MATHEMATICS
GRADE 8

DATE: .....

TOPIC: GEOMETRY OF 2- D SHAPES

CONCEPTS & SKILLS TO BE ACHIEVED:
By the end of the lesson learners should know and be able to

- Identify and write clear definitions of triangles in terms of their sides and angles, distinguishing between:
  - equilateral triangles; isosceles triangles; right-angled triangles
- Identify and write clear definitions of quadrilaterals in terms of their sides and angles, distinguishing between:
  - Parallelogram; rectangle; square; rhombus; trapezium; kite

RESOURCES:	DBE Workbook 1, Sasol-Inzalo Learner Book, Textbooks,
ONLINE RESOURCES	https://drive.google.com/open?id=1Qw6gZzmSxQ-ypsHmqx1LHnVbA2HsKX79 https://www.thelearningtrust.org/asp-treasure-box

INTRODUCTION
Revision on the concept from Grade 7:

A triangle is a closed 2D shape with three straight sides. We can classify or name different types of triangles according to the lengths of their sides and according to the sizes of their angles.

TRIANGLES CAN BE NAMED ACCORDING TO THEIR SIDES OR THEIR ANGLES

DAY 1: ACTIVITY 1:

LESSON PRESENTATION/DEVELOPMENT

Teaching activities	Learning activities (Learners are expected to)

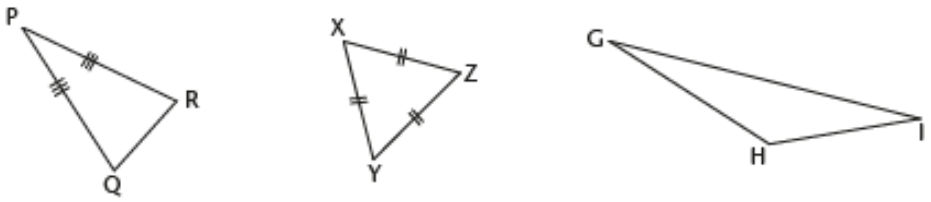
Work through the following activity:

ACTIVITY 1: NAMING TRIANGLES ACCORDING TO THEIR SIDES:

1. Match the name of each type of triangle with its correct description:

Name of triangle	Description of triangle
Isosceles triangle	All the sides of a triangle are equal.
Scalene triangle	None of the sides of a triangle are equal.
Equilateral triangle	Two sides of a triangle are equal.

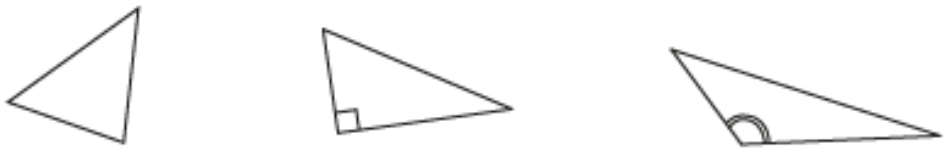
2. Name each type of triangle by looking at its sides:



- Learners may respond to teacher while working activities on the board

ACTIVITY 2: NAMING TRIANGLES ACCORDING TO THEIR ANGLES:

Study the following triangles and then answer the questions:



Acute triangle **Right-angled triangle** **Obtuse triangle**

1. Are all the angles of a triangle always equal?

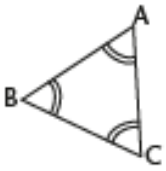
2. When a triangle has an obtuse angle, what kind of triangle is it called?

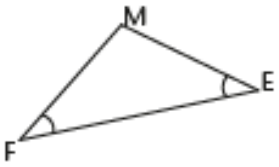
3. When a triangle has only acute angles, what kind of triangle is it called?

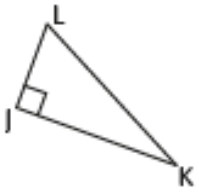
4. What size must one of the angles of a triangle be for it to be called a right-angled triangle?

ACTIVITY 3: INVESTIGATING THE ANGLES AND SIDES OF TRIANGLES

Look at the triangles below. The arcs show which angles are equal







Equilateral triangle **isosceles triangle** **right-angled triangle**

NOTE:

1. ΔABC is an equilateral triangle. What do you notice about its angles?
2. ΔFEM is an isosceles triangle. What do you notice about its angles?
3. ΔJKL is a right-angled triangle. Is its longest side opposite the 90° angle?

CONSOLIDATION/CONCLUSION

Emphasise the following:

Properties of triangles:

- The sum of the interior angles of a triangle is 180°.
- An equilateral triangle has all sides equal and each interior angle is equal to 60°.
- An isosceles triangle has two equal sides and the angles opposite the equal sides are equal.
- A scalene triangle has no sides equal.
- A right-angled triangle has a right angle (90°).
- An obtuse triangle has one obtuse angle (between 90° and 180°).
- An acute triangle has three acute angles (< 90°).

MEMORANDUM: DAY 1:

Activity 1:

Name of triangle	**Description of triangle**
Isosceles triangle	Two sides of a triangle are equal.
Scalene triangle	None of the sides of a triangle are equal.
Equilateral triangle	All the sides of a triangle are equal.

2. From left to right:
   Isosceles triangle
   Equilateral triangle
   Scalene triangle

Activity 2:

1. No
2. Obtuse triangle

3. Acute triangle
4. 90°

Activity 3:

1. All angles are equal
2. Only two angles are equal
3. Yes

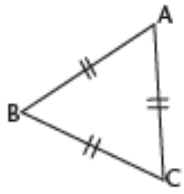
DAY 2: ACTIVITY 1:

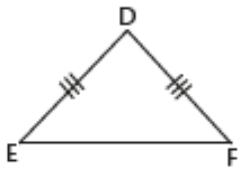
LESSON PRESENTATION/DEVELOPMENT

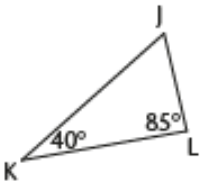
Teaching activities	Learning activities (Learners are expected to)

Activity 1

Look at the following examples of working out unknown angles and sides when certain information is given. The reason for each statement is written in square brackets.







∠A = ∠B = ∠C = 60° [Angles in an equilateral Δ = 60°]

DE = DF [Given]

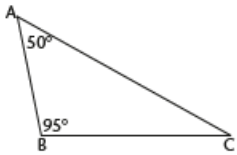
∠E = ∠F [Angles opposite the equal sides of an isosceles Δ are equal]

∠J = 55° [The sum of the interior angles of a Δ = 180°; so ∠J = 180° – 40° – 85°]

You can shorten the following reasons in the ways shown:

- Sum of interior angles (∠s) of a triangle (Δ) = 180°: **Interior ∠s of Δ**
- Isosceles triangle has two sides and two angles equal: **Isosceles Δ**
- Equilateral triangle has three sides and three angles equal: **Equilateral Δ**
- Angles forming a straight line = 180°: **Straight line**

1. Find ∠C



CONSOLIDATION/CONCLUSION

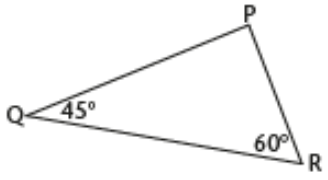
Emphasise the following:

- Sum of interior angles (∠s) of a triangle (Δ) = 180°: **Interior ∠s of Δ**
- Isosceles triangle has two sides and two angles equal: **Isosceles Δ**
- Equilateral triangle has three sides and three angles equal: **Equilateral Δ**
- Angles forming a straight line = 180°: **Straight line**

HOMEWORK/CONSOLIDATION: Do the following exercises. The solutions can be found at the end of the lesson.

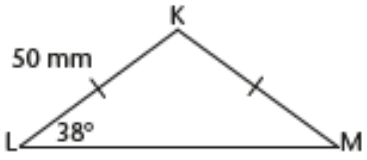
FIRST ATTEMPT TO DO THE EXERCISE BEFORE YOU WORK THROUGH THE SOLUTIONS

1. Find ∠ P

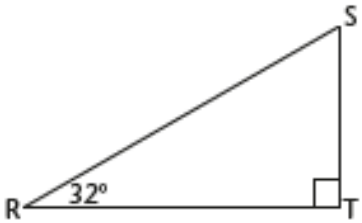


2. (a) Find KM.

b) Find ∠ K

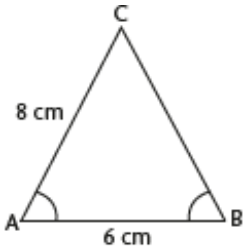


3. What is the size of ∠S ?

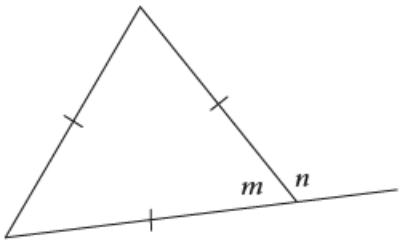


4. a) Find CB.

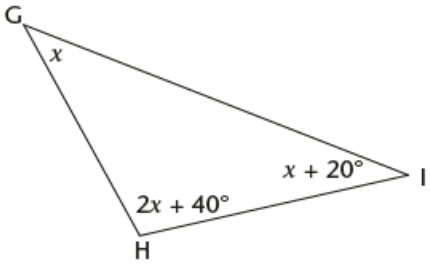
b) Find ∠C if ∠A = 50°.



5. Angle *m* and *n* form a straight angle. Calculate the size of *m* and *n*.



6. Calculate the size of x and ∠H



MEMORANDUM: DAY 2:

1. $\hat{Q} + \hat{P} + \hat{R} = 180°$ [Interior <s of a Δ]
   $45° + \hat{P} + 60° = 180°$
   $\hat{P} = 180° - 45° - 60°$
   $\hat{P} = 75°$

2. (a) KM = KL = 50 mm
   (b) $\hat{L} = \hat{M} = 38°$ [Isosceles Δ]
   $\hat{K} + \hat{L} + \hat{M} = 180°$ [Interior <s of a Δ]
   $\hat{K} + 38° + 38° = 180°$
   $\hat{K} = 180° - 38° - 38°$
   $\hat{K} = 104°$

3. $\hat{S} + \hat{T} + \hat{R} = 180°$ [Interior <s of a Δ]
   $\hat{S} + 90° + 32° = 180°$
   $\hat{S} = 180° - 90° - 32°$
   $= 58°$

4. (a) DF = DE = 4mm [Isosceles Δ]

   (b) $\hat{D} + \hat{E} + \hat{F} = 180°$ [Interior <s of a Δ]
   $100° + \hat{E} + \hat{E} = 180°$
   $100° + 2\hat{E} = 180°$
   $2\hat{E} = 180° - 100°$
   $\hat{E} = 80° \div 2$
   $\hat{E} = 40°$

5. m = 60° [Equilateral Δ]
m + n = 180° [Straight line]
n = 180° - 60°
n = 120°

6. $x + (2x + 40°) + (x + 20°) = 180°$ [Interior <s of a Δ]
$4x$ = 180° - 40° - 20°
$4x$ = 120°
x = 30°

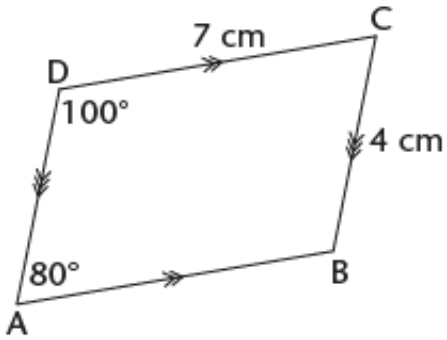
$\hat{H}$ = $2x$ + 40°
$\hat{H}$ = 2(30°) + 40°
$\hat{H}$ = 100°

DAY 3:

LESSON PRESENTATION/DEVELOPMENT

Teaching activities	Learning activities (Learners are expected to)
Revision of quadrilaterals: **• A rectangle is a parallelogram that has all four angles equal to 90°.** **• A rhombus is a parallelogram with all four sides equal.** **• A square is a rectangle with all four sides equal and angles equal to 90°** **• A trapezium is a quadrilateral with one pair of opposite sides parallel.** **• A kite is a quadrilateral with two pairs of adjacent sides equal.** **Classification of quadrilaterals should include the recognition that:** **• rectangles and rhombi are special kinds of parallelograms** **• a square is a special kind of rectangle and rhombus.** **• Properties of quadrilaterals learners should know:** **-- the sum of the interior angles of quadrilaterals = 360°** **-- the opposite sides of parallelograms are parallel and equal** **-- the opposite angles of parallelograms are equal** **-- the opposite angles of a rhombus are equal** **-- the opposite sides of a rhombus are parallel and equal** **-- the size of each angle of rectangles and squares is 90°** **-- a trapezium has one pair of opposite sides parallel** **Work through the following activity:** **ACTIVITY 1 UNKNOWN ANGLES AND SIDES OF QUADRILATERALS**	

Find the length of all the **unknown sides** and **angles** in the following quadrilateral.
Give reasons to justify your statements.
(Also recall that the sum of the angles of a quadrilateral is 360°.)



CONSOLIDATION/CONCLUSION

Emphasise the following:
Classification of quadrilaterals should include the recognition that:

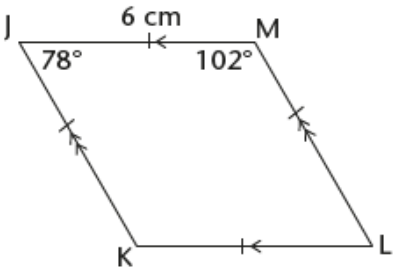
- rectangles and rhombi are special kinds of parallelograms
- a square is a special kind of rectangle and rhombus.

HOMEWORK/CONSOLIDATION: Do the following exercises. The solutions can be found at the end of the lesson.

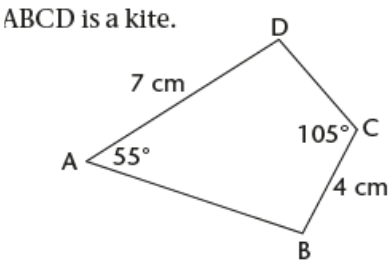
FIRST ATTEMPT TO DO THE EXERCISE BEFORE YOU WORK THROUGH THE SOLUTIONS

Find the length of all the **unknown sides** and **angles** in the following quadrilaterals.
Give reasons to justify your statements.

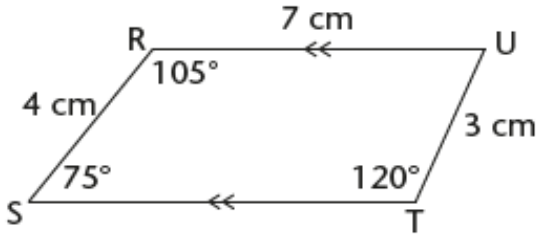
1.



2. ABCD is a kite



3. The perimeter of RSTU is 23cm



MEMORANDUM: DAY 3:

1. JKLM is a rhombus [opposite sides||Type equation here. and all sides equal]
   JK=LM=KL=JM=6cm [Rhombus]
   $\hat{K}$=$\hat{M}$=102° [rhombus]
   $\hat{J}$=$\hat{L}$=18° [rhombus]

2. $\hat{D}$=$\hat{B}$ [kite]
   $\hat{D}$+$\hat{B}$+55°+105° = 360° [quadrilateral]
   2$\hat{D}$=360° − 105° − 55°
   $\hat{D}$=100°=$\hat{B}$
   AB=AD=7cm [kite]
   BC=CD=4cm [kite]

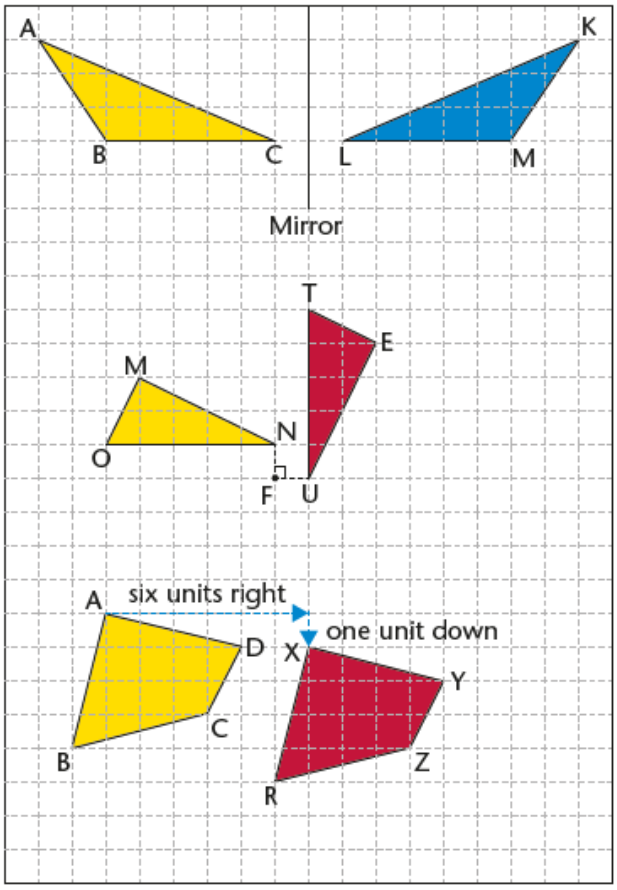
3. 4+7+3+ST=23cm
   ST= 9cm
   75°+105°+120°+ $\hat{U}$=360° [quadrilateral]
   $\hat{U}$=60°

DAY 4:

LESSON PRESENTATION/DEVELOPMENT

Teaching activities

Work through the following activity:
ACTIVITY 1: CONGRUENCY:



Refer to the figure and answer the questions based on the shapes in the figure:

1. ΔABC is reflected in the vertical line (mirror) to give ΔKLM.

Are the sizes and shapes of the two triangles exactly the same?

2. ΔMON is rotated 90° around point F to give you ΔTUE.

Are the sizes and shapes of ΔMON and ΔTUE exactly the same?

3. Quadrilateral ABCD is translated six units to the right and one unit down to give quadrilateral XRZY.

Are ABCD and XRZY exactly the same?

In the previous activity, each of the figures was transformed (reflected, rotated or translated) to produce a second figure. The second figure in each pair has **the same angles**, **side lengths**, **size and area** as the first figure. The second figure is therefore an **accurate copy** of the first figure.

When one figure is an image of another figure, we say that the two figures are congruent. The symbol for congruency is: ≡

For example, in **ΔABC** and **ΔKLM,**
∠ A is congruent to (matches and is equal to) ∠K
∠B is congruent to ∠M
∠Cis congruent to ∠L .
We therefore use this notation: **ΔABC ≡ ΔKML**

Similarly, for the other pairs of figures on the previous page:

ΔMON ≡ ΔTUE and **ABCD ≡ XRZY**.
The notation of congruent figures also shows which sides of the two figures correspond and are equal. For example, **ΔABC ≡ ΔKML** shows that: **AB = KM, BC = ML and AC = KL.**

CONSOLIDATION/CONCLUSION

Emphasise the following:
When one figure is an image of another figure, we say that the two figures are congruent. The symbol for congruency is: ≡

HOMEWORK/CONSOLIDATION: Do the following exercises. The solutions can be found at the end of the lesson.

FIRST ATTEMPT TO DO THE EXERCISE BEFORE YOU WORK THROUGH THE SOLUTIONS

Copy the following table and write down which angles and sides are equal between each pair of congruent figures:

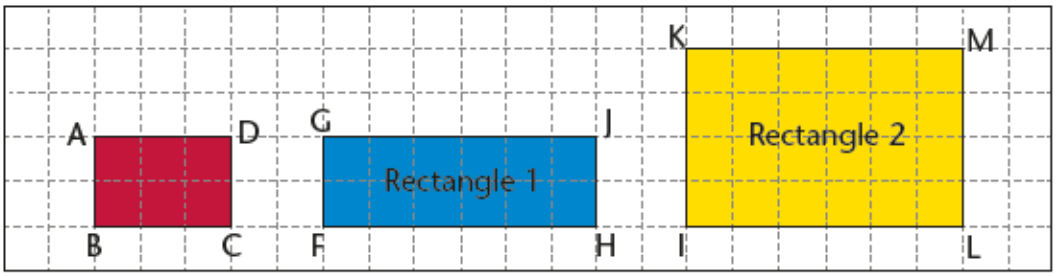
1. ΔPQR ≡ ΔUCT	2. ΔKLM ≡ ΔUWC

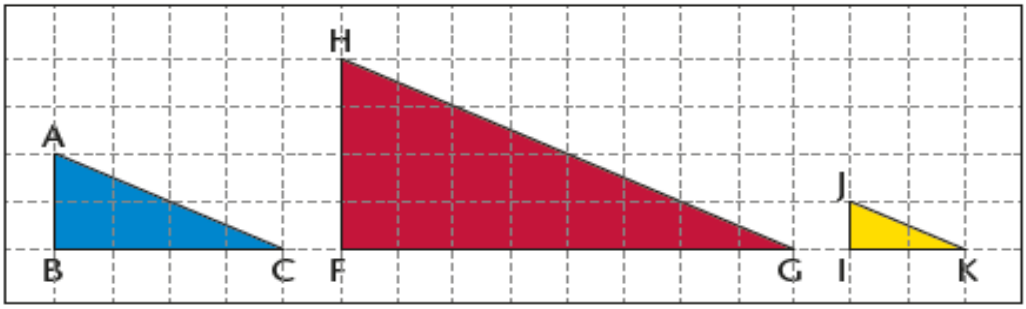
MEMORANDUM: DAY 4:

1. ΔPQR ≡ ΔUCT	2. ΔKLM ≡ ΔUWC
$\hat{P}=\hat{U}$, $\hat{Q}=\hat{C}$, $\hat{R}=\hat{T}$ PQ=UC, QR=CT, PR=UT	$\hat{K}=\hat{U}$, $\hat{L}=\hat{W}$, $\hat{M}=\hat{C}$ KL=UW, LM=WC, KL=PQ

DAY 5:

LESSON PRESENTATION/DEVELOPMENT

Teaching activities	Learning activities (Learners are expected to)
Work through the following activity: **ACTIVITY: SIMILARITY** **In Grade 7, you learnt that two figures are similar when they have the same shape (their angles are equal) but they may be different sizes. The sides of one figure are proportionally longer or shorter than the sides of the other figure; that is, the length of each side is multiplied or divided by the same number. We say that one figure is an enlargement or a reduction of the other figure** 1. Look at the rectangles below and answer the questions that follow:  (a) Look at rectangle 1 and ABCD. How many times is FH longer than BC? How many times is GF longer than AB? (b) Look at rectangle 2 and ABCD. How many times is IL longer than BC? How many times is LM longer than CD? (c) Is rectangle 1 or rectangle 2 an enlargement of rectangle ABCD? Explain your answer. 2. Look at the triangles below and answer the questions that follow	respond



(a) How many times is:

- FG longer than BC? HF longer than AB?
- HG longer than AC? IK shorter than BC?
- JI shorter than AB? JK shorter than AC?

(b) Is ΔHFG an enlargement of ΔABC? Explain your answer.

(c) Is ΔJIK a reduction of ΔABC? Explain your answer.

CONSOLIDATION/CONCLUSION

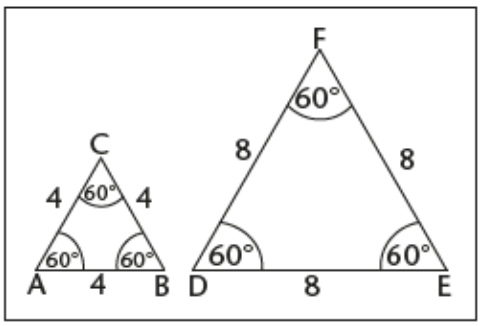
Emphasise the following:

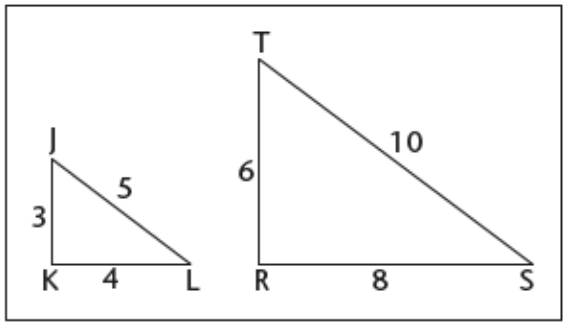
- When you enlarge or reduce a polygon, you need to enlarge or reduce all its sides proportionally, or by the same ratio. This means that you multiply or divide each length by the same number.
- **Similar figures are figures that have the same angles (same shape) but are not necessarily the same size**.

HOMEWORK/CONSOLIDATION: Do the following exercises. The solutions can be found at the end of the lesson.

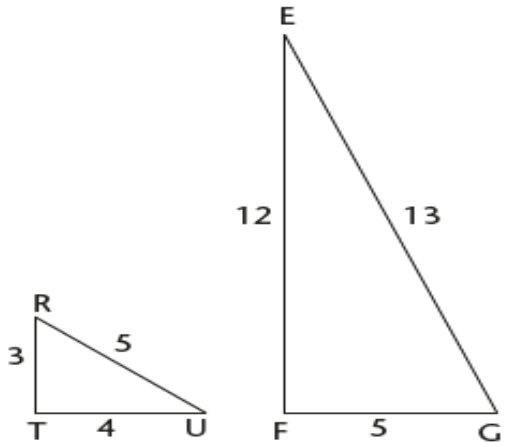
FIRST ATTEMPT TO DO THE EXERCISE BEFORE YOU WORK THROUGH THE SOLUTIONS

1. Are the triangles in each pair similar? Give a reason for each answer.

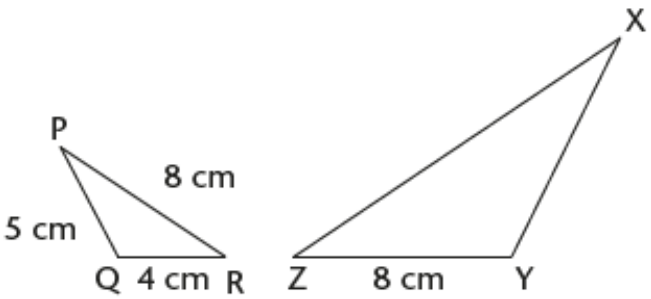




2. Is ΔRTU /// ΔEFG? Give a reason for your answer.



3. ΔPQR /// ΔXYZ. Determine the length of XZ and XY.



4. Are the following statements true or false? Explain your answers.

(a) Figures that are congruent are similar.

(b) Figures that are similar are congruent.

(c) All rectangles are similar.

(d) All squares are similar.

MEMORANDUM : DAY 5:

1. Yes. The angles are the same size (equilateral Δ).
   Yes. The corresponding sides are enlarged in the same proportion.
2. No. While RT × 4 = EF, TU is enlarged less than 2 times to FG.
3. 3. ZY is 2 × QR. So XZ = 2PR = 16 cm and XY = 2PQ = 10 cm
4. (a) True, the corresponding sides are in the same proportion (equal, in fact).
   (b) False, the corresponding sides are not necessarily of equal length.
   (c) False, the breadth can be enlarged by one proportion and the length by another.
   (d) True, corresponding sides are in the same proportion as length = breadth