Day 72	A Level Maths: A Tier 10-a-day
1 $f(x) = \ln x + 4x - 6$. Show that the equation $f(x) = 0$ has a root α in the interval $[1, 2]$.	
2 Find the coefficient of x^2 in the expansion of $(1 - 2x)^9$.	
3 A 4 kg box is pulled along rough horizontal ground, $\mu = 0.2$, by a rope at angle θ above the horizontal, where $\tan\theta = \frac{12}{5}$. The tension is 40 N. Find (a) the normal reaction, (b) the acceleration of the box. Take $g = 9.8$. Give answers to 3 s.f. if not exact.	
4 For $n = 8$ pairs of (x, y): $\Sigma x = 148$, $\Sigma y = 155$, $\Sigma x^2 = 3062$, $\Sigma y^2 = 3661$, $\Sigma xy = 2520$. Calculate the product moment correlation coefficient, and describe the correlation.	
5 A driver at constant speed sees a hazard 48 m ahead. After a reaction time of 0.4 s she brakes with deceleration 5 m s^{-2} and stops exactly at the hazard. Find (a) her initial speed, (b) the total time from seeing the hazard to stopping.	

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6 20 values have $\Sigma x = 600$ and $\Sigma x^2 = 18720$. One value was recorded as 46 but should have been 32. Find the correct mean and standard deviation (3 s.f.).	
7 Find the coefficient of x^2 in the expansion of $(2 + 2x)(1 + x)^5$.	
8 l_1: $\mathbf{r} = \begin{pmatrix} -4 \\ 2 \\ -8 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$ l_2: $\mathbf{r} = \begin{pmatrix} -1 \\ 1 \\ -4 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 2 \\ 0 \end{pmatrix}$ Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.	
9 Solve $2\text{cosec}^2\,\theta - 14\cot\theta + 22 = 0$ for $0° < \theta < 360°$. Give answers to 1 d.p.	
10 A(2, 4) and B(−8, 4) are the ends of a diameter of a circle. (a) Find the equation of the circle, in the form $x^2 + y^2 + ax + by + c = 0$. (b) Show that C(1, 1) lies on the circle.	