



Our Students. Our Passion

NAM QUANG TUITION

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Mathematical Methods

Unit 3

Week 1

Each week, there's a cover sheet that outlines what the week's topics will be

Topic: Introduction to Functions and Graphs

Solving Equations

Factorisation

Interval Notation

Sketching basic functions

Cubic expressions (introduction)

Student's name: _____

Student ID: _____

NQT tutor: _____ Centre: _____

What you need to know about Mathematical Methods Unit 3 & 4

Students are expected to apply techniques, routines and processes involving rational and real arithmetic, algebraic manipulation, equation solving, graph sketching, differentiation and integration.

It is assumed students taking the program are familiar with determining the equation of a straight line, basic factorisation, Pythagoras theorem, identifying and manipulation of quadratic and exponential functions and sketching graphs of basic functions. Basic concepts of probability are also assumed.

There are four study areas you need to satisfactorily complete in order to accomplish Unit 3 & 4:

AREA OF STUDY 1

Polynomial and power functions

- Define key features of functions and ability to manipulate them
- Power, exponential, logarithmic, circular and modulus functions
- Transformations of functions
- Graphing polynomial, sum, difference, product, composite and inverse functions
- Applications of hybrid functions

AREA OF STUDY 2

Algebra

- Algebra of various functions
- Logarithm and exponent laws
- Simultaneous equations
- General solutions, finding approximate or exact solutions within a restricted domain

AREA OF STUDY 3

Calculus

- Determining the original function from its derivative and anti-derivative
- Derivative properties of single and combined functions
- Applications of differentiation to curve sketching
- Limiting values
- Properties of anti-derivatives and definite integrals

AREA OF STUDY 4

Probability

- Discrete and continuous random variables
- Central measures and standard deviations
- Construction of probability density functions
- Binomial and normal distributions
- Conditional probability

At the commencement of each semester, there's an outline of the Unit's key areas of study, as in line with VCAA Study Designs.

For all NQT lessons, bring your own Graphics Calculator to each and every class, as well as a notebook/exercise book to be used throughout the year. Also you should bring your Mathematical Methods textbook as an additional resource for your learning.

Factor theorem

$f(2) = 0$ Therefore $(x - 2)$ is also a factor

$f(-2) = 20$ Not a factor

$f(3) = 0$ Therefore $(x - 3)$ is also a factor

Because it is a cubic, it cannot have more than 3 factors so we don't have to try other numbers
Thus our factorised equation of $y = x^3 - 4x^2 + x + 6$ is $y = (x + 1)(x - 2)(x - 3)$

Using long division

If you are unfamiliar or need to refresh your learning with the long division method, please consult your tutor.

$$\begin{array}{r}
 x^2 - 5x + 6 \leftarrow \text{Our answer} \\
 x+1 \overline{) x^3 - 4x^2 + x + 6} \\
 \underline{-(x^3 + x^2)} \\
 -5x^2 + x \\
 \underline{-(-5x^2 - 5x)} \\
 6x + 6 \\
 \underline{-(6x + 6)} \\
 0 \leftarrow \text{The remainder}
 \end{array}$$

By using long division, we have found that $(x+1)(x^2 - 5x + 6) = x^3 - 4x^2 + x + 6$

Next, we need to factorise the quadratic part into its linear factors

$$(x+1)(x^2 - 5x + 6)$$

$$(x+1)(x-2)(x-3)$$

There is clearly set out theories as well as tips in speech bubbles to help guide you through commonly made errors and how to tackle them.

Just like the factor theorem method, we have come to the same answer of $y = (x + 1)(x - 2)(x - 3)$

So should you use the Factor Theorem or Long Division?

Both methods work just fine with these kinds of cubic equations, however it is probably better to use the long division method. This is because not all cubic equations have 3 linear factors.

So you may end up factorizing a cubic into one linear and quadratic factor. The factor theorem is mainly used as the first step to find one linear factor, followed by long division to see if there are any others.

NOTE: Not all cubics have exactly 3 linear factors, some may only have 1 or 2.

Checking Understanding

Using only the Factor Theorem, factorise the following and show all working

5.a $x^3 + x^2 - 24x + 36$

b. $x^3 - 31x - 30$

Find one linear factor using the Factor Theorem, then use long division to simplify where possible

6.a. $x^3 - x^2 + 2x - 8$

b. $x^3 - 12x + 16$

c. $8x^3 + 10x^2 - 83x + 20$

d. $x^3 + 6x^2 + 10x + 4$
hint: complete the square

After all theory has been clearly explained, you have the chance to apply your knowledge in a series of questions, both straightforward as well as those requiring analytical skills.