

STEP II, 2009, Q13

- 13 Satellites are launched using two different types of rocket: the Andover and the Basingstoke. The Andover has four engines and the Basingstoke has six. Each engine has a probability p of failing during any given launch. After the launch, the rockets are retrieved and repaired by replacing some or all of the engines. The cost of replacing each engine is K .

For the Andover, if more than one engine fails, all four engines are replaced. Otherwise, only the failed engine (if there is one) is replaced. Show that the expected repair cost for a single launch using the Andover is

$$4Kp(1 + q + q^2 - 2q^3) \quad (q = 1 - p) \quad (*)$$

For the Basingstoke, if more than two engines fail, all six engines are replaced. Otherwise only the failed engines (if there are any) are replaced. Find, in a form similar to (*), the expected repair cost for a single launch using the Basingstoke.

Find the values of p for which the expected repair cost for the Andover is $\frac{2}{3}$ of the expected repair cost for the Basingstoke.



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