

The University of New South Wales  
School of Mathematics and Statistics  
Mathematics Drop-in Centre

## THE BINOMIAL THEOREM

If you need to expand an expression like  $(x + y)^5$  you should not begin by writing it as

$$(x + y)(x + y)(x + y)(x + y)(x + y) .$$

There is a large chance of going wrong if you do it this way, and even if you do get the correct answer it is going to take you a lot of time. Instead you should use the binomial theorem. This works as in the following example:

$$(x + y)^5 = 1x^5y^0 + 5x^4y^1 + 10x^3y^2 + 10x^2y^3 + 5x^1y^4 + 1x^0y^5 .$$

The pattern of powers should be easy to understand: we start with  $x$  to the highest power (5 in this case) and decrease by 1 at each step; we start with  $y$  to the power 0 and increase by 1 at each step. We'll see soon where the coefficients 1, 5, 10, 10, 5, 1 come from. Of course the above expression can be simplified since  $x^0 = 1$  and  $x^1 =$

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