A Guide to Polynomial Functions

Teaching Approach

Polynomial functions are covered in the second term of Grade 12 over a period of a week. In this section, we do the remainder and the factor theorems. If you get a remainder then the term is not a factor of the given expression and if the remainder is zero then the term is a factor. Lesson two uses knowledge in lesson one to teach learners how to solve cubic functions. We solve cubic equations and prepare for the cubic functions in the coming weeks. To factorise cubic expressions we use the factor theorem and the synthetic division method.

The videos included in the Grade 12 Polynomial Functions are to be watched in sequential order as lesson two depends on lesson one. Summaries of skills and context of each video are in this document, allowing you to find something appropriate, quickly and easily.

When teaching learners polynomial functions it is important that you give learners all the approaches that can be used to enable them to find factors. The link between arithmetic and algebra can enhance learners understanding of the factor theorem.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch of show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next days lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. Factorisation of Polynomial

This video looks at the remainder and the factor theorems. We then use these to test if a term is a factor of a polynomial. We use the synthetic division and inspection method to find the trinomial so that we can further factorise.

2. Solving Cubic Equations

In this video, we solve cubic equations. We use the product method to solve the equations that is we factorise and equate to zero. We use the factor theorem to find factors and the synthetic division method to factorise.

Resource Material

Resource materials are a list of links available to teachers and learners to enhance their experience of the subject matter. They are not necessarily CAPS aligned and need to be used with discretion.

1. Polynomial Functions	http://www.purplemath.com/modules/factrthm.htm	Explains the reasoning behind the Factor Theorem, and then demonstrates the use of it.
	http://www.youtube.com/watch?v=WyPXqe-KEm4	Lesson demonstration on how to use the factor theorem.
2. Solving Cubic Equations	http://www.mathcentre.ac.uk/resources/uploaded/mc-ty-cubicequations-2009-1.pdf	Solving by spotting factors.
	http://www.mash.dept.shef.ac.uk/Resources/web-cubicequations-john.pdf	The general strategy for solving cubic equations.
	http://www.youtube.com/watch?v=FBFHBxnAU9I	Demonstration on how to solve cubic equations.

Task

Question 1

1.1 Determine the value of m if $x^3 + mx^2 - 2x + 6$ is divided by x-1, and leaves a remainder of 16.

1.2 When $f(x) = ax^3 + bx^2 - 4x + 6$ is divided by x+2 the remainder is -10. When it is divided by x +1, the remainder is 5. Determine the values of a and b.

1.3 Prove that $x - 2$ is a factor of $x^3 - x^2 - 22x + 40$ and hence factorise the expression completely.

Question 2

Solve for x:

$x^3 + x^2 - 10x + 8 = 0$

Task Answers

Question 1

1.1 $f(1) = 16$

$f(1) = 1^3 + m(1)^2 - 2(1) + 6$

$f(1) = 5 + m$

$\therefore 5 + m = 16$

$m = 11.$

1.2 $f(-2) = a(-2)^3 + b(-2)^2 - 4(-2) + 6$

$f(-2) = -8a + 4b + 14$

$4b - 8a = -24$

$b - 2a = -6 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$

$f(-1) = a(-1)^3 + b(-1)^2 - 4(-1) + 6$

$f(-1) = -a + b + 10$

$-a + b = -5 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$

$2 - 1$

$a = 1$

$b - 2(1) = -6$

$b = -4$

1.3 $f(2) = 2^3 - 2^2 - 22(2) + 40$

$f(2) = 0$

	x^3	x^2	x^1	x^0
Coeff	1	-1	-22	40
x=2		2	2	-40
	1	1	-20	0
	x^2	x^1	x^0	

$x^3 - x^2 - 22x + 40 = (x - 2)(x^2 + x - 20)$

$=(x - 2)(x - 4)(x + 5)$

Question 2

$f(2) = 2^3 + 2^2 - 10(2) + 8$

$f(2) = 0$

	x^3	x^2	x^1	x^0
Coeff	1	1	-10	8
x=2		2	6	-8
	1	3	-4	0
	x^2	x^1	x^0	

$x^3 + x^2 - 10x + 8 = (x - 2)(x^2 + 3x - 4)$

$= (x - 2)(x - 1)(x + 4)$

Therefore $x = -4 \text{ or } x = 1 \text{ or } x = 2$

Acknowledgements

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