Day 45	A Level Maths: A Tier 10-a-day
1 Prove that $(n + 3)^2 - (n - 3)^2$ is a multiple of 12 for every integer n.	
2 Find the least integer n for which $5^n > 10^5$.	
3 X ~ B(24, 0.2). Find, to 3 significant figures: (a) P(X = 7) (b) P(X ≥ 7) (c) P(X ≤ 6)	
4 A uniform plank AB (mass 10 kg, length 4 m) rests horizontally on supports at C and D, where AC = 0.5 m and DB = 1 m. A 10 kg particle is placed at E, AE = x m, and the plank is about to tilt about D. Find x.	
5 $f(x) = 3x^3 - 30x - 9$. (a) Show that (x + 3) is a factor of f(x). (b) Solve f(x) = 0, giving surds in simplest form.	

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6 θ is small and measured in radians. Use small angle approximations to show that
$4\sin 2\theta + 4\cos 3\theta = 1.5$
can be written as $a\theta^2 + b\theta + c = 0$ with integers a, b, c. Hence find the approximate solution with $0 < \theta < 0.8$, to 3 s.f.

7 A crate of mass 12 kg is pulled at constant speed along rough horizontal ground, $\mu = 0.3$, by a force of P N at angle θ above the horizontal, $\tan\theta = \frac{3}{4}$. Find P and the normal reaction. Take g = 9.8.

8 Bulbs are defective with probability 0.2, independently. A pack of 10 bulbs is rejected if it has at least 3 defective.
From 12 such packs, find the probability that exactly 3 are rejected (3 s.f.).

9 A circle touches both coordinate axes and passes through the point $(9, -2)$. Its centre lies in the fourth quadrant.
Find the equations of the two possible circles.

10 $l_1: \mathbf{r} = \begin{pmatrix}2\\4\\0\end{pmatrix} + \lambda\begin{pmatrix}-3\\2\\3\end{pmatrix}$
$l_2: \mathbf{r} = \begin{pmatrix}-4\\3\\1\end{pmatrix} + \mu\begin{pmatrix}-3\\-3\\-2\end{pmatrix}$
Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.