

## STEP II, 2007, Q12

**12** I have two identical dice. When I throw either one of them, the probability of it showing a 6 is  $p$  and the probability of it not showing a 6 is  $q$ , where  $p + q = 1$ . As an experiment to determine  $p$ , I throw the dice simultaneously until at least one die shows a 6. If both dice show a six on this throw, I stop. If just one die shows a six, I throw the other die until it shows a 6 and then stop.

- (i) Show that the probability that I stop after  $r$  throws is  $pq^{r-1}(2 - q^{r-1} - q^r)$ , and find an expression for the expected number of throws.

[Note: You may use the result  $\sum_{r=0}^{\infty} rx^r = x(1-x)^{-2}$ .]

- (ii) In a large number of such experiments, the mean number of throws was  $m$ . Find an estimate for  $p$  in terms of  $m$ .



# NextStepMaths.com

To view mark schemes, fully worked solutions and examiner's comments, and for more details about tutoring and other services offered, go to

[NextStepMaths.com](http://NextStepMaths.com)