

## **Pre-requisite knowledge for the Level 3 Entry Engineering MSS**

In order to prepare for the Level 3 Entry Engineering MSS participants must revise and familiarise themselves with the following topics from SQA's Engineering Mathematics 1 – 4. These topics are essential pre-requisites and will not be delivered during the Level 3 Entry Engineering MSS.

### **Algebra**

- Partial fractions
- Completing the square
- Factorisation
- Simultaneous equations

### **Complex Numbers**

- Cartesian (rectangular), polar and exponential forms of a complex number
- Arithmetic of complex numbers

### **Differential Calculus**

- Differentiation of standard functions
- Chain, Product and Quotient Rules

### **Integral Calculus**

- Integration of standard functions
- Integration by substitution and Integration by parts

### **Ordinary Differential Equations (ODEs)**

- Solving first order ODEs by separating variables and by means of an integrating factor

### **Matrices**

- Matrix algebra (addition, subtraction, scalar multiplication and matrix multiplication)
- Inverse of a  $2 \times 2$  and a  $3 \times 3$  matrix

**IMPORTANT: For revision purposes the following section contains web links to notes and online videos covering the above topics.**

# **1. Algebra (Engineering Mathematics 1 - 4)**

## **(i). Partial fractions**

- **Notes:**

<http://www.mathcentre.ac.uk/resources/uploaded/mc-ty-partialfractions-2009-1.pdf>

- **Videos:**

<https://www.youtube.com/watch?v=ooUQ8u9G9BU> (Introduction)

<https://www.youtube.com/watch?v=tJMJeW3EgY> (Two linear factors in the denominator)

<https://www.youtube.com/watch?v=gp5QZZUS0uk> (Three linear factors in the denominator)

<https://www.youtube.com/watch?v=RrMjCiE6Jog> (Repeated linear factors in the denominator)

<https://www.youtube.com/watch?v=xaUAF7t9Nr4> (Quadratic factor in the denominator)

## **(ii). Completing the square**

- **Notes**

<http://mathcentre.ac.uk/resources/workbooks/mathcentre/mc-TY-completingsquare2-2009-1.pdf>

- **Videos**

<https://www.examsolutions.net/tutorials/completing-the-square/> (Watch Parts 1 and 2)

<https://www.youtube.com/watch?v=UQoQC-V9bcA> (Example)

<https://www.youtube.com/watch?v=aUMP6Fyc57c> (Examples)

## **(iii). Factorisation of Quadratic Functions**

- **Notes**

<http://www.mathcentre.ac.uk/resources/uploaded/mc-ty-factorisingquadratics-2009-1.pdf>

- **Videos**

<https://www.youtube.com/watch?v=7SYzvkiYEIY> (Introduction)

<https://www.youtube.com/watch?v=GoRKluaDuR0> (Factorising by inspection – Example 1)

<https://www.youtube.com/watch?v=nx2jnio38Uo> (Factorising by inspection – Example 2)

[https://www.youtube.com/watch?v=JfHb4Tk\\_7dQ](https://www.youtube.com/watch?v=JfHb4Tk_7dQ) (Factorising by inspection – Example 3)

[https://www.youtube.com/watch?v=X\\_5qaAnQEhk](https://www.youtube.com/watch?v=X_5qaAnQEhk) (Factorising by grouping)

#### **(iv). Simultaneous equations**

- **Notes**

<http://www.mathcentre.ac.uk/resources/uploaded/mc-bus-simult-2009-1.pdf>

- **Videos**

[https://www.youtube.com/watch?v=Vvjf0j\\_CJA8](https://www.youtube.com/watch?v=Vvjf0j_CJA8) (Elimination Method - Example)

<https://www.youtube.com/watch?v=HqODPD1QCd0&t=9s> (Elimination Method - Example)

<https://www.youtube.com/watch?v=cKNvQSIpEIM> (Elimination Method - Example)

<https://www.youtube.com/watch?v=r59oLimduIM> (Substitution Method - Example)

### **2. Complex Numbers (Engineering Mathematics 1 & 4)**

- **Notes**

[https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/COMPLEX\\_NUMBERS\\_2019.pdf](https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/COMPLEX_NUMBERS_2019.pdf)

- **Videos**

[https://www.youtube.com/watch?v=Vk78-7bUbzo&list=PL5pdglZEO3Ni\\_482ywsWzMb7MxvfYI1I](https://www.youtube.com/watch?v=Vk78-7bUbzo&list=PL5pdglZEO3Ni_482ywsWzMb7MxvfYI1I)

(Introduction)

<https://www.youtube.com/watch?v=Pdmg4V3eXZU> (Argand diagram)

<https://www.youtube.com/watch?v=3Yw--3L7bCg> (Addition, subtraction and multiplication

- Watch up to 8:20)

<https://www.youtube.com/watch?v=iu3makB0kqo> (Division)

[https://www.youtube.com/watch?v=g5\\_ojBMubAg](https://www.youtube.com/watch?v=g5_ojBMubAg) (Modulus & Argument of a complex number)

<https://www.youtube.com/watch?v=7R1katdVgE> (Polar form)

<https://www.youtube.com/watch?v=e4KM13j2wgg> (Exponential form)

<https://www.youtube.com/watch?v=luQu18BLR1M> (Converting between different forms)

<https://www.youtube.com/watch?v=jV8Okhus4Vw> (Multiplication & division in polar form)

### **3. Differential Calculus (Engineering Mathematics 2 & 3)**

- **Notes**

[https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/DIFFERENTIAL\\_CALCULUS\\_2019.pdf](https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/DIFFERENTIAL_CALCULUS_2019.pdf)

- **Videos**

- <https://www.youtube.com/watch?v=8lv8zx87aiU> (Differentiation of standard functions)

- <https://www.youtube.com/watch?v=iOHYuBoWwTY&list=PL5pdglZEO3NhMG9eQqe4KEBgkdq9eZD0Y&index=2> (Product Rule)

- <https://www.youtube.com/watch?v=frOJXB0oKrQ&list=PL5pdglZEO3NhMG9eQqe4KEBgkdq9eZD0Y&index=5> (Quotient Rule)

- <https://www.youtube.com/watch?v=KKaRHdZ-Qus&list=PL5pdglZEO3NjXZin1bpEJpYcmkivJpOK8&index=2&t=0s> (Chain Rule)

#### **4. Integral Calculus (Engineering Mathematics 2 & 3)**

- **Notes**

[https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/INTEGRAL\\_CALCULUS\\_2019.pdf](https://www.gcu.ac.uk/media/gcalwebv2/gcuoutreach/INTEGRAL_CALCULUS_2019.pdf)

- **Videos**

<https://www.youtube.com/watch?v=Kx0KHVDUPvE> (Integration of standard functions)

<https://www.youtube.com/watch?v=SgHewYUeAMY> (Integration by substitution)

<https://www.youtube.com/watch?v=YrDQIqRgksQ> (Integration by parts)

#### **5. First Order Ordinary Differential Equations (Engineering Mathematics 4)**

- **Notes**

<https://edshare.gcu.ac.uk/5007/2/index.html> (Read Sections 2.1 - 2.4). Notes contain links to videos.

- **Videos: First Order ODEs – Separating the Variables**

<https://www.youtube.com/watch?v=nlvr3UyMiQ4> (Example)

<https://www.youtube.com/watch?v=TojF0AAOdW0> (Example)

<https://www.youtube.com/watch?v=M54Ymx7ATc> (Example)

- **Videos: First Order ODEs – Integrating Factor Method**

<https://www.youtube.com/watch?v=jz3HLOS6Omc> (Example)

<https://www.youtube.com/watch?v=cdrhTsSOkcU> (Example)

#### **6. Matrices (Engineering Mathematics 4)**

- **Notes & Videos**

<https://edshare.gcu.ac.uk/4972/2/Matrices-For-Eng-1/index.html> (Notes contain links to videos)

#### **Additional Maths Resources**

- <https://www.examsolutions.net/maths/>
- <http://www.mathcentre.ac.uk/students/topics/>
- <http://www.mathtutor.ac.uk/>
- <https://www.khanacademy.org/math>