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# Combinations and the Binomial Series Expansion | Past Paper Question | C2 Edexcel January 2011 Q5

Given that  $\binom{40}{4} = \frac{40!}{4!b!}$ ,

$${}^n C_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

(a) write down the value of  $b$ . (1)  $b = 36$

In the binomial expansion of  $(1+x)^{40}$ , the coefficients of  $x^4$  and  $x^5$  are  $p$  and  $q$  respectively.

(b) Find the value of  $\frac{q}{p}$ . (3)

$$(1+a)^n \equiv 1+na + \frac{n(n-1)}{2!}a^2 + \frac{n(n-1)(n-2)}{3!}a^3 + \dots$$

Coefficient of  $x^4 = p$

$$(a+b)^n \equiv {}^n C_0 a^n b^0 + {}^n C_1 a^{n-1} b^1 + {}^n C_2 a^{n-2} b^2 + \dots$$

$$\therefore \frac{40(39)(38)(37)}{4!} = p \quad \text{or} \quad p = \binom{40}{4} = 91390$$

Coefficient of  $x^5 = q$

$$\frac{40(39)(38)(37)(36)}{5!} = q \quad \text{or} \quad q = \binom{40}{5} = 658008$$

$$\therefore \frac{q}{p} = \frac{40!}{5!35!} \times \frac{4!36!}{40!}$$

$$= \frac{36}{5} = 7.2$$

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