Day 27	A Level Maths: A Tier 10-a-day
1 Summary statistics for the daily total rainfall (mm) in the same month are: Heathrow: mean 25.5, standard deviation 1.3; Leuchars: mean 27.5, standard deviation 5.9. Make two comparisons.	
2 Given that $\log_a 2 = p$ and $\log_a 3 = q$, express $\log_a\left(\frac{\sqrt{2}}{3}\right)$ in terms of p and q.	
3 An arithmetic series has first term 15 and common difference 2. The sum of the first n terms is 392. Find n.	
4 $y = x\,e^{-4x}$ for $x > 0$. Find the exact coordinates of the stationary point and determine its nature.	
5 Forces $F_1 = (5\mathbf{i} - \mathbf{j})$ N, $F_2 = (9\mathbf{i} + 12\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 5 kg particle in equilibrium. Find (a) a and b. F_2 is then removed; (b) find the magnitude of the acceleration.	

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6 Solve $x(\sqrt{2} - 1) = -3 - 3\sqrt{2}$, writing x in the form $p + q\sqrt{2}$.	
7 Particle A (10 kg) lies on a rough table, $\mu = 0.1$, joined by a light string over a smooth pulley to particle B (4 kg), 1 m above the floor. Released from rest; B lands without rebounding. Find (a) the acceleration of A before B lands, (b) the further distance A moves. Take $g = 9.8$. Give answers to 3 s.f. if not exact.	
8 Complaints occur as a Poisson process at a mean rate of 3 per day. After a change, the number recorded in one day is 1. Test at the 5% level whether the mean rate has decreased.	
9 (a) Express $12 \sin x - 5 \cos x$ in the form $R \sin(x - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. Give α to 1 d.p. (b) Solve $12 \sin x - 5 \cos x = 2$ for $0° \leq x < 360°$, giving answers to 1 d.p.	
10 The equation $x^2 + (2k - 4)x + (k) = 0$ has two distinct real roots. Find the set of possible values of k.	