05	**7a**	Anne and Kay are employed by an accounting firm. Anne accepts employment with an initial annual salary of \$50 000. In each of the following years her annual salary is increased by \$2500. Kay accepts employment with an initial annual salary of \$50 000. In each of the following years her annual salary is increased by 4%. (i) What is Anne's annual salary in her thirteenth year? (ii) What is Kay's annual salary in her thirteenth year? (iii) By what amount does the total amount paid to Kay in her first twenty years exceed that paid to Anne in her first twenty years?	**2** **2** **3**

i. Anne: $T_n = a + (n-1)d$ with $a = 50\,000$, $d = 2500$, $n = 13$

$= 50\,000 + (13-1) \times 2500$

$= 50\,000 + 12 \times 2500$

$= 80\,000$ $\therefore$ Anne's salary is \$80 000

ii. Kay: $T_n = ar^{n-1}$ with $a = 50\,000$, $r = 1.04$, $n = 13$

$= 50\,000 \times 1.04^{12}$

$= 80\,051.61093$ $\therefore$ Kay's salary is \$80 051.61

ii. Anne: $S_n = \frac{n}{2}[2a + (n-1)d]$ with $a = 50\,000$, $d = 2500$, $n = 20$

$S_{20} = \frac{20}{2}[2(50\,000) + (20-1) \times 2500]$

$= 10[100\,000 + 19 \times 2500]$

$= 1\,475\,000$ $\therefore$ Anne's salary after 20 years is \$1 475 000

Kay: $S_n = \frac{a(r^n - 1)}{r - 1}$ with $a = 50\,000$, $r = 1.04$, $n = 20$

$= \frac{50000(1.04^{20} - 1)}{1.04 - 1}$

$= 1\,488\,903.93$ $\therefore$ Kay's salary after 20 years is \$1 488 903.93

Difference = \$1 488 903.29 – \$1 475 000

= \$13 903.93

* 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

(a) The most obvious and consistent error involved the incorrect use of the value of n as 14 and hence $(n-1) = 13$, in parts (i) and (ii).

(i) A percentage of candidates determined their answers by long-hand methods of calculation rather than by using the formula. Of those who tried to use formulae, the confusion between arithmetic and geometric was quite evident. For example, some converted the \$2500 increase to a 5% increase each year.

(ii) The wording '4% increase' led to some confusion with \$2000 being incorrectly used in an arithmetic formula.

(iii) In the better responses, candidates indicated a clear understanding of the summation formulae for both arithmetic and geometric series. Some confusion existed in the use of 20 years having used 13 in parts (i) and (ii). Common errors included finding the difference between the T_{20}'s; using the techniques of time repayments and superannuation; double use of geometric series due to error in (i); use of $r = 0.04$ and using the second term of the series as the initial term; and poor calculator usage from correct expressions.

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