 Polynomials

| Syllabus elements | Teaching ideas | Teaching resources |
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| Introduction | Graphs of simple polynomials should be drawn, using all the techniques available.Polynomials are used extensively in many different types of engineering including civil engineering where polynomial equations are used to design road curves as well as to model where to place supports when designing bridges to ensure that maximum deformation is kept within allowances. | [Presentations covering this unit of work are available from Richmond High School](https://drive.google.com/a/education.nsw.gov.au/folderview?id=0B_YpsU7XJITVNlhaZUhsT0Rscm8&usp=sharing&tid=0B_YpsU7XJITVNXM1NjhnRnNjTjQ). |
| Terminology, notation and some basic properties of a polynomial. | The polynomial topic has a lot of new terminology that needs to be explicitly taught to students. Links to prior learning are particularly useful. Teachers need to ensure that they utilise the correct terminology to avoid confusion.The following useful facts should be noted.* For very large
* A polynomial of odd degree always has at least one real zero.
* At least one maximum or minimum value of P occurs between any two distinct real zeros.
 | [Every polynomial with an odd degree has at least one real root](http://gomaths.net/3747.).This fact is necessary for the methods of approximation to work. |
| Extension – Bezier Curves and Pixar in a Box | Some students will be interested in exploring Bezier representations of curves - essentially a parametric representation of polynomials. Pixar and Khan Academy offer a lesson sequence exploring animation techniques which includes interactive and a good introduction to some of the mathematics to representing and animating curves. Several hours of content and interactives - suitable for self-directed study (and play).For a shorter accelerated sequence on Bezier Curves, go straight to “**Mathematics of Animating Curves**” - watch the videos, do the interactives. The final exercise makes links to Binomial Theorem. | [Khan Academy page on ‘Pixar in a box’](https://www.khanacademy.org/partner-content/pixar) |
| Extension – application to cryptography | Binary polynomials are used to encode block of binary data.  |  |
| Extension – Taylor and Maclaurin Series | Students will benefit from seeing Taylor series and Maclaurin series expansions - providing a link to (infinite) polynomial expansions and other, non-algebraic functions. The [Wikipedia page on Taylor series](https://en.wikipedia.org/wiki/Taylor_series) will be accessible to most students. |  |
|  where  is the divisor,  the quotient and  the remainder | It is useful to get students to review their numerical long division skills as a lead in to polynomial long division. The importance of setting out should become apparent. | [MathsLink page on how to Build a Polynomial Factor Exploration Tool in GeoGebra](http://mathslinks.net/faculty/geogebra-howto-build-a-polynomial-factor-exploration-tool)[A silly maths song about long division](http://gomaths.net/2664) |
| CAS Support | Both Wolfram Alpha and the GeoGebra CAS window can do polynomial division. Students may wish to access this support when checking their work. |  |
| Multiple Zeroes | Students need to be able to predict the shapes of polynomials given factorised versions of the polynomial.  |  |
|  | Since polynomials of degree  has  roots, this is a wonderful time to introduce why we can’t “find” some of the roots until we learn about complex numbers. | [A quick trick to finding fifth roots](http://gomaths.net/3493) |
| Sum and Product of Roots | The new Reference Sheet contains these formulas. |  |
| Student Polynomial Exploration Tool | It is extremely helpful for students to experience the relationship between factors and roots through interactive use of GeoGebra. Especially helpful to explore multiple zeroes. See attached sheet. | [Zuber GeoGebra How To – Polynomial Factor Exploration Tools](https://mathslinks.net/faculty/geogebra-howto-build-a-polynomial-factor-exploration-tool) |
| Consequences of the Factor Theorem. In Extension 1, we generalise the result from the Quadratic Identity Theorem to all polynomials. |  |  |