<u>Title:</u> How to teach the concept of a gradient in a Grade 11 Class

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Introduction

Gradient is a critical concept in high school mathematics. According to the requirements of the curriculum, gradient is introduced in Grade 9(GET level) and learners are expected to know and apply it throughout their FET mathematics. Although it is introduced in Grade 9, we have found out that some Grade 11 lack conceptual knowledge of a gradient and find it difficult to apply that knowledge in plotting and working with linear functions.

Aims and Objectives of the Lesson

According to CAPS FET Mathematics, teaching should not be limited to "how", but rather feature the "when" and "why" of problem types. Learning procedures and proof without a good understanding of why they are important will leave learners ill-equipped to use their knowledge in later life. In our presentation we would like to share a different approach to teaching of a gradient, the one which foregrounds conceptual understanding of a gradient. We then used this conceptual knowledge of a gradient as a foundation to introduce and then teach analytical geometry. The correct use of the language of mathematics is an essential mathematical skill which needs to be developed in a learner, according to CAPS. We believe that through this approach, the required mathematical skill will be developed. We chose to talk about a gradient because almost 50% of FET mathematics content requires an understanding and application of knowledge of a gradient.

Content

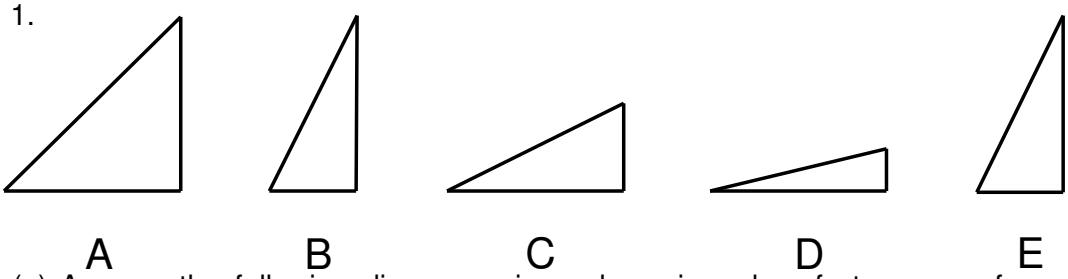
Grade 11 learners are expected to

- Know how to define a gradient or slope
- Formula for calculating gradient of a line
- To know how to sketch the graph of a linear function , given a gradient
- To know how to find the equation of a line, given points on that straight line
- To know conditions for parallel and perpendicular lines.

We designed the following tasks which were specifically aimed at testing learner's conceptual understanding of a gradient, application of that knowledge in plotting and working with linear functions.

Mathematics Activity: Gradient

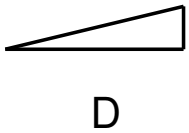
1.



(a) Arrange the following diagrams given above in order of steepness, from less steep to very steep.

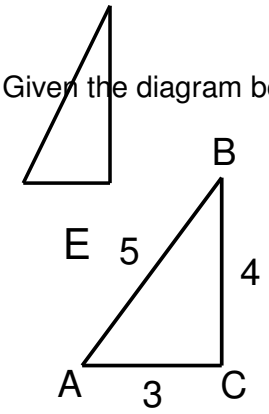
(b) Explain why C is steeper that D.

(c) Sketch a new diagram F which shows F less steep than D.



(d) Sketch a new diagram G which shows G steeper than E.

2. Given the diagram below;



(a)What is the slope/ gradient of AB?

(b)If BC = 3 ; AC = 4 , what is the slope AB?

(c)Which one of the two above is steeper than the other?

3. Sketch on the grid below, straight lines with the following gradients, m:

(a) m = 1
(b) m=3
(c) m= 0
(d) m=- $1/3$
(e) m= $2/5$
(f) m= -3

We gave the test to Grade 11 learners and the results showed that learners lack conceptual understanding of a gradient; are unable to sketch a graph of a straight line, given the gradient; couldn't apply this knowledge in problem solving.

Concepts we taught in this Lesson

1. Learners to develop Conceptual understanding of a gradient
    - Relate it to steepness or flatness of a line and not only restrict it to formula
    - Gradient of a horizontal line
    - Meaning of gradient of a vertical line
    - Meaning of a negative gradient
2. Use this foundational knowledge to teach Analytical Geometry: Angle of inclination, Co-linear points, parallel and perpendicular lines.

Our approach of questioning was such that learners are encouraged to use conceptual knowledge of a gradient language to justify their reasoning.

Conclusion

We gave the same test to the learners at the end of the lesson. This activity was used to identify gaps and also used after the intervention to see if there was improvement in learner performance. We found out that learner's knowledge of a gradient has grown from being formula bound to a broader understanding of a gradient. They were able to answer the "why" and the "when" questions confidently. Angle of inclination, Co-linear points, parallel and perpendicular lines were, as a result of this foundation better understood by the learners.