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2014 12d Use the binomial theorem to show that $0 = \binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \ldots + (-1)^n\binom{n}{n}$. **2**

$$(1 + x)^n = \binom{n}{0} + \binom{n}{1}x + \binom{n}{2}x^2 + \ldots + \binom{n}{n}x^n$$

Let $x = -1$: $(1 - 1)^n = \binom{n}{0} + \binom{n}{1}(-1) + \binom{n}{2}(-1)^2 + \ldots + \binom{n}{n}(-1)^n$

$$0 = \binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \ldots + (-1)^n\binom{n}{n}$$

State Mean: **1.14**

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by BOSTES.

Board of Studies: Notes from the Marking Centre

Candidates who had fluency with the binomial expansion of either $(1+ x)^n$ or $(1- x)^n$ were most successful. One method that was often used was:

$$(1 - 1)^n = 0 = \binom{n}{0}.1^n.(-1)^0 + \binom{n}{1}.1^{n-1}.(-1)^1 + \binom{n}{2}.1^{n-2}.(-1)^2 + \ldots + \binom{n}{n}.1^0.(-1)^n$$

$$= \binom{n}{0} - \binom{n}{1} + \binom{n}{2} + \ldots + \binom{n}{n}(-1)^n$$

Common problems were:

- misusing the sigma notation for the expansion of $(1+ x)^n$ or $(1- x)^n$
- failing to realise that the expansion of $(1+ x)^n$ is not the same as $(x +1)^n$ as a direct binomial expansion
- approaching this part by considering specific cases (say proving true for $n = 3$)

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/2014/pdf_doc/2014-maths-ext-1.pdf

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