Day 108	A Level Maths: A Tier 10-a-day
1 $f(x) = 3x^2 - 30x + 66$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the minimum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
2 $y = \text{cosec}(3x)$. Find $\frac{dy}{dx}$ and its exact value at $x = \frac{\pi}{9}$.	
3 A lift of mass 500 kg carries a person of mass 75 kg. The cable tension is 5347.5 N and the lift is accelerating. Find (a) the magnitude and direction of the acceleration, (b) the force of the floor on the person. Take g = 9.8.	
4 The 540 items in a list are numbered 1 to 540. A systematic sample of 36 items is taken, starting with a random item among the first few. The first item selected is number 6. Find the sampling interval and the number of the last item selected.	
5 A is (−5, 3) and B is (5, −3). (a) Find the equation of the perpendicular bisector of AB, in the form ax + by = c. (b) The perpendicular bisector meets the x-axis at P. Find the area of triangle ABP.	

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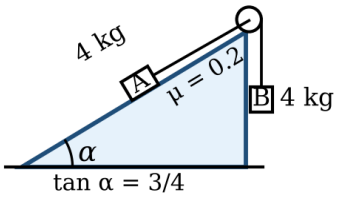
6 $X \sim B(120, 0.3)$. Use a normal approximation to estimate $P(X \leq 42)$ to 3 significant figures.

7 $g(x) = \dfrac{1}{11 + 6\sin x + 8\cos x}$

(a) Write $6\sin x + 8\cos x$ in the form $R\sin(x + \alpha)$, with α acute.

(b) Find the greatest and least values of $g(x)$ and the smallest positive x at which the greatest value occurs (1 d.p.).

8 The system is released from rest and A moves up the rough plane. Find (a) the acceleration, (b) the tension in the light string. Take $g = 9.8$. Give answers to 3 s.f. if not exact.



9 $f(x) = x^2 - 6x + 11$, $x \in \mathbb{R}$, and $g(x) = \dfrac{4}{x - 1}$, $x > 1$.

(a) Find the range of f.

(b) Show that gf is defined and find its range.

10 A closed cylinder has radius r cm and volume 250π cm^3.

Show that its surface area is $A = 2\pi r^2 + \dfrac{500\pi}{r}$, and find the minimum value of A in terms of π.