13	**15 d**	Pat and Chandra are playing a game. They take turns throwing two dice. The game is won by the first player to throw a double six. Pat starts the game. (i) Find the probability that Pat wins the game on the first throw. (ii) What is the probability that Pat wins the game on the first or on the second throw? (iii) Find the probability that Pat eventually wins the game.	**1** **2** **2**

(i) $P(\text{Pat: double 6}) = \frac{1}{36}$

(ii) Pat wins on first or second

$= P(\text{Pat: double 6}) + P(\text{Pat: no double 6, Chandra: no double 6, Pat: double 6})$

$= \frac{1}{36} + \frac{35}{36} \times \frac{35}{36} \times \frac{1}{36}$

$= \frac{2521}{46656}$

(iii) $P(\text{Pat eventually wins})$

$= \frac{1}{36} + \left(\frac{35}{36}\right)^2 \times \frac{1}{36} + \left(\frac{35}{36}\right)^4 \times \frac{1}{36} + \ldots$

$= \frac{1}{36}\left[1 + \left(\frac{35}{36}\right)^2 + \left(\frac{35}{36}\right)^4 + \ldots\right]$

Geometric series, $a = 1$, $r = \left(\frac{35}{36}\right)^2$,

limiting sum $= \frac{1}{1-r}$

$= \frac{1}{36}\left[\frac{1}{1-\left(\frac{35}{36}\right)^2}\right]$

$= \frac{36}{71}$

State Mean:
0.86/1
0.65/2
0.15/2

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

(i) Most candidates scored one mark for this part.

(ii) Common problems were:

- not adding in the probability from the first throw
- not realising that taking 'turns' was a necessary component of the problem
- not realising that the game stopped if Pat won and that the branches in a tree diagram only continued from the person who had lost
- not realising that for Pat to have a second turn, Pat needed to lose, then Chandra needed to lose, and then Pat would have a turn again; they needed P(LLW) for the calculation of Pat winning on the second throw $\frac{35}{36} \times \frac{35}{36} \times \frac{1}{36}$
- one of the most common answers was $\frac{1}{36} + \left(\frac{1}{36} \times \frac{35}{36}\right)$, in which it had been forgotten that Chandra needed to lose the second throw so Pat could then throw to win.

(iii) A significant number of candidates did not attempt this part, with those attempting it finding it a very difficult question.

Common problems were:

- a common but incorrect answer was a bald $\frac{1}{2}$ or $1 - P$ (Chandra losing), making the assumption that there was a 50–50 chance with two people playing
- not writing down a series before attempting a calculation.

Source: **http://www.boardofstudies.nsw.edu.au/hsc_exams/**