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| **Minor Award Name** | Maths for Information Technology |
| **Minor Award Code** | 5N18396 |
| **Level** | QQI Level 5 |

**Suggested resources to support delivery:**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| Basic Arithmetic | Textbook  (Online PDF) | Covers Whole Numbers, Fractions and Mixed Numbers, Decimals and Percents, Ratio and Proportion, Signed Numbers | Anthony Weaver Department of Mathematics and Computer Science Bronx Community College, New York | <http://fsw01.bcc.cuny.edu/mathdepartment/Courses/Math/MTH01/allmath01.pdf> |
| Number Systems | Online PDF | A nice formal treatment of Binary, Octal and Hexadecimal Numbers. Also contains some useful references. | Richard M. Timoney  (TCD) | <http://www.maths.tcd.ie/~richardt/MA1S11/MA1S11-ch5.pdf> |
| Introductory Maths – General | Website | An easy-to-use website that offers mathematics in an enjoyable and accessible manner.  Covers topics ranging from arithmetic, algebra, geometry, trigonometry and data.  Possibly useful for learners who find level 5 maths challenging. | mathsisfun.com  (maintained by Rod Pierce DipCE BEng, with contributions from many others) | <https://www.mathsisfun.com/> |
| Basic Arithmetic and Algebra | Worksheet Website | A website for generating ‘free to use’ worksheets in PDF format. Answers included.  Possibly useful for learners who find level 5 maths challenging. | worksheetworks.com | http://www.worksheetworks.com/math.html |
| Basic Arithmetic and Algebra | Worksheet Website | Another website for generating worksheets. Covers a broad range of topics relating to basic Arithmetic and Algebra. Could be used by teachers to assess learners’ mastery of basic math facts and/or to give them extra math practice | Math-Drills.com  All material on Math-Drills.com is original work that is copyright and subject to terms of use | <http://www.math-drills.com/> |
| Engineering Maths/ Mathematical Modelling / Algebra | Website | Steps.ie – contains maths video relating to project maths however the maths section also contains information on mathematical modelling and real world maths. | STEPS is managed by Engineers Ireland and supported by Science Foundation Ireland, the Department of Education and Skills, and a number of major engineering employers. | <http://steps.ie/> |
| Set Theory (Introductory) | Online PDF | A brief, informal introduction to the basics of set theory – includes terminology, notation, common universal sets as well as basic set operations | P Kirby | www.math.fsu.edu/~pkirby/mad2104/SlideShow/s1\_1.pdf |
| Set Theory (Introductory) | Video (about 25 mins) | Introduction to Set Concepts and Venn Diagrams | [Bill Witte](https://www.youtube.com/channel/UCt0_6j5Ans-CLKpSUOC1A-w) | https://www.youtube.com/watch?v=Jt-S9J947C8 |
| Venn Diagrams | Video (about 25 mins) | Practical Video Tutorial on Venn Diagram – demonstrates solutions to given problems. | [Brandon Foltz](https://www.youtube.com/channel/UCFrjdcImgcQVyFbK04MBEhA) | <https://www.youtube.com/watch?v=22tiyb7Kemk> |
| Boolean Logic | Website | This site is dedicated to growing awareness and interest among students about the broader impact of maths, exemplified by the unique contribution of George Boole  Contains Teacher Lesson Plans and Worksheets that show a different approach to teaching STEM skills through real world puzzles and fun activities. | University College Cork (UCC) | <http://georgeboole.com/boole2school/resources/> |
| Downloads include Number Tricks,  Geometrical Approach to Counting,  Teacher Workshop and  Handbook | Website | [Maths](http://mathscircles.ie/why-maths-circles-2) circles allow students the space to develop their problem solving skills in an environment that isn't driven by any goal other than the enjoyment of investigation and discovery.circles allow students the space to develop their problem solving skills in an environment that isn't driven by any goal other than the enjoyment of investigation and discovery | Maths Circles | <http://mathscircles.ie/> |
| Binary Arithmetic | Game | Cisco Binary Game | Cisco | http://forums.cisco.com/CertCom/game/binary\_game\_page.htm |
| Binary Arithmetic | Game | Binary Number Game |  | http://britton.disted.camosun.bc.ca/binary.swf |
| Number Systems | Worksheet  Website | A website for generating ‘free to use’ worksheets in PDF format. |  | http://www.math-aids.com/Number\_Systems/ |
| Functions and Calculus (Advanced) | Website (PDFs) | This site provides a complete set of free online (and downloadable) notes and/or tutorials for Algebra, Function and Calculus. (Also contains a nice primer for Complex Numbers, a set of Common Math Errors, Cheat Sheets) and some tips on How to Study Math. | Paul Dawkins (Lecturer at Lamar University, Texas, USA) | http://tutorial.math.lamar.edu/ |
| Trigonometry | Website with Link to PDF Book | This book covers elementary trigonometry including concepts of radian/degree measure, trigonometric ratios and practical problems using Sine and Cosine Rules. There are useful exercises at the end of each section. | Michael Corral | <http://www.mecmath.net/trig/> |
| Geometry | PDF online | Contains hands-on activities relating to finding perimeter and area as well as a review of linear measurement, polygons (two-dimensional figures), and preparation for the study of volume (three-dimensional figures) | NCTM Content Standard/National Science Education Standard (US) | https://www.nsa.gov/academia/\_files/collected\_learning/elementary/geometry/geodesign.pdf |
| Statistics | Website / Video | The Joy of Stats: documentary which takes viewers on a rollercoaster ride through the wonderful world of statistics to explore the remarkable power they have to change our understanding of the world, presented by superstar boffin Professor Hans Rosling, whose eye-opening, mind-expanding and funny online lectures have made him an international internet legend.  Duration: 1 hour (approx.) | Wingspan Productions  (Gapminder) | <http://www.gapminder.org/videos/the-joy-of-stats/> |
| Statistics and Probability | Website | A set of annual statistical projects dating back to 2000.  Teachers decide which project to use by browsing the questionnaires for each of the years listed. The supporting documents for each questionnaire usually include the pdf of the questionnaire, teachers' notes designed to iron out ambiguities in the questions and sometimes technical notes too.  In addition to the questionnaires from each year the site includes other free resources including the Random Data Selector (RDS), the Data Interrogation Tool, the Real and Engaging Statistics and Data Handling booklets and the many downloadable teaching and learning materials developed from each questionnaire of the project.  Teachers are required to register so that they can have access to census data and also to keep up to date with all the latest news, events and resources.  All of the resources on the CensusAtSchool website are free to download and use, unless otherwise stated. | CensusAtSchool is a non-profit making project funded by organisations interested in promoting good use of statistics and data handling.  Sponsors of censusatschool.ie include NCCA, NCTE, the Irish CSO and the Project Maths Development Team. | <http://www.censusatschool.ie/>  © [Royal Statistical Society Centre for Statistical Education](http://www.rsscse.org.uk/) |
| Probability – Permutations and Combinations | Websites | These websites contain example simulations and activities that the students can try themselves | Varied | <http://www.mathgames.com/skill/7.74-permutations>  http://studyjams.scholastic.com/studyjams/jams/math/probability/combinations.htm |
| Statistics and Probability  (and lots more) | Website  (FlexBook Textbooks available) | Statistics: Topics covered include data collection, data summary and data presentation.  Probability: Topics covered include counting techniques, theoretical and experimental probability, compound events, sets and conditional probability. | The CK-12 Foundation was founded with the mission to enable everyone to learn in his or her own way | Statistics  <http://www.ck12.org/statistics/>  Probability  http://www.ck12.org/probability/ |
| Introduction to Algorithms: | Website | Short video (5mins.) that explains the concept of an algorithm. The video is followed by 2 games and how algorithms can be employed to play/solve the games more efficiently | The content is a collaboration of [Dartmouth Computer Science](http://www.cs.dartmouth.edu/) professors [Thomas Cormen](http://www.cs.dartmouth.edu/~thc/) and [Devin Balkcom](http://www.cs.dartmouth.edu/~devin/), plus the Khan Academy computing curriculum team. | <https://www.khanacademy.org/computing/computer-science/algorithms> |
| Data Structures and Algorithms | Website | A comprehensive treatment of algorithms and data structures. Good introduction to arrays and associated operations. | tutorialspoint.com | http://www.tutorialspoint.com/data\_structures\_algorithms/index.htm |
| Sigma and Pi Notation | Web Page | A very lucid exposition of Sigma and Pi Notation | Whit Ford (Blog) | https://mathmaine.wordpress.com/2010/04/01/sigma-and-pi-notation/ |
| Array Traversal | Web Page | Simple array traversal algorithms demonstrated by computing sum and min. Java code. Nice Visuals. | [Shun Yan Cheung](http://www.mathcs.emory.edu/faculty-member.php?name=Shun-Yan-Cheung), Emory University | http://www.mathcs.emory.edu/~cheung/Courses/170/Syllabus/09/array-alg1.html |
| Linear and Binary Search | Video | YouTube exposition of Linear and Binary Search | <http://xoax.net/> | <https://www.youtube.com/watch?v=wNVCJj642n4> |
| Sorting | Videos | A series of YouTube videos which explain a variety of sorting algorithms including the Bubble Sort, Insertion Sort, Merge Sort and Quick Sort in a clear and concise manner. Also | <http://xoax.net/> | <https://www.youtube.com/watch?v=P00xJgWzz2c&list=PLAB1DA9F452D9466C> |
| Sorting | Website | Contains links to a variety of activities and resources including some visualisations of sorting algorithms in action. |  | <http://csunplugged.org/sorting-algorithms/> |
| Algorithms | Website | Definition and specification of algorithms including viaualisations of a swap and a selection of sorts | Virginia,Tech, VA | http://courses.cs.vt.edu/~csonline/Algorithms/Lessons/index.html |
| Algorithms | Website | Website with support material for Algorithms, 4th Ed bu Sedgewick & Payne.  Maybe a little advanced but some great ideas and links. | Robert Sedgewick & Kevin Wayne (Princeton) | <http://algs4.cs.princeton.edu/home/> |
| Sorting and Searching | Book | *The Art of Computer Programming*, Vol. 3: *Sorting and Searching*. 3rd edition, 1997. | Donald Knuth |  |

**General resources (covering more than one topic)**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| General | Website (tutorials) | Khan academy – series of web videos on everything from Early Math, Arithmetic, Algebra, Geometry, Trigonometry, Probability & Statistics, Calculus (Differential and Integral) and much more.  Khan Academy offers practice exercises, instructional videos, and a personalised learning dashboard that empower learners to study at their own pace in and outside of the classroom. | Khan Academy – US website (founded by Sal Khan and funded by Bill Gates)  The mission of KA is to provide a free, world‑class education for anyone, anywhere. | <https://www.khanacademy.org/math> |
| Leaving Cert and Junior Cert maths topics | Website | Project maths website – has sections organised by level (LC or JC) and further by topic with a variety of materials – many align closely to level 5 maths.  Digital versions of materials from project maths workshops.  Website has student area with some interesting resources, in particular the section on how to use CASIO or SHARP calculators. | Project maths is a new initiative to teaching maths at secondary level in Ireland. | <http://www.projectmaths.ie/> |
| General | Website | Click on the Resources section for links to Factsheets (Functions, Differentiation, Integration, Trigonometry and Complex Numbers) and Workbooks (Number Systems, Basic Arithmetic and Algebra, and Logs and Indices) | The Centre for Excellence in Mathematics Teaching and Learning (CEMTL) based at University of Limerick (UL) | http://www3.ul.ie/cemtl |
| General |  | A website designed to help learners gain intuitive insights into a wide range of mathematical topics.  Teachers may find this website useful when introducing a new topic that learners may find difficult to grasp.  Themes addressed include Popular Math Insights, Arithmetic & Number, Algebra and Counting, Geometry, Trigonometry, Statistics and Calculus. | Kalid Azad  Content is freely available under a Creative Commons Attribution-NonCommercial-ShareAlike license. | http://betterexplained.com/ |
| General | Website | mathstutor.ie – free for teachers – collection of maths videos but targeted to project maths.  Some of the resources may be of use at level 5. | Eamon Toland – founder and managing director. | <http://www.themathstutor.ie/> |
| General | Website | studyclix.ie – free for teachers – collection of resources for a variety of subjects including maths.  Maths section is focussed on project maths but linking to certain videos suitable for level 5 is probably the best solution. | Studyclix is an innovative education company based at the Innovation Centre at Sligo Institute of technology.  Created by Luke Saunders and Keith Wright. | <https://www.studyclix.ie/> |
| General | Website | A series of resources covering Arithmetic, Algebra, Functions/Graphs, Geometry, Vectors, Trigonometry, Differentiation and Integration  Each topic contains a video tutorial, support text, diagnostic test and an exercise to do. Some topics also have an extension film and/or an animation to accompany them. Learners can work through at their own pace, pausing, rewinding, testing and exploring until they've grasped the concept.  Mathtutor is not a course and does not offer accreditation - but it does offer excellent revision possibilities. | mathtutor.ac.uk is developed by a group of teachers, mathematicians and new media producers from the Universities of Leeds, Lougborough and Coventry and the former EBST Trust. | <http://www.mathtutor.ac.uk/> |
| General | Website | The site contains resources which can be used to raise levels of achievement in maths, and to increase appreciation of the power and wonder of maths, across the school, sixth form college and further education system | UK Site.  National Centre for Excellence in the Teaching of Mathematics (NCETM) | <https://www.ncetm.org.uk/> |
| General | Website | Claims to be the web's most extensive mathematical resource, provided as a free service to the world's mathematics and internet communities as part of a commitment to education and educational outreach by Wolfram Research, makers of Mathematica. | Created by Eric W. Weisstein with contributions from the world’s mathematical community | <http://mathworld.wolfram.com/> |

**Other resources (including books)**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| Teaching & Learning | Website (Portal) | A website that addresses national priorities in STEM teaching and learning in Ireland. Contains many useful links.  Teachers may find the resources available here particularly useful http://epistem.ie/resources/teaching-learning-resources/secondary-resource-guides/ | Epi-Stem - National Centre for STEM Education, University of Limerick, Ireland | http://epistem.ie/ |
| Teaching & Learning  *A Mathematician's Lament / Lockhart's Lament* | Online PDF | *A Mathematician's Lament*, often referred to informally as *Lockhart's Lament*, is a short book on the [pedagogics](https://en.wikipedia.org/wiki/Mathematics_education) and [philosophy](https://en.wikipedia.org/wiki/Philosophy_of_mathematics) of [mathematics](https://en.wikipedia.org/wiki/Mathematics) by [Paul Lockhart](https://en.wikipedia.org/w/index.php?title=Paul_Lockhart_(mathematician)&action=edit&redlink=1). Characterised as a strongly worded opinion piece arguing for an [intuitive](https://en.wikipedia.org/wiki/Intuition_(psychology)) and [heuristic](https://en.wikipedia.org/wiki/Heuristic) approach to teaching and the importance of mathematics teaching reforms, the book frames learning mathematics as an artistic and imaginative pursuit which is not reflected at all in the way the subject is taught. | [Paul Lockhart](https://en.wikipedia.org/w/index.php?title=Paul_Lockhart_(mathematician)&action=edit&redlink=1) | https://www.maa.org/external\_archive/devlin/LockhartsLament.pdf |
| Teaching & Learning  *Nix The ~~Tricks~~* | Online PDF | *Nix The ~~Tricks~~* - A guide to avoiding shortcuts that cut out math concept development. This book is filled with alternatives to the shortcuts so prevalent in mathematics education and explains exactly why the tricks are so bad for understanding math | Tina Cardone and the online math community known as the MTBoS | http://nixthetricks.com/index.html |
| Teaching & Learning | Website | Useful resources and links relating to T&L of Mathematics |  | <http://www.educationscotland.gov.uk/learningandteaching/curriculumareas/mathematics/index.asp> |
| Teaching & Learning - General | Website | A website with a range of ideas and resources for using ICT in Maths. | Rob Simpson | http://maths-it.org.uk/ |

**Useful Organisations:**

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| **Name** | **Contact Information** |
| The Irish Mathematical Society or IMS is the main professional organization for mathematicians in Ireland. | <http://www.maths.tcd.ie/pub/ims/> |
| Irish Maths Teachers Association (IMTA) - The aim of the IMTA (founded in 1964) is to promote and assist the teaching of mathematics at all levels | <http://www.imta.ie/> |
| Maths Week - Maths Week is Co-ordinated by CALMAST, Waterford Institute of Technology.  Can be approached to offer guest speaker for maths week. Maths week is in early October. | Email: [mathsweek@wit.ie](mailto:mathsweek@wit.ie) Website: <http://www.mathsweek.ie/> |

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| NITTA (National Information Technology Teachers Association) | Contact michaelfoley@cfedundrum.com to subscribe to mailing list. |

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| Quality and Qualifications Ireland (QQI) – details on component specifications for minors and major awards. | <http://www.qqi.ie/> |
| Further Education Support Service (FESS) | <http://www.fess.ie/> |
| National Council for Curriculum and Assessment (NCCA) – section on project maths. | <http://www.ncca.ie/> |
| State Examinations Commission (SEC) home page - Previous exam papers at Junior and Leaving certificate | <http://www.examinations.ie/> |
| Project maths development team | <http://www.projectmaths.ie/> |

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| **MOOCs (Massive Online Open Courses)** | |
| Free access to online courses  Search regularly for new courses and new start dates | https://www.mooc-list.com/ |