

Q	Marking instructions	AO	Marks	Typical solution
10(a)(i)	Takes logarithms of both sides PI	1.1a	M1	$F = ae^{kt}$ $\ln F = \ln ae^{kt}$ $\ln F = \ln a + \ln e^{kt}$ $\ln F = \ln a + kt$
	Derives the required equation Must see either: $\ln F = \ln a + \ln e^{kt}$ Or $\ln F = \ln a + kt/\ln e$	2.1	R1	
	<b>Subtotal</b>		<b>2</b>	

Q	Marking instructions	AO	Marks	Typical solution
10(a)(ii)	Equates $\ln a$ to intercept value $6.55 \leq \ln a \leq 6.65$ Or Uses one/two points on graph to form 1/2 equations in $\ln a$ and $k$	3.1b	M1	$\ln a = 6.6$ $a = 735$ $\text{gradient} = 0.5 = k$
	Equates $k$ to a gradient value Or Solves equation(s) or uses $F$ to find a value of $a$ and/or a value of $k$	1.1a	M1	
	Obtains a value for $a$ AWFW 700 to 773	1.1b	A1	
	Obtains a value for $k$ AWFW 0.45 to 0.55	1.1b	A1	
	<b>Subtotal</b>		<b>4</b>	

Q	Marking instructions	AO	Marks	Typical solution
10(b)(i)	Recalls rate of change of $e^{kt}$ is $ke^{kt}$ Condones done numerically using their $a$ and $k$	1.2	M1	$\frac{dF}{dt} = kae^{kt} = kF$
	Obtains given result in algebraic terms only AG	2.1	R1	
	<b>Subtotal</b>		<b>2</b>	

Q	Marking instructions	AO	Marks	Typical solution
10(b)(ii)	Substitutes their value for $k$ provided $0.45 \leq k \leq 0.55$ and $F = 9200$ into the differential	3.4	M1	$\text{At } t = 5 \quad \frac{dF}{dt} = 0.5 \times 9200$ $= 4600 \text{ per day}$
	Obtains value for $\frac{dF}{dt}$ AWFW 4140 to 5060	3.2a	A1	
	<b>Subtotal</b>		<b>2</b>	

Q	Marking instructions	AO	Marks	Typical solution
10(c)	<p>Makes a suitable comment in context to explain why the number of followers will not be/unlikely to be more than 1 billion.</p> <p>E.g.</p> <p>Realistically the number of followers is too large.</p> <p>In reality, the number of followers will not continue to grow exponentially</p> <p>Singer may do something which causes followers to unfollow or lose followers</p> <p>Song may become less popular</p> <p>Song may not be to that number of people's taste</p> <p>New songs may be released</p> <p>No individual has a social media following of over 1 billion people</p> <p>Model only based upon days 2 and 5 so too much extrapolation</p> <p>People are fickle/lose interest</p> <p>If any incorrect statement is included with a correct statement(s) then E0</p>	3.5a	E1	<p>It is unlikely that the singer will have over one billion followers as that is too high a number.</p> <p>So, the exponential model will not be valid after 30 days.</p>
	Subtotal		1	