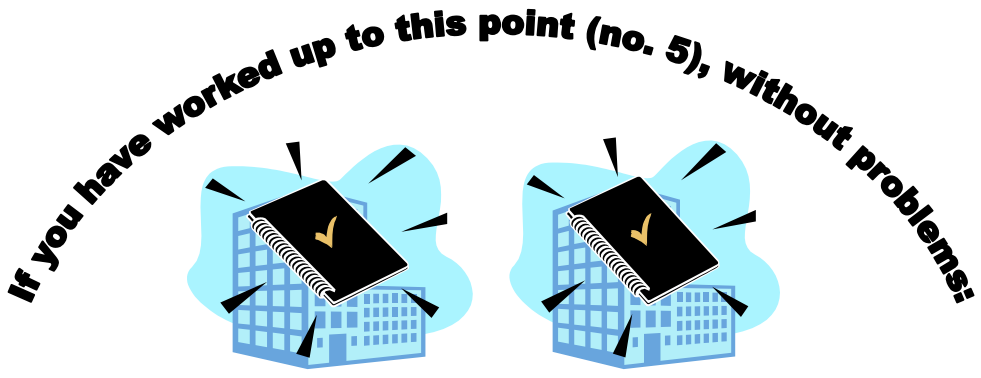
X is a point on DC so that XC = BC.

Prove that:

5.1 $\Delta DNX \,|||\, \Delta ANR$

5.2 NX • AB = 2DX • NR





"CONGRATULATIONS"

Assessment for the learning experience

Meeting the outcomes: How confident are about what you

Meeting the outcomes: How confident are about what you have learnt?

For the learner: Stop and think!

What have you learnt in the previous activities?

Look at these questions about things you have learnt in this experience.
For each question decide whether:

- you can do it or know about it;
- you need more practice with it;
- you need to read more about it.

Discuss your answers with a partner or a group.

- Can you compare quantities using ratio notation?
- Can you think of other similar quantities you could compare using ratio?
- Can you solve problems using ratio and proportion?
- Do you know the difference between similar and congruent?
- Can you use ratios/angles to work out similarity

For the educator

Assess learners' progress by checking the following:

- Can they compare quantities using ratio notation?
- Do they know what it means for quantities to be in proportion?
- Can they solve problems using ratio and proportion?
- Do they know the difference between similar and congruent figures?
- **Can they use ratios/angles to work out similarity?**