By unit/lessons: secondary school example

Year 8, Semester 2

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| **Topic 8.1.2: The Cartesian plane** | | |
| **Strand**: Number and Algebra | **Sub-strand:** Linear and non-linear relationships | **Recommended teaching time:** 2 weeks (approximately 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content description:**  Plot linear relationships on the Cartesian plane with and without the use of digital technologies [(VCMNA283)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA283) | | |
| **Achievement standard** (excerpt): | | |
| **Level 7** | **Level 8** | **Level 9** |
| Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. **Students** solve linear equations and **graph linear relationships on the Cartesian plane.** | Students apply the index laws using integer indices to variables and numbers, express numbers in scientific notation, solve problems involving very small and very large numbers, and check the order of magnitude of calculations. They solve problems involving simple interest. Students use the distributive law to expand algebraic expressions, including binomial expressions, and simplify a range of algebraic expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment using a range of strategies including the use of digital technology. Students sketch and draw linear and non-linear relations, solve simple related equations and explain the relationship between the graphical and symbolic forms, with and without the use of digital technology. |

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| **Activities** | **Proficiencies** |
| * Cartesian coordinates in four quadrants. * Using coordinates in four quadrants to specify points. * Formulating rules for linear growing patterns (e.g. [Chairs](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144), [garden beds](http://mathematicscentre.com/taskcentre/147gardn.htm)) and write tables of coordinates from the rules. * Introducing variables, e.g. through rule for growing pattern and simple formulas such taxi-fare charges. * Obtaining number pairs for two related variables and plotting the relation on simple scaled axes. * Using spreadsheets or other technology to generate tables/lists of coordinates from rules, and generate a plot. * Scale and proportion related to enlargements or reductions of shapes in the Cartesian plane, scale plans and maps. * Calculating and estimating distances from scale plans and maps. * Using Information on a map or scale plan to obtain actual distances, checking reasonableness of answers. | * **Understanding** through interpreting information on maps and plans. * **Fluency** through obtaining actual distances from maps and scale drawings and accurately plotting points from a table of coordinates. * **Problem solving** through applying the ‘draw a diagram’ strategy to formulate and solve authentic problems, and communicate the result effectively. * **Reasoning** through evaluating the reasonableness of answers related to actual distances calculated from maps and scale drawings. |

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| **Considering different levels of student ability** |
| Level 7   * Students who are working at this level could: * Use coordinates and match-the-dot activities to draw various objects, shapes and images across all four quadrants in the Cartesian plane   Level 9   * Students who are working at this level could: * Investigate the exact construction of complete graphs by regular polygons and their diagonals with coordinates on the circumference of a circle centred at the original in the Cartesian plane (e.g. [Polygon vertex calculator](http://www.mathopenref.com/coordpolycalc.html) ) |

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| **Assessment ideas** |
| Students:   * formulate rules for linear growing patterns (e.g. [chairs](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144), [garden beds](http://mathematicscentre.com/taskcentre/147gardn.htm)) in terms of a variable, generate a table of coordinates from the rules and plot the coordinates on the Cartesian plane. |

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| **Resources** | | |
| AMSI [Plotting linear relationships](http://www.amsi.org.au/ESA_middle_years/Year8/Year8_md/Year8_1a.html#teacon-2) | NCTM Illuminations [Chairs](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144) [Point plotter](http://nlvm.usu.edu/en/nav/frames_asid_331_g_3_t_2.html?from=category_g_3_t_2.html)  [Function machine](http://nlvm.usu.edu/en/nav/frames_asid_191_g_3_t_2.html?from=category_g_3_t_2.html) | FUSE: [Plot linear relationships on the Cartesian plane with and without the use of digital technologies](http://fuse.education.vic.gov.au/VCAA/VCMNA283) |