Day 321	A Level Maths: S Tier 10-a-day
1 A box of mass 5 kg is at rest on rough horizontal ground ($\mu = 0.1$). A horizontal force of 8.4 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}.	
2 The curve C has equation $y = \frac{x + 11}{x + 3}$. (a) Write down the equations of the asymptotes of C. (b) The line $y = -2x + k$ is a tangent to C. Find the possible values of k.	
3 A stone is thrown vertically upwards with speed 9 m s^{-1} from the top of a cliff. The top of the cliff is 17.1 m above the sea. Find (a) the time taken for the stone to reach the sea, (b) the total distance travelled by the stone, to 3 s.f. Take $g = 9.8$ m s^{-2}.	
4 $f(x) = \frac{kx - 1}{x - 2}$ for $x \neq 2$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.	
5 The tangent to $y = \frac{x^2 + 4}{x + 4}$ at the point where $x = 1$ meets the axes at A and B. Find the exact area of triangle OAB, where O is the origin.	

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6 The daily output of a machine is N(μ, 4) with known variance 4. The mean was claimed to be 56 units. A random sample of 36 has mean 55.75. Test at the 10% level whether the mean is different from 56.	
7 Use integration by parts to find the exact value of $\int_0^{\pi} x \cos x \, dx$	
8 Data satisfy $y = ab^x$. The line of best fit for lg y against x is lg y = 0.9 + 0.85x. (a) Find a and b to 3 significant figures. (b) Estimate y when x = 16, to 3 significant figures. (c) Interpret the value of b.	
9 The curve C has parametric equations $x = 2t$, $y = 3t^2$. The line $y = \frac{9}{2}x - 6$ meets C at A and B. Find the exact length AB.	
10 Line l_1: $\mathbf{r} = \begin{pmatrix} 8 \\ 0 \\ -1 \end{pmatrix} + s\begin{pmatrix} 3 \\ 3 \\ -1 \end{pmatrix}$, line l_2: $\mathbf{r} = \begin{pmatrix} 9 \\ 2 \\ -4 \end{pmatrix} + t\begin{pmatrix} 2 \\ 2 \\ -2 \end{pmatrix}$. Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.	