Day 178	A Level Maths: A Tier 10-a-day
1 The vectors $\begin{pmatrix} k \\ k \\ 6 \end{pmatrix}$ and $\begin{pmatrix} k \\ 5 \\ 1 \end{pmatrix}$ are perpendicular. Find the possible values of k and, for the larger value, the exact length of the first vector.	
2 A ball is projected from the ground at 33 m s^{-1} at angle α above the horizontal, $\tan \alpha = \frac{12}{5}$. At time T s, while in flight, it is moving perpendicular to its initial direction. Find (a) T, (b) the height of the ball then. Take g = 9.8. Give answers to 3 s.f. if not exact.	
3 X, the mass (g), is normally distributed with mean 63 and standard deviation 5. Find (a) P(X > 57.5) (b) P(57.5 < X < 60.5), each to 3 s.f.	
4 $f(x) = 3x^2 + 18x + 25$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the minimum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
5 A 900 kg car tows a 300 kg trailer by a light tow-bar on a horizontal road. Driving force 1230 N; resistances 500 N (car), 250 N (trailer). Find (a) the acceleration and the tow-bar tension. At 15 m s^{-1} the tow-bar breaks. (b) How far does the trailer then travel?	

Day 178	A Level Maths: A Tier 10-a-day
6 A curve has equation $xy - y^2 - 4y = 12$. Show that P(−3, −3) lies on the curve and find the equation of the tangent at P in the form $ax + by + c = 0$ with integer a, b, c.	
7 The probability that a seed germinates is 0.03 on each independent trial. Find the least number of trials needed so that the probability of this happening at least once is greater than 0.995.	
8 $u_1 = 0$ and $u_{n+1} = \frac{1}{2} u_n + 4$. (a) Find the limit L of the sequence as $n \to \infty$. (b) Find the least n for which $\lvert u_n - L \rvert < 0.1$.	
9 A circular ripple has area A cm^2 increasing at a constant 6 $cm^2 s^{-1}$. Find the rate at which the circumference is increasing when the radius is 3 cm.	
10 (a) Solve $3x - 5 < 6$. (b) Solve $x^2 - x - 6 \geq 0$. (c) Hence find the values of x satisfying both inequalities.	