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 in detail 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 2×2 and a 3×3 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=tJMJieW3EgY (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 (Factorising by inspection – Example 3)

  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 (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

- **Videos**

  https://www.youtube.com/watch?v=Vk78-7bUbzo&list=PL5pdglZEO3Ni_482ywsWzMb7MxvfvYI1I

  (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 (Modulus & Argument of a complex number)

  https://www.youtube.com/watch?v=7R1katdgVgE (Polar form)

  https://www.youtube.com/watch?v=e4KM13j2wgw (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

- **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=PL5pdglZEO3NjXZin1bpEJpYCmkjvJpOK8&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

- **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=M54Ymxf7ATc (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