Question Number	Scheme	Marks
4.	(a) $t_n = 1 \times r^{n-1} = r^{n-1}$	B1
	(b) $r^{n-1} + r^n = r^{n+1}$	M1
	$\Rightarrow 1 + r = r^2$	A1
	$\Rightarrow r^2 - r - 1 = 0$	
	$\Rightarrow r = \dfrac{1 \pm \sqrt{1+4}}{2}$	M1
	$\Rightarrow r = \dfrac{1+\sqrt{5}}{2}$ since $r > 0$	A1
	(c) $t_1 = 1, \quad t_2 = r = \dfrac{1+\sqrt{5}}{2}$	
	$t_3 = t_1 + t_2 = 1 + \dfrac{1+\sqrt{5}}{2} \quad \left(= \dfrac{3+\sqrt{5}}{2} \right)$	M1 A1
	$t_4 = t_2 + t_3 = \dfrac{1+\sqrt{5}}{2} + \dfrac{3+\sqrt{5}}{2} = \dfrac{4+2\sqrt{5}}{2} = 2 + \sqrt{5}$	A1 (8)
	alternative	
	(c) $t_4 = \left(\dfrac{1+\sqrt{5}}{2} \right)^3 = \dfrac{1 + 3\sqrt{5} + 3(\sqrt{5})^2 + (\sqrt{5})^3}{8}$ M1	
	$= \dfrac{1 + 3\sqrt{5} + 15 + 5\sqrt{5}}{8}$ oe A1	
	$= \dfrac{16 + 8\sqrt{5}}{8} = 2 + \sqrt{5}$ A1	

Notes for Question 4
(a) B1 for $t_n = 1\times r^{n-1}$ $\left(\text{or } t_n = r^{n-1}\right)$
(b)
M1 for forming an equation $r^{n-1}+r^n = r^{n+1}$ follow through their expression for t_n (ie their expression from (a) in $t_n + t_{n+1} = t_{n+2}$)
A1 for dividing by r^{n-1} to obtain a correct 3 term quadratic - terms in any order - from a **correct** initial equation (ie eg $t_n = r^n$ in (a) giving the equation $r^n + r^{n+1} = r^{n+2}$ would score B0M1A0)
Alternative: Make $r=1$ so $t_1+t_2=t_3$ M1 and so $1+r=r^2$ A1
M1 for solving **their** 3 term quadratic equation - see start of doc for information about solving quadratic equations. Either the general formula must be quoted correctly or the full substitution seen (as answer given) **OR** subst. $r=\dfrac{1+\sqrt{5}}{2}$ (M1) then if everything correct including a conclusion, give A1
A1cso for $r=\dfrac{1+\sqrt{5}}{2}$ * as $r>0$. Since this is a given answer **we must see** $r>0$ somewhere. A correct general formula with $\pm$ needed or both solutions shown and the positive chosen with the reason. If $r=\dfrac{1+\sqrt{1+4}}{2} \Rightarrow r=\dfrac{1+\sqrt{5}}{2}$ $r>0$ is given, award M1A0.

Notes for Question 4 Continued

(c)

M1 for obtaining t_3 by using $t_3 = t_1 + t_2$ their numerical t_1 and t_2

A1 for $t_3 = 1 + \frac{1+\sqrt{5}}{2}$ oe

A1cao and cso for $(t_4) = 2+\sqrt{5}$

Alternatives for (c)

M1 for using **their** formula found in (a) and attempting the expansion

A1 for $\frac{1+3\sqrt{5}+15+5\sqrt{5}}{8}$ oe A1 for $2+\sqrt{5}$

$t_4 = t_3 + t_2 = t_2 + t_1 + t_2$ $= 2\times\frac{\left(1+\sqrt{5}\right)}{2}+1$ $= 2+\sqrt{5}$	M1A1 A1

By calculator: $\left(\frac{1+\sqrt{5}}{2}\right)^3 = 2+\sqrt{5}$ scores M1A1A1, but an incorrect (or partially correct) answer scores M0A0A0