Q9	Model Solution – 45 Marks	Marking Notes
(a)	Answer: The time value of money suggests that the value of money changes over time. Money gotten today is more valuable than money gotten in the future. They should take the money now and invest it to earn interest. (Note you could also say that if they received the money in the future it would be less valuable because the inflation would have eroded the purchasing power of the money.	MS (0, 5, 10) PC: Any comment about money being more valuable now
(b)	$F = P(1+i)^n$ $1.08 = 1(1+i)^{12}$ $(1.08)^{\frac{1}{12}} = 1.006434030$ $i = 0.006434030$ $Rate = 0.6434\%$	MS (0, 4, 8, 10) LPC: $F = P(1+i)^n$ with some correct substitution HPC: Correct approach but incorrect answer, or fails to get the percentage **Incorrect rounding = 9 marks**
(c)	Future value of the first €500 $= 500(1.006434)^{59}$ Future value of the second €500 $= 500(1.006434)^{58}$ Future value of the third €500 $= 500(1.006434)^{57}$ Future value of the second last €500 $= 500(1.006434)$ Future value of the last €500 = €500 as it is invested at the end of the last payment period The sum of all future values of all regular savings of €500 a month is: $500 + 500(1.006434) \ldots \ldots\ldots\ldots 500(1.006434)^{58} + 500(1.006434)^{59}$ This sum is a geometric sequence with $S_n = \frac{a(1-r^n)}{1-r}$, $a = 500, r = 1.006434$ and $n = 60$ $S_n = \frac{500(1-1.006434^{60})}{1-1.006434} = €36,472$	Ms (0, 4, 6, 8, 10) LPC: Some work of merit. E.G. uses the S_n formula with some correct substitution OR for $5 \times 12 = 60$ MPC: Has correct approach fails to reach an answer HPC: Reaches an answer but with one or two mistakes. **Incorrect rounding = 9 marks**

(d)	The future/final value (FV) of his investment needs to be €5000. Assume that he makes a regular saving of €x per month. €5000 = sum of the future values of all the regular payments of €x into the fund. Future value of the first €x $= x(1.0006434)^{35}$ Future value of the second €x $= x(1.006434)^{34}$ Future value of the second last €x $= x(1.006434)$ Future value of the last €x = €x The sum of all future values of all regular savings of €x a month is: $5000 = x + x(1.006434) \ldots \ldots\ldots\ldots + x(1.006434)^{34} + x(1.006434)^{35}$ This sum is a geometric sequence with $S_n = \frac{a(1-r^n)}{1-r}$, $a = x$, $r = 1.006434$ and $n = 36$ $5000 = \frac{x(1-1.006434^{36})}{1-1.006434}$ $5000 = 40.3653471x$ $x =$ €123.87	Ms (0, 5, 8, 12, 15) LPC: Some work of merit. MPC: Identifies correct variables for the sum formula HPC: Correct approach or final answer reached with one or two mistakes **Incorrect rounding = 14 marks**