Day 347	A Level Maths: A Tier 10-a-day
1 A curve has parametric equations $x = 4t + 3$, $y = 3t^2 + 3$. Find a Cartesian equation of the curve in the form $y = f(x)$.	
2 A 5 kg particle rests on a rough plane inclined at α, $\tan\alpha = \frac{12}{5}$, $\mu = 0.1$. A force of P N acts up a line of greatest slope and the particle stays at rest. Find the range of values of P. Take $g = 9.8$. Give answers to 3 s.f. if not exact.	
3 $P(A) = 0.1$ and $P(A \cup B) = 0.64$. (a) Given that A and B are independent, find P(B). (b) Given instead that A and B are mutually exclusive, find P(B). (c) In the case in (a), find $P(A' \cap B)$.	
4 The 3rd term of a geometric sequence is 9 and the 5th term is 81. Find the common ratio and the first term. Find the sum of the first 8 terms.	
5 Particles A (6 kg) and B (4 kg) move in the same direction on a smooth horizontal line at 9 m s^{-1} and 8 m s^{-1}. They collide and coalesce. Find (a) the speed of the combined particle, (b) the kinetic energy lost in the collision.	

Day 347 **A Level Maths: A Tier 10-a-day**

6 A, B and C have position vectors $\begin{pmatrix}-4\\1\\-2\end{pmatrix}$, $\begin{pmatrix}-4\\0\\-3\end{pmatrix}$ and $\begin{pmatrix}-4\\k\\-1\end{pmatrix}$ relative to O, where k is a constant. Given that A, B and C are collinear, find k and the ratio AB : BC.

7 $X \sim N(\mu, \sigma^2)$, with $P(X < 57) = 0.0668$ and $P(X > 64) = 0.0228$.
Find μ and σ.

8 $g(x) = \frac{1}{21 + 16\sin x + 12\cos x}$
(a) Write $16\sin x + 12\cos x$ in the form $R\sin(x + \alpha)$, with α acute.
(b) Find the greatest and least values of g(x) and the smallest positive x at which the greatest value occurs (1 d.p.).

9 The line $y = kx - 1$ is a tangent to the curve $y = x^2 + x + 3$.
(a) Find the possible values of k.
(b) For the larger value of k, find the coordinates of the point of contact.

10 $l_1: \mathbf{r} = \begin{pmatrix}3\\5\\-2\end{pmatrix} + \lambda\begin{pmatrix}0\\1\\-1\end{pmatrix}$
$l_2: \mathbf{r} = \begin{pmatrix}7\\-1\\-4\end{pmatrix} + \mu\begin{pmatrix}2\\-3\\-1\end{pmatrix}$
Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.