 Permutations and combinations

| Syllabus elements | Teaching ideas | Teaching resources |
| --- | --- | --- |
| Ordered Selection without Replacement | Introduction of factorial notation.  To spark interest see a [YouTube video on card shuffling chances](https://youtu.be/SLIvwtIuC3Y)  Introduction of permutation notation | See [Wootube for more lesson ideas and worked examples](https://youtu.be/JVbbRCVBVRI)  [A unit of work by Richmond High School](https://drive.google.com/a/education.nsw.gov.au/folderview?id=0B_YpsU7XJITVd3Qwd2wtZm9NV00&usp=sharing&tid=0B_YpsU7XJITVNXM1NjhnRnNjTjQ)  [Permutations and Combinations calculator](http://gomaths.net/2348) with a good explanation of some of the restrictions placed on permutations and combinations  [Circular arrangements](http://gomaths.net/2613) |
| Unordered selection | Introduction of combination notation |  |
| Link between Combinations and Binomial Theorem | Video game players will like this exploration. | [Q-Bert teaches the Binomial Theorem](https://www.youtube.com/watch?v=qsTptTo4d54) |
| Extension: Combinatorics and Pixar in a Box | Some students will be interested in exploring how counting theory is used to generate realistic crowds of swarming robot in Wall-E - essentially permutations and combinations.  Pixar and Khan Academy offer a lesson sequence exploring animation techniques which includes interactive and a good introduction to some of the mathematics involved in counting theory. Several hours of content and interactives - suitable for self-directed study (and play).  For a shorter accelerated sequence on combinatorics, go straight to “**Counting Crowds**” - watch the videos, do the interactives and practice questions | [Khan Academy resource on Pixar](https://www.khanacademy.org/partner-content/pixar)  [More discussion – Khan Academy’s Pixar resource](https://www.khanacademy.org/partner-content/pixar/crowds)  [More academic discussion – Khan Academy’s Pixar resource](https://www.khanacademy.org/partner-content/pixar/crowds/crowds2) |
| The Enigma Machine | A good introduction to an application of Permutations is the Enigma Machine. Some excellent videos on Numberphile.  In particular:  158,962,555,217,826,360,000 (Enigma Machine) – Numberphile  The Flaw in the Enigma Machine – Numberphile  These videos also give a good background into the history of cryptography, and the critical role of Alan Turing and other mathematician in World War II. | [A YouTube video on the Enigma Machine](https://www.youtube.com/watch?v=G2_Q9FoD-oQ)  [A YouTube video on the flaw in the Enigma Machine](https://www.youtube.com/watch?v=V4V2bpZlqx8) |
|  | 43,252,003,274,489,856,000 [Rubik's Cube Combinations – Numberphile](https://www.youtube.com/watch?v=QV9k6dRQQe4) |  |