 Binomial theorem

| Syllabus element | Teaching ideas | Teaching resources |
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| Expansion of  for *n* = 2, 3, 4 … | If students have already completed Permutations and Combinations (18E), they will be familiar with the notation that is used as the coefficients of the binomial expansion. This is a useful link as the formula will show students why the binomial expansion is symmetrical.  Different notations for the coefficients should be explained and related. | A comprehensive [handout for students on binomial theorem](http://mths.co/4139):  This interactive manipulative shows students the link between [binomial expansion and probabilit](http://www.mathsisfun.com/data/quincunx.html)y  [Khan Academy’s series of lessons on Binomial Theorem](https://www.khanacademy.org/math/algebra2/polynomial_and_rational/binomial_theorem/v/binomial-theorem) |
| Pascal Triangle. | Binomial expansion is usually introduced using Pascal’s triangle. | There are many Pascal’s triangle resources on the internet including:  [The 12 days of Pascal’s Triangle](http://gomaths.net/3466)  YouTube video – [The Binomial Theorem Using Pascal’s Triangle](https://www.youtube.com/watch?v=NLQmQGA4a3M)  [An activity to get students up and out of their seats while discovering the binomial theorem](http://mathcoachblog.com/2013/05/28/the-binomial-theorem-jigsaw/) |
| Is it really Pascal’s Triangle?? | Most definitely not!  Yang Hui (pronounce ‘hoi’) published diagrams of the triangle many centuries earlier. Ancient Hindu and medieval Islamic scholars also published books with the triangle. (In the Middle East, the triangle is caller Omar Khayyam's triangle - the same person as in the famous poem The Rubaiyat of Omar Khayyam. Imagine if William Shakespeare had published mathematical treatises at the same time as writing his plays!). [More information](https://en.wikipedia.org/wiki/Omar_Khayy%C3%A1m). | Activity: In this famous image from a Chinese mathematics textbook, there is an error! Challenge your students to find it. The number are rod-and-stick notation.  [Image source](https://en.wikipedia.org/wiki/Pascal%27s_triangle) |
| Proof of the Pascal Triangle relations. | It will be important that students can generalise Pascal’s triangle to get  for | [Discussion of some of the properties of Pascal’s Triangle](http://www.trans4mind.com/personal_development/mathematics/series/pascalsTriangle.htm) |
| Extension to the expansion | Students can use the symmetry of the distribution to make this an easier task. They also need to understand the commutative and associative properties of addition and multiplication to arrange the binomial in a way that can be expanded. |  |
|  | AMSI “Supporting Australian Maths” project: support material for teachers on Binomial Theorem. | [A guide for teachers – Years 11 and 12. Binomial distribution.](http://www.amsi.org.au/ESA_Senior_Years/PDF/BinomialDistribution4d.pdf) |
|  | Proof of Pascal’s triangle relationships using mathematical induction.  This can be done as part of Binomial Theorem or as a separate section on mathematical induction (7.4E). | The formal proof is given in the syllabus. |
|  | Students need to be able to:   * Use the notation * Find a specific term of a series. * Find the greatest term of an expansion by comparing the ratio of successive terms. * Differentiating or Integrating series. | See many of the above resources. |