Day 77	A Level Maths: S Tier 10-a-day
1 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 22 cm and its area is 28 cm^2. Find the two possible pairs of values of r and θ.	
2 Given that $\sqrt{14}$ is irrational, prove by contradiction that $\sqrt{2} + \sqrt{7}$ is irrational.	
3 Three forces $(-3\mathbf{i} - 7\mathbf{j})$ N, $(-2\mathbf{i} + k\mathbf{j})$ N and $(-\mathbf{i} + 2\mathbf{j})$ N act on a particle of mass 4 kg. The resultant is parallel to $(-\mathbf{i} - \mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
4 Find the exact value of $\int_0^{\pi/6} \tan 2x \, dx$	
5 A lift of mass M kg, carrying a passenger of mass 90 kg, hangs from a vertical cable. The tension in the cable is 4644 N and the floor exerts a force of 774 N on the passenger. Find (a) the acceleration of the lift, with its direction, (b) the value of M. Take g = 9.8 m s^{-2}.	

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6 For events A and B, P(A) = 0.65, P(B) = 0.35 and P(A | B) = 0.15. (a) Find P(A ∩ B). (b) Find P(A | B′).	
7 Evaluate $\sum_{r=5}^{11}(3 \times 3^r + 2r)$.	
8 Find the exact value of $\tan^{-1}(\frac{1}{2}) + \tan^{-1}(\frac{1}{5}) + \tan^{-1}(\frac{1}{8})$.	
9 The curve $y = 2x^2 - 5x + 3$ is translated by $\begin{pmatrix}2\\2\end{pmatrix}$ and then a stretch, scale factor $\frac{1}{3}$, parallel to the x-axis. Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.	
10 X takes values 0, 1, 2, 3 with P(X = x) = k(x + 1). X_1 and X_2 are independent copies of X. (a) Find k. (b) Find $P(X_1 + X_2 = 3)$. (c) Find $P(X_1 = X_2)$ and $E(X_1 + X_2)$.	