Lesson 4

Additional Mathematics
A-Level Pure Mathematics : Year 1
Binomial Expansion

4.1 Slay Those Brackets

When expanding brackets using Pascal's Triangle the working can become cluttered thus making it easy to make an error, and also hard to tack one down. However, there is a robust and reliable way to set out the calculations. That's the focus of this lesson.

4.2 Example

Expand the brackets of $(3 - 2x)^4$

The Solution :

Teaching Video: http://www.NumberWonder.co.uk/v9062/4.mp4

$$(3 - 2x)^4 = \quad 1 \times (\quad) \times (\quad)$$
$$+ \quad 4 \times (\quad) \times (\quad)$$
$$+ \quad 6 \times (\quad) \times (\quad)$$
$$+ \quad 4 \times (\quad) \times (\quad)$$
$$+ \quad 1 \times (\quad) \times (\quad)$$

Simplifying,

$$(3 - 2x)^4 =$$

[4 marks]

4.3 Exercise

Marks Available : 30

Question 1

Use the template below to help expand the brackets of $(5 + 3x)^3$

$$(5 + 3x)^3 = \quad 1 \times (\quad) \times (\quad)$$
$$+ \quad 3 \times (\quad) \times (\quad)$$
$$+ \quad 3 \times (\quad) \times (\quad)$$
$$+ \quad 1 \times (\quad) \times (\quad)$$

Simplifying,

$$(5 + 3x)^3 =$$

[4 marks]

Question 2

Use the template below to help expand the brackets of $(2 - 5x)^5$

$$(2 - 5x)^5 = \quad 1 \times (\quad) \times (\quad)$$
$$+ \quad 5 \times (\quad) \times (\quad)$$
$$+ \quad 10 \times (\quad) \times (\quad)$$
$$+ \quad 10 \times (\quad) \times (\quad)$$
$$+ \quad 5 \times (\quad) \times (\quad)$$
$$+ \quad 1 \times (\quad) \times (\quad)$$

Simplifying,

$$(2 - 5x)^5 =$$

[5 marks]

Question 3

Expand the brackets of $\left(4 + x^2\right)^3$

[4 marks]

Question 4

(i) Expand the brackets and simplify the terms;

$$\left(x + \frac{1}{x}\right)^4$$

[4 marks]

(ii) In the expansion, if a term is without any positive integer power of x then that term is said to be "independent of x"
Which is the term of the expansion which is *independent of* x ?

[1 mark]

Question 5

On your calculator find the button marked ${}^{n}C_{r}$
It's often, but not always, above the multiplication button.

Use this button to work out the following,

${}^{4}C_{0}$ ${}^{4}C_{1}$ ${}^{4}C_{2}$ ${}^{4}C_{3}$ ${}^{4}C_{4}$

Hopefully, you have now realised that Pascal's Triangle is in your calculator !

[2 marks]

Question 6

A-Level Examination Question from January 2015, C12, Q4(a) (Edexcel)
Find the first 4 terms in ascending powers of x of the binomial expansion of

$$\left(2 + \frac{x}{4}\right)^{10}$$

giving each term in its simplest form

[5 marks]

Question 7

Additional Mathematics Exam Question from June 2018, Paper 1, Q9(i) (Cambridge)

Find the first 3 terms in the expansion of $\left(2x - \frac{1}{16x}\right)^8$ in descending powers of x

[5 marks]