
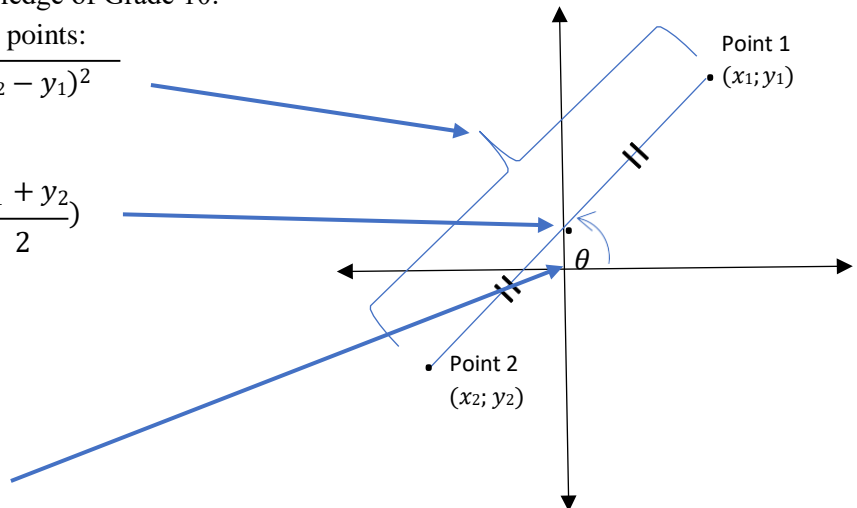


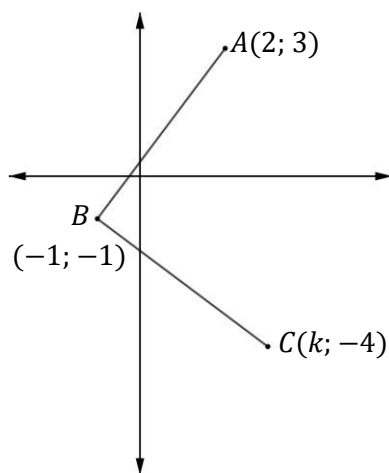


SUBJECT and GRADE	Mathematics– Grade 11	
TERM 2	Week 1	
TOPIC	Analytical Geometry: Inclination of Line	
AIMS OF LESSON	<p>Revise Grade 10 content and formulae</p> <ul style="list-style-type: none"> • Distance between two points • Gradient of a line segment • Midpoint of line segment <p>Introduction to the inclination of a Line Apply these formulae in typical examination type of questions. Highlight the importance of the properties of quadrilaterals</p>	
RESOURCES	Paper based resources	Digital resources
	Please go to the Analytical Geometry section in your Mathematics Textbook.	 <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 5px;">https://bit.ly/34mizV</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-top: 10px;">https://www.siyavula.com</div>
INTRODUCTION	<p>Let's refresh our knowledge of Grade 10:</p> <p>Distance between two points: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$</p> <p>Midpoint of a Line: $\text{Midpoint} \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$</p> <p>Gradient of a line: $m = \frac{y_2 - y_1}{x_2 - x_1}$</p> <p>$m = \tan \theta$ θ Angle of inclination</p> 	

CONCEPTS AND SKILLS

Lesson 1A:

In the diagram below $A(2; 3)$, $B(-1; -1)$ and $C(k; -4)$ are three points in a Cartesian plane.



Remember:

If $l_1 \parallel l_2$ then $m_1 = m_2$

If $l_1 \perp l_2$ then $m_1 \cdot m_2 = -1$

Co-linear Points:

The gradients are equal and there must be a common point

Task

1. Calculate the **length** of AB

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$AB = \sqrt{(-1 - 2)^2 + (-1 - 3)^2}$$

$$AB = \sqrt{(-3)^2 + (-4)^2} = \sqrt{25}$$

$$AB = 5$$

2. Calculate the **gradient** of AB

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{3 - (-1)}{2 - (-1)} = \frac{4}{3}$$

3. Write down the gradient of BC if **$AB \perp BC$** .

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

$$\therefore m_{BC} = -\frac{3}{4}$$

4. Determine the **value of k**.

$$m_{BC} = -\frac{3}{4}$$

$$\frac{-1 + 4}{-1 - k} = -\frac{3}{4}$$

$$\frac{3}{-1 - k} = -\frac{3}{4}$$

$$-1 - k = 4$$

$$3(-1 - k) = -12$$

$$-3 - 3k = -12$$

$$-3k = -9$$

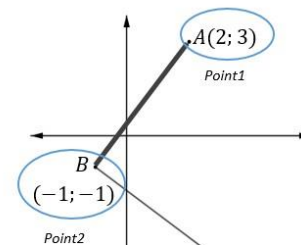
$$\therefore k = 3$$

5. Determine the midpoint of AC.
- $$\text{midpnt } AC \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$$

Important questions you should ask yourself!

1. What? ...length (d).

- Distance formula – you need 2 points AB
- Substitute
- Use calculator to find answer.



2. What? Gradient (m) AB

- You need 2 points
- Substitute
- Simplify

3. What? Gradient

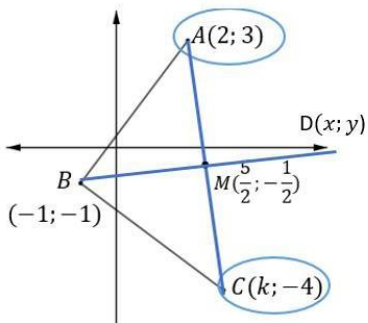
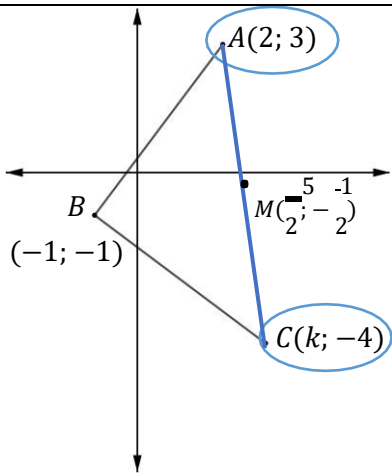
- You need 2 points but you only have **ONE**
- **Any other clues? $AB \perp BC$**
- $\therefore m_{AB} \cdot m_{BC} = -1$

4. What? Value of variable

- You need an **equation**
- What do you know?
BC? Gradient is known.
- 2 points B and C

5. What? Midpoint AC

- Points A and C
- Point C is now (3;-4)



$$\text{midpnt}_{AC} \left(\frac{2+3}{2}; \frac{3-4}{2} \right)$$

$$\text{midpnt}_{AC} \left(\frac{5}{2}; \frac{-1}{2} \right)$$

6. Determine the co-ordinates of a point D such that the quadrilateral ABCD is a rectangle.

$$\text{midpnt}_{BD} \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$$

$$\text{midpnt}_{BD} \left(\frac{5}{2}; \frac{-1}{2} \right)$$

$$\frac{x-1}{2} = \frac{5}{2} \quad \text{and} \quad \frac{y-1}{2} = -\frac{1}{2}$$

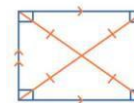
$$x-1 = 5 \quad y-1 = -1$$

$$x = 6 \quad y = 0$$

$$\therefore D(6; 0)$$

- Substitute
- Simplify

The Rectangle



The rectangle and its diagonals.

- * Equal in length
- * **Not** perpendicular to each other
- * Intersect in the mid point. (they bisect)

M is therefore the midpoint of both AC and BD if the quadrilateral is a rectangle.

We can thus use the midpoint formula to find the coordinates of D.

CAN YOU ?

1. C is the point (1 ; -2). The point D lies in the second quadrant and has coordinates (x; 5). If the length of CD is $\sqrt{53}$ units, find the value of x.

[Solution: $x = -1$]

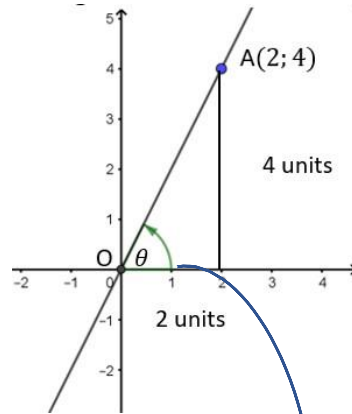
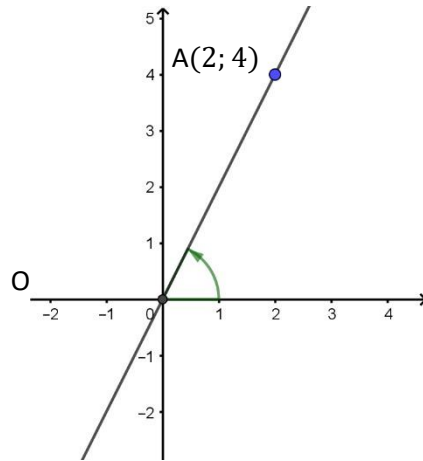
2. Given the points P(5; -1) and Q(2; a), find a if the gradient of PQ is 2.

[Solution: $a = -7$]

Lesson 1B: The Angle of inclination

Important Notes:

The angle of inclination is the angle between the positive x -axis and the line.



$m = \frac{y_2 - y_1}{x_2 - x_1}$ but we also calculate the

$$m_{AO} = \frac{4 - 0}{2 - 0}$$

$$m_{AO} = \frac{4}{2} = 2$$

$$\tan \theta = \frac{4}{2} = 2$$

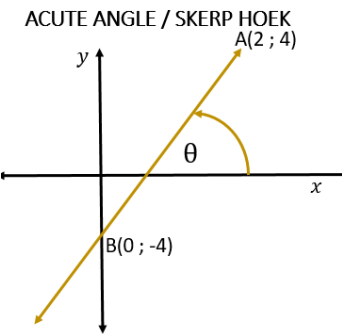
$$\tan \theta = m$$

$$\theta = \tan^{-1} 2 = 63,43^\circ$$

Therefore we can use $m = \tan \theta$ to determine the ANGLE of INCLINATION

This angle can only be between 0° and 180° .

Examples:

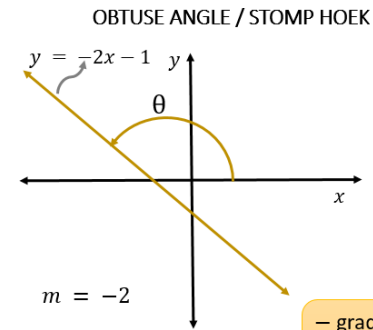


$$m = \frac{4 - (-4)}{2 - 0} = 4$$

$$\tan \theta = 4$$

$$\theta = 75,96^\circ$$

+ gradient \rightarrow
Acute angle/Skerp hoek



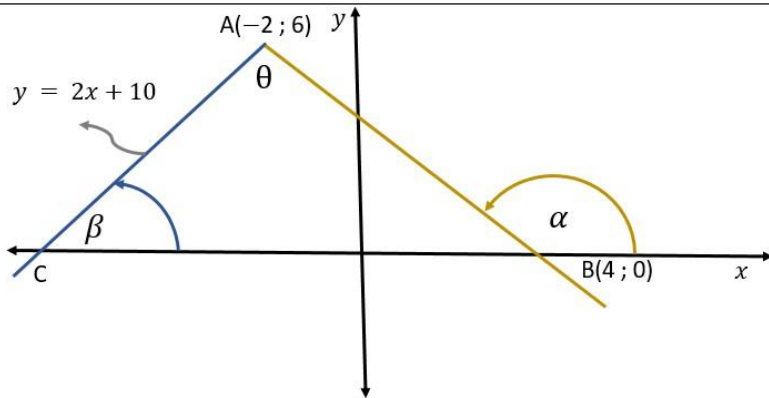
$$m = -2$$

$$\tan \theta = -2$$

$$\theta = 180^\circ - 63,43 \dots$$

$$\theta = 116,57^\circ$$

- gradient \rightarrow
Obtuse angle
Stomp hoek



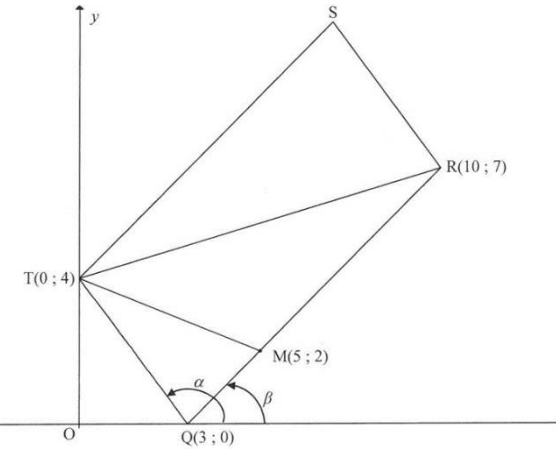
Determine the size of θ

Solution:

$m_{AC} = 2$ $\tan \beta = 2$ $\beta = 63,43^\circ$	$m_{AB} = \frac{0-6}{4-(-2)} = -1$ $\tan \alpha = -1$ $\alpha = 180 - 45^\circ = 135^\circ$	$\theta = \alpha - \beta$ $\theta = 135^\circ - 63,43^\circ$ $= 71,57^\circ$
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Ext angle of a triangle
 Or
 Interior angles of a triangle can be used

CAN YOU?



Use the diagram to determine:

1. the gradient of TQ [$m = -\frac{4}{3}$]
2. the length of RQ [$\sqrt{98} = 7\sqrt{2}$]
3. F(k; -8) is a point in the Cartesian plane such that T, Q and F are co-linear. Find k. [$k = 9$]
4. the size of \hat{TQR} . [$60,07^\circ$]

ACTIVITIES/ASSESSMENT	Mind Action Series	Platinum	Everything Maths Siyavula	Classroom Mathematics
	Ex: 3 &4 Pg: 69 ; 70	Ex: 2; Pg 66	Ex: 4 - 6 Pg: 130 - 131	Ex: 4.1 Pg: 84
CONSOLIDATION	<ul style="list-style-type: none"> • Read questions carefully and so that you understand what is required and thus select the correct formula. • Take care to ensure correct substitution into the formula. • Make sure you know all the basic properties of quadrilaterals. 			