Day 26	A Level Maths: A Tier 10-a-day
1 A particle P has position vector $\mathbf{r} = (t^3 - 6t)\mathbf{i} + (4t^2 - 8t)\mathbf{j}$ metres at time t s. Find (a) the speed of P when t = 2, (b) the value of t when P is moving parallel to $\mathbf{i}$.	
2 $\lvert a\rvert = 6$, $\lvert b\rvert = 7$ and the angle between a and b is 90°. Find the exact values of $a \cdot b$ and $\lvert a + b\rvert$.	
3 (a) Solve $3x - 3 \leq -2$. (b) Solve $x^2 + 4x - 5 < 0$. (c) Hence find the values of x satisfying both inequalities.	
4 A 12 kg box is pulled from rest along rough horizontal ground by a horizontal force of 50.64 N and moves 9.6 m in 8 s. Find (a) the coefficient of friction. The force is then removed; (b) find the further distance moved. Take g = 9.8. Give answers to 3 s.f. if not exact.	
5 The curve with equation $y = -x^2 + x + 5$ is transformed by a reflection in the x-axis, followed by a translation of $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$. Find the equation of the image curve.	

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6 Solve the differential equation $x\frac{dy}{dx} = 3y$, given that $y = 2$ when $x = 1$ ($x > 0$, $y > 0$). Give y in terms of x.	
7 A sequence is defined by $u_1 = k$ and $u_{n+1} = -2u_n + 1$. Given that $u_3 = -17$, find (a) the value of k, (b) $\sum_{r=1}^{4} u_r$.	
8 $X \sim N(58, 4^2)$. Find $P(X > 61 \mid X > 59)$ to 3 significant figures.	
9 The vectors $\begin{pmatrix} k \\ k \\ 5 \end{pmatrix}$ and $\begin{pmatrix} k \\ -1 \\ -4 \end{pmatrix}$ are perpendicular. Find the possible values of k and, for the larger value, the exact length of the first vector.	
10 $X \sim B(30, p)$. H_0: $p = 0.2$ is tested against H_1: $p \neq 0.2$ at the 5% level. (a) Find the critical region. (b) Find the actual significance level of the test (3 s.f.).	