07	**9c**	Mr and Mrs Caine each decide to invest some money each year to help pay for their son's university education. The parents choose different investment strategies. (i) Mr Caine makes 18 yearly contributions of \$1000 into an investment fund. He makes his first contribution on the day his son is born, and his final contribution on his son's seventeenth birthday. His investment earns 6% compound interest per annum. Find the total value of Mr Caine's investment on his son's eighteenth birthday. (ii) Mrs Caine makes her contributions into another fund. She contributes \$1000 on the day of her son's birth, and increases her annual contribution by 6% each year. Her investment also earns 6% compound interest per annum. Find the total value of Mrs Caine's investment on her son's third birthday (just before she makes her fourth contribution). (iii) Mrs Caine also makes her final contribution on her son's seventeenth birthday. Find the total value of Mrs Caine's investment× on her son's eighteenth birthday.	**3** **2** **1**

i. Total $= 1000 \times 1.06^{18} + 1000 \times 1.06^{17} + \ldots + 1000 \times 1.06$

$= 1000 \times (1.06 + 1.06^2 + \ldots + 1.06^{17} + 1.06^{18})$

Now, $(1.06 + 1.06^2 + \ldots + 1.06^{17} + 1.06^{18})$ is geometric series with

$a = 1.06$, $r = 1.06$ and $n = 18$ and $S_n = \frac{a(r^n - 1)}{r - 1}$

$= 1000 \times \frac{1.06(1.06^{18} - 1)}{1.06 - 1}$

$= 32759.99$ (2 dec pl) $\therefore$ the value is \$32 759.99

ii. Contributions: $1000, 1000 \times 1.06, 1000 \times 1.06^2$

Total value = 1000 invested for 3 years: 1000×1.06^3

$+ 1000 \times 1.06$ invested for 2 years: $1000 \times 1.06 \times 1.06^2$

$+ 1000 \times 1.06^2$ invested for 1 year: $1000 \times 1.06^2 \times 1.06^1$

$= 3 \times 1000 \times 1.06^3$

$= 3573.05$ (2 dec pl) $\therefore$ the value is \$3573.05

iii. Mrs Caine's total investment $= 18 \times 1000 \times 1.06^{18}$

$= 51\,378.10$ (2 dec pl) $\therefore$ the value is \$51 378.10

- 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) Better responses recognised this as a 'superannuation' style question and were able to form the relevant series. However, many candidates were unable to determine the correct number of terms in the series. Use of the formula $S_n = \frac{a(r^n - 1)}{r - 1}$ was well done, although a common mistake was to use $a = 1$.

(ii) Most responses showed some understanding of the problem but did not write down correctly the steps necessary to obtain the correct answer. Often this involved incorrect use of brackets.

(iii) Only the better responses recognising the link between parts (ii) and (iii) were able to correctly answer this part.

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