Day 335	A Level Maths: A Tier 10-a-day
1 A particle moves on the x-axis. At time t s its acceleration is $(12t - 36)$ m s^{-2}. When t = 0 it is at O with velocity 7 m s^{-1}. Find (a) its velocity when the acceleration is zero, (b) its displacement from O then.	
2 Show by counter-example that the statement "$n^2 + n + 11$ is prime for all positive integers n" is false.	
3 Summary statistics for the daily mean visibility (Dm) in the same month are: Camborne: mean 23, standard deviation 3.6; Leeming: mean 17, standard deviation 4.6. Make two comparisons.	
4 $y = \sin^2(2x)$. Find $\frac{dy}{dx}$ and its exact value at $x = \frac{\pi}{6}$.	
5 Express $\frac{-4x^2 - 11x - 10}{(x - 1)(x + 4)^2}$ in the form $\frac{A}{(x - 1)} + \frac{B}{(x + 4)} + \frac{C}{(x + 4)^2}$, and find A, B and C.	

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6 Particle A (4 kg) rests on a smooth table, joined by a light string over a smooth pulley at the edge to particle B (6 kg), hanging 1.2 m above the floor. Released from rest. Find (a) the tension, (b) the speed of B as it hits the floor. Take g = 9.8. Give answers to 3 s.f. if not exact.

7 The curve with equation $y = x^2 - 6x - 5$ is transformed by a stretch, scale factor 2, parallel to the y-axis, followed by a translation of $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$.
Find the equation of the image curve.

8 The line l has equation $\mathbf{r} = \begin{pmatrix} -5 \\ 1 \\ -3 \end{pmatrix} + t\begin{pmatrix} -3 \\ 2 \\ -3 \end{pmatrix}$.
Find the coordinates of the foot of the perpendicular from P(−5, −1, 3) to l, and the exact distance from P to l.

9 0.5% of people have a disease. The screening test is positive for 90% of those who have it and for 4% of those who do not.
(a) Find the probability that a person tests positive.
(b) Given a positive test, find the probability that the person has the disease (3 s.f.).

10 l_1: $\mathbf{r} = \begin{pmatrix} -1 \\ 1 \\ 4 \end{pmatrix} + \lambda\begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}$
l_2: $\mathbf{r} = \begin{pmatrix} 4 \\ 1 \\ 1 \end{pmatrix} + \mu\begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$
Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.