Day 337	A Level Maths: S Tier 10-a-day
1 A lift of mass 300 kg, carrying a passenger of mass 90 kg, is supported by a vertical cable. The lift is moving upwards and accelerating at 2.4 m s^{-2}. Find (a) the force the floor exerts on the passenger, (b) the tension in the cable. Take g = 9.8 m s^{-2}.	
2 The curve $y = ax^n$ passes through (1, 6) and (3, 54). Find the values of a and n.	
3 X ~ B(12, p). It is given that $P(X = 2) = \frac{11}{10} \times P(X = 1)$. (a) Find the value of p. (b) Find P(X = 0), correct to 3 significant figures.	
4 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where $v = t^2 - 5t + 4$ for $0 \leq t \leq 6$ Find (a) the times at which P is at instantaneous rest, (b) the total distance travelled by P in the first 6 seconds.	
5 $g(x) = x^2 - 2$. Also $fg(x) = -3x^2$, where f is a linear function. (a) Find f(x). (b) Solve gf(x) = 7.	

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6 A and B take turns, A first, to score; the first to score wins. P(A scores) = $\frac{2}{5}$, P(B scores) = $\frac{1}{6}$ each attempt.
Find P(A wins (a) on attempt 1 or 2, (b) overall).

7 Solve $x^4 - x^3 - 15x^2 + 9x + 54 < 0$.

8 $f(\theta) = \frac{1}{21 + 8\sin\theta + 15\cos\theta}$
(a) Write $8\sin\theta + 15\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$.
(b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.

9 The curve C has equation $y = \frac{2x - 3}{x - 2}$.
(a) Write down the equations of the asymptotes of C.
(b) The line $y = -x + k$ is a tangent to C.
Find the possible values of k.

10 The line l has equation $\mathbf{r} = \begin{pmatrix} 0 \\ -1 \\ 5 \end{pmatrix} + t\begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix}$.
The point P has coordinates $(-2, -2, 2)$.
Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.