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08	**9b**	Peter retires with a lump sum of \$100 000. The money is invested in a fund which pays interest each month at a rate of 6% per annum, and Peter receives a fixed monthly payment of \$$M$ from the fund. Thus, the amount left in the fund after the first monthly payment is \$(100 500 – M). (i) Find a formula for the amount, \$$A_n$, left in the fund after n monthly payments (ii) Peter chooses the value of M so that there will be nothing left in the fund at the end of the 12th year (after 144 payments). Find the value of M.	 **2** **3**

i. Let $A_1 = 100\,000 \times 1.005 - M$ as 6% pa, then 0.5% = 0.005 per month

$= 100\,500 - M$

$A_2 = (100\,000 \times 1.005 - M) \times 1.005 - M$

$= 100\,000 \times 1.005^2 - M(1 + 1.005)$

$A_n = 100\,000 \times 1.005^n - M(1 + 1.005 + \ldots + 1.005^{n-1})$

ii. As n =144,

$0 = 100\,000 \times 1.005^{144} - M(1 + 1.005 + \ldots + 1.005^{143})$

$M = 100\,000 \times 1.005^{144} \div (1 + 1.005 + \ldots + 1.005^{143})$

Now, for $1 + 1.005 + \ldots + 1.005^{143}$, $a = 1$ $r = 1.005$ and $n = 144$ and use

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$= \frac{1(1.005^{144} - 1)}{1.005 - 1}$$

$$\therefore M = 100\,000 \times 1.005^{144} \div \frac{1(1.005^{144} - 1)}{1.005 - 1}$$

$$= \frac{100000 \times 1.005^{144} \times 0.005}{1.005^{144} - 1}$$

$= 975.8502136$

$= 975.85$ (2 dec pl) $\therefore$ value of M is 975.85

* 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) The most successful candidates were those that developed the correct expression, starting from the given expression for A_1, then finding A_2, A_3 and on to A_n. Candidates are reminded that working needs to be shown, as incorrect expressions for A_n without supporting working could not be awarded marks that were available for intermediate steps. Apart from those responses where candidates could not successfully develop the correct expression for A_n, another common error was in calculating the interest rate to be used, despite the fact that the expression for A_1 was given.

(ii) Candidates who developed the correct expression for A_n were generally successful in this part. In better responses, candidates recognised and were able to sum a geometric series and few calculator errors were evident. Common mistakes were in using $n = 143$ in the sum of the geometric series, substituting $n = 12$ into the expression for A_n and incorrect manipulation of the equation in M .

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