Day 287	A Level Maths: S Tier 10-a-day
1 Solve $5^{2x} - 4 \times 5^{x} + 3 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
2 Find the sum of all the integers from 1 to 793 inclusive that are divisible by 3 or by 7, but not by both.	
3 A car of mass 1500 kg, with engine power 29.7 kW, climbs a straight road with $\sin\alpha = \frac{1}{25}$ against a constant resistance of 600 N. Find (a) the greatest steady speed up the hill, (b) the acceleration at $\frac{25}{3}$ m s^{-1}. Take g = 9.8 m s^{-2}.	
4 The scores in an aptitude test are normally distributed. 5% are less than 17 and 25% are greater than 31. Find the mean and standard deviation, each correct to 3 significant figures.	
5 A box of mass 25 kg is at rest on rough horizontal ground ($\mu = 0.5$). A horizontal force of 140 N acts on it for 7 s and is then removed. Find (a) the speed when the force is removed, (b) the total distance travelled before the box stops. Take g = 9.8 m s^{-2}.	

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6 The curve C has equation $x^2y + xy^2 = -6$. Find the equation of the tangent to C at the point $(-1, -2)$, in the form $ax + by + c = 0$ with integers a, b, c.	
7 $f(x) = \frac{kx + 9}{x - 4}$ for $x \neq 4$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.	
8 Solve simultaneously: $x - 2y = -2$ $x^2 - xy - y^2 = 4$	
9 Two boats P and Q move so that, t hours after noon, their position vectors in km are $\mathbf{r}_P = \begin{pmatrix}2\\0\end{pmatrix} + t\begin{pmatrix}-1\\1\end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix}-8\\2\end{pmatrix} + t\begin{pmatrix}1\\1\end{pmatrix}$. Find the time at which they are closest and the exact minimum distance between them.	
10 X takes values 2, 3, 4, 5 with $P(X = x) = k(8 - x)$. X_1 and X_2 are independent copies of X. (a) Find k. (b) Find $P(X_1 + X_2 = 8)$. (c) Find $P(X_1 = X_2)$ and $E(X_1 + X_2)$.	