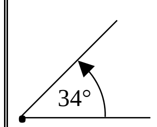
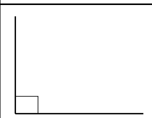
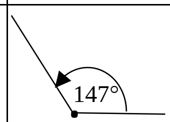
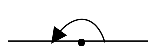
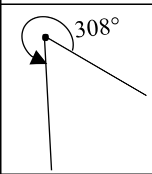
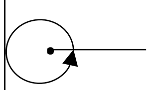
SUBJECT and GRADE	Mathematics Grade 10	
TERM 1	Week 7: EUCLIDEAN GEOMETRY	
TOPIC	Revision Grade 9	
AIMS OF LESSON	To understand and apply the theorems in Geometry	
RESOURCES	***Paper based resources***	***Digital resources***
	Please refer to the chapter in your textbook on Euclidean Geometry	*https://www.youtube.com/watch?v=WK5w3_e2v0s ; https://www.youtube.com/watch?v=00Mwp2W8jnU https://www.youtube.com/watch?v=p6w1JBLS-Tk ; https://www.youtube.com/watch?v=jWHOF6cFbpw https://www.youtube.com/watch?v=w8T6Lkmo-T0 ; https://www.youtube.com/watch?v=r7m424e3Kdc https://www.youtube.com/watch?v=n44WDrtzppM*
INTRODUCTION	In this lesson we will revise Gr 9 Geometry.	
CONCEPTS/ SKILLS	• Parallel Lines, alternate, corresponding and co-interior angles • Revising Angles • Identification of Different Triangles • The Difference between Congruency and Similarity • The Practice of Logical Reasoning	
Lesson 1 + 2	Revision of Gr 9 Geometry: Lines and angles	

1. Lines and Angles (∠s):

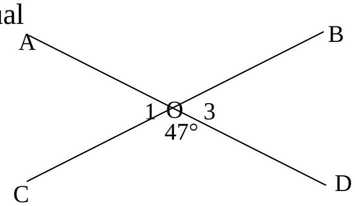
Type of ∠	**Acute ∠:**	**Right ∠:**	**Obtuse ∠:**	**Straight ∠:**	**Reflex ∠:**	**Revolution:**
Size	Between 0° and 90°	= 90°	Between 90° and 180°	= 180°	Between 180° and 360°	= 360°
Example						

Theorems on lines and angles:

1. If 2 lines intersect each other, then the pairs of **vertically opposite** angles are equal

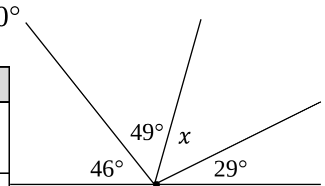
Example: In the figure:

Statement	Reason
$A\hat{O}B = 47°$	vertically opp.
and $\hat{O}_1 = \hat{O}_3$	vertically opp.



2. The sum of **angles on a straight line** = 180°

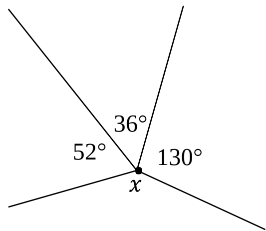
Statement	Reason
$x + 46° + 49° + 29° = 180°$	∠s on straight line
$\therefore x = 180° - 124°$	
$\therefore x = 56°$	



- 2 angles that add up to 90°, are **complementary ∠s**
- 2 angles that add up to 180°, are (Adjacent) **supplementary ∠s**
- Lines that intersect at right ∠s (90°), are **perpendicular** (⊥) on each other

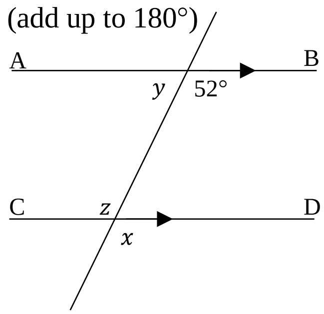
3. The sum of **angles around a point** = 360°

Example: Find the value of x in the diagram:



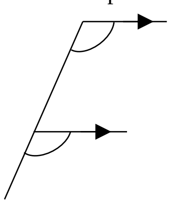
Statement	Reason
$x + 52° + 36° + 130° = 360°$	∠s around point OR revolution
$\therefore x = 360° - 218°$	
$\therefore x = 142°$	

4. When 2 **parallel lines** are cut by a transversal:
   - The pairs of **corresponding ∠s** are **equal**
   - The pairs of **alternate ∠s** are **equal** and
   - The **co-interior ∠s** are **supplementary** (add up to 180°)

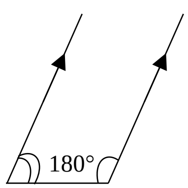


Statement	Reason
$x = 52°$	Corresp. ∠s; AB//CD
$z = 52°$	Alternate ∠s; AB//CD
$y + z = 180°$	Co-int. ∠s; AB//CD

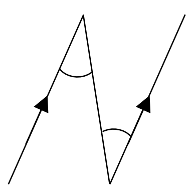
Corresponding ∠s =



Co-interior ∠s suppl.



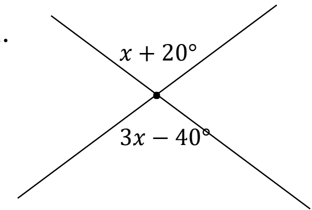
Alternate ∠s =



CAN YOU?

Determine, with reasons, the value of the letters:

1.



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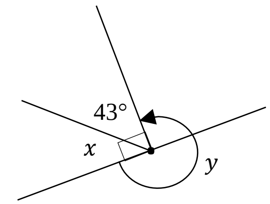

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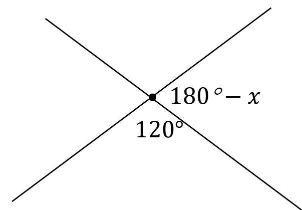

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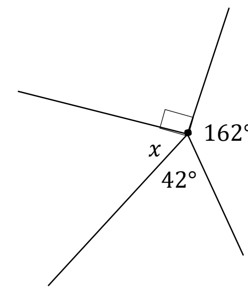

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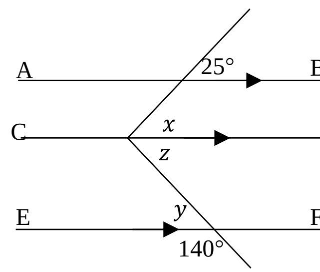
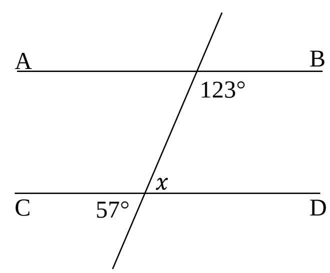


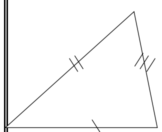
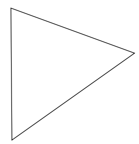
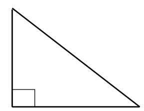
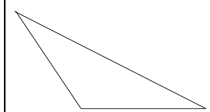
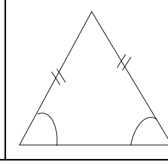
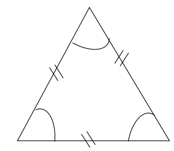
Answers: 1. 30°
2. $x = 47°; y = 270°$
3. 120°
4. 66°
5. $x = 25°; y = 40°;\ z = 40°$

6. Prove that AB//CD



Lesson 3 + 4	Revision: Gr 9 Geometry: Triangles

2. Triangles (Δs):

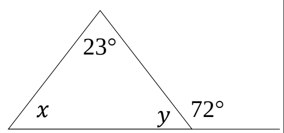
Type of Δ	Scalene Δ:	Acute Δ:	Right-angled Δ:	Obtuse Δ:	Isosceles Δ:	Equilateral Δ:
	No equal sides ⇒ no equal ∠s	All angles are acute (< 90°)	1 ∠ equal 90°; the other 2 are acute (Pythagoras)	1 angle is obtuse (> 90°)	2 equal sides ⇒ 2 equal ∠s opposite equal sides	All 3 sides equal ⇒ all ∠s are equal to 60°
Example						

- The smallest ∠ is opposite the shortest side
- The longest side (opposite the right ∠) in a right-angled Δ is called the hypotenuse
- There can be only 1 obtuse angle or right angle in a Δ

Theorems on Δs:

1. The sum of the interior angles of a triangle is 180° **(int. ∠s of Δ)**

2. The exterior angle of a triangle is equal to the sum of the 2 opposite interior angles (**ext. ∠ of Δ)**

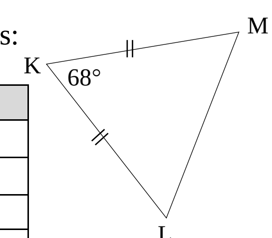


Example: Determine, with reasons, the size of x and y:

Statement	Reason
$x + 23° = 72°$	Ext. ∠ of Δ
$\therefore x = 49°$	
$y + x + 23° = 180°$	Int. ∠s of Δ
$\therefore y + 49° = 180°$	
$\therefore y = 131°$	

3. In an isosceles triangle:
   - The angles opposite the 2 equal sides are equal **(∠s opp. = sides) OR**
   - The sides opposite the 2 equal angles are equal **(sides opp. =∠s)**

Example: Determine the size of K$\hat{M}$L, with reasons:

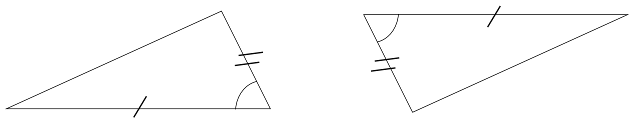


Statement	Reason
K$\hat{M}$L = K$\hat{L}$M	∠s opp. = sides
K$\hat{M}$L + K$\hat{L}$M + 68° = 180°	Int.∠s of Δ
∴2K$\hat{M}$L+ 68° = 180°	
∴2K$\hat{M}$L = 112°	
∴K$\hat{M}$L = 56°	

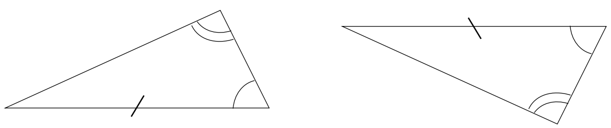
4. 2 triangles are **congruent (≡)** if:

- **3 sides** of 1 Δ is equal to 3 sides of another Δ **(s, s, s)**

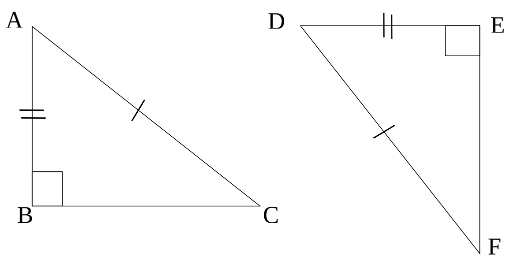
- 2 sides and the **included** ∠ of 1 Δ is equal to 2 sides and the included ∠ of another Δ **(s, ∠, s)**



- 2 ∠s and a side of 1 Δ is equal to 2 ∠s and the **corresponding side** of another Δ **(∠, ∠, s)**



- The **hypotenuse and a side** of a right-angled Δ is equal to, The hypotenuse and a side of another right-angled Δ **(90°, h, s)**



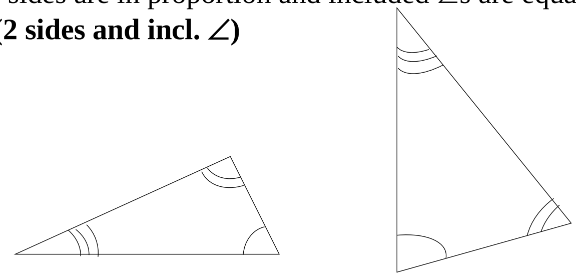
Write the equal ∠s in corresponding places (usually given so in question)

Congruency means equal in size (length of sides) and equal in form (size of ∠s)

∴ if ΔABC ≡ ΔDEF ⇒ $\hat{A} = \hat{D}, \hat{B} = \hat{E}$ and $\hat{C} = \hat{F}$. Also AB = DE, AC = DF and BC = EF

5. 2 triangles are **similar (|||)** if:

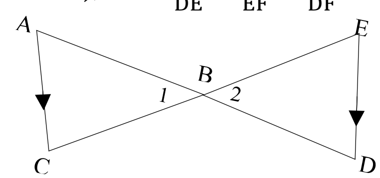
- they are **equiangular**
  (3 ∠s of 1 Δ is equal to 3 ∠s of other Δ) – **(∠, ∠, ∠)**
- their corresponding sides are in proportion (**sides in prop**.)
- 2 sides are in proportion and included ∠s are equal
  (2 sides and incl. ∠)



- Similar Δs are only equal in form (size of ∠s)
- The corresponding sides are in proportion:
  If ΔABC ||| ΔDEF ($\hat{A} = \hat{D}, \hat{B} = \hat{E}$ and $\hat{C} = \hat{F}$), then: $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

Example:

1) Prove that ΔABC ||| ΔDBE
2) If AD = 19, BD = 7, and DE = 21, determine the length of AC

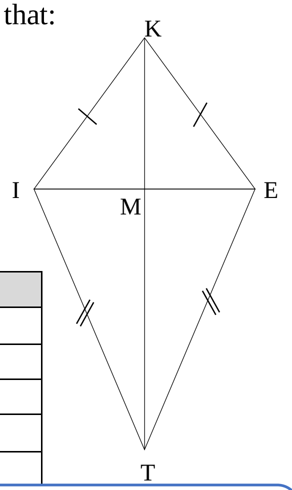


Statement	Reason
1) In ΔABC and ΔDBE:	
1. $\hat{B}_1 = \hat{B}_2$	Vertically opp.
2. $C\hat{A}B = B\hat{D}E$	Alt. ∠s; AC//ED
∴ΔABC ||| ΔDBE	∠, ∠, ∠
$\therefore \frac{AB}{DB} = \frac{AC}{DE} = \frac{BC}{BE}$	
2) $\frac{AB}{DB} = \frac{AC}{DE}$	From |||
$\therefore \frac{12}{7} = \frac{AC}{21}$	AB = AD − BD
$\therefore AC = \frac{12 \times 21}{7} = 36$	

For ||| we only need to prove 2 ∠s equal in the 2 Δs

Example: In the diagram we have a quadrilateral, KITE, with KI = KE and IT = ET. The diagonals intersect at M. Prove that:

1) $\Delta KIT \equiv \Delta KET$
2) IM = ME
3) $KT \perp IE$



For ≡ we must prove 3 things (sides and ∠s) =

Solution:

Statement	Reason
1) In ΔKIT and ΔKET:	
1. KI = KE	Given
2. IT = ET	Given
3. KT is common	∠, ∠, ∠
∴ΔKIT ≡ ΔKET	(s, s, s)
2) In ΔKIM and ΔKEM:	
1. KI = KE	Given
2. KM is common	
3. $I\hat{K}M = E\hat{K}M$	ΔKIT ≡ ΔKET
∴ΔKIM ≡ ΔKEM	(s, ∠, s)
3) From ΔKIM ≡ ΔKEM:	
$I\hat{M}K = K\hat{M}E$	
But $I\hat{M}K + K\hat{M}E = 180°$	Adjacent- suppl. OR ∠s on line
∴ $I\hat{M}K = K\hat{M}E = 90°$	
∴ $KT \perp IE$	

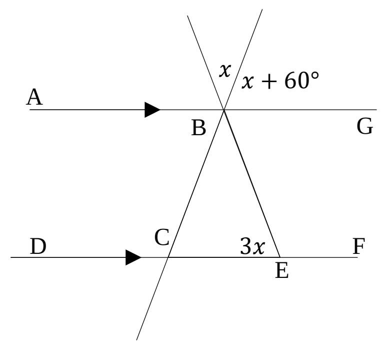
Use ≡ to prove IM = ME

From ≡ : $I\hat{K}T = E\hat{K}T$
We CANNOT use $K\hat{I}M = K\hat{E}M$
… ∠s opp. = sides, since we need the INCLUDED∠

CAN YOU?

A. Determine, with reasons, the values of the letters:

1.



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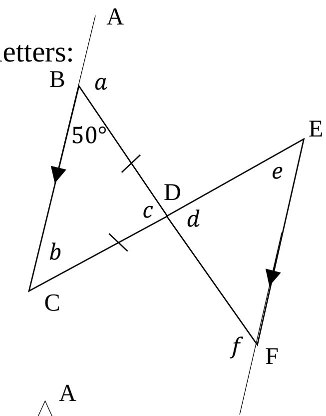
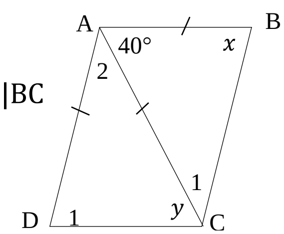


3.

AD||BC



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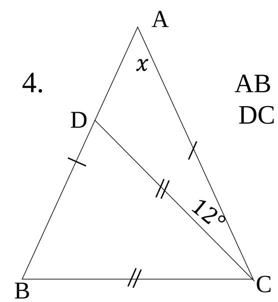
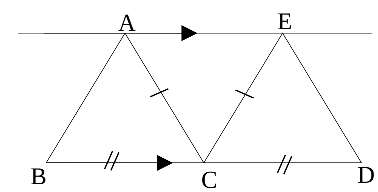
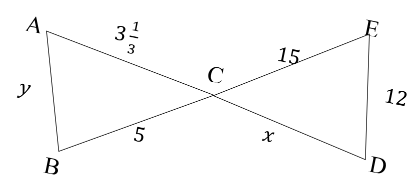


AB = AC and DC = BC

B. Prove that ΔABC ≡ ΔEDC



C. 1. Use the diagram and calculate the values of x and y if ΔABC ||| ΔDEC



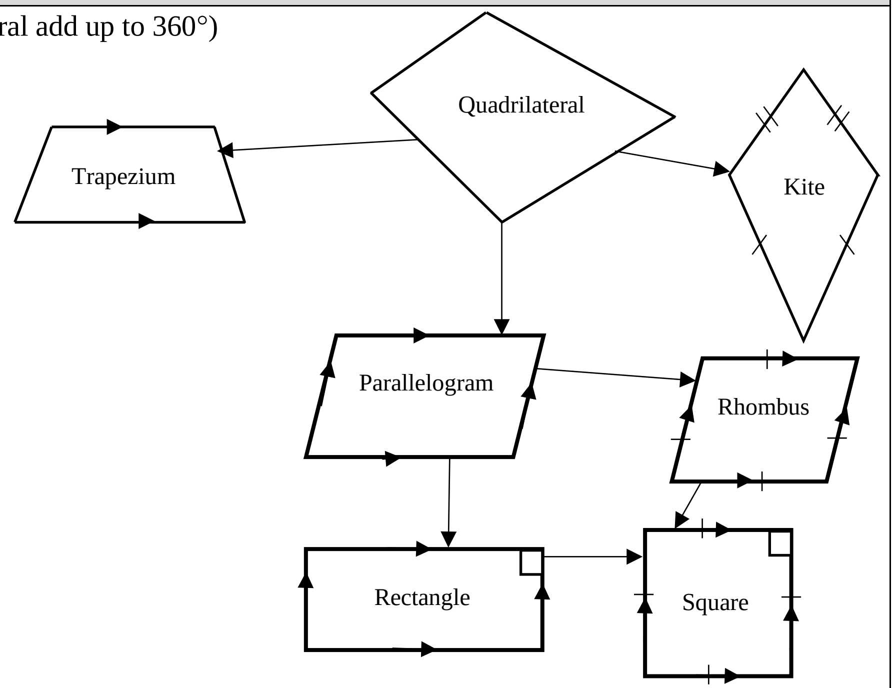
Answers: A. 1. 24° 2. $a = 130°; b = 50°; c = 80°; d = 80°; e = 50°; f = 130°$ 3. $x = 70°; y = 55°$ 4. 52° C $x = 10; y = 4$	

Lesson 5	**Quadrilaterals**

A **Quadrilateral** is any 4-sided figure - the interior angles of a quadrilateral add up to 360°)

CAN YOU? Match each figure with the correct descriptor

Figure		Descriptor	
1.	square	a)	A quadrilateral with two pairs of adjacent sides equal
2.	rectangle	b)	A quadrilateral with two pairs opposite sides parallel
3.	rhombus	c)	A quadrilateral with one pair of opposite sides parallel
4.	quadrilateral	d)	A rectangle with all sides equal and a 90° angle.
5.	trapezium	e)	A parallelogram with two pairs of parallel sides and a 90° angle.
6.	parallelogram	f)	A parallelogram with all sides equal
7.	kite	g)	A quadrilateral is a four-sided figure



ACTIVITIES	*Consider other exercises from your Mathematics Textbook*
VALUES	*Dear learner. Albert Einstein said: "A person who never made a mistake never tried anything new." Learn from your mistakes and become a better you.*