Day 135	A Level Maths: A Tier 10-a-day
1 A ball is projected horizontally at 6 m s^{-1} from a point 44.1 m above horizontal ground. Find (a) the horizontal distance to the landing point, (b) the speed and direction (angle below the horizontal, 1 d.p.) on landing. Take g = 9.8. Give answers to 3 s.f. if not exact.	
2 The random variable X has P(X = x) = k(7 − x) for x = 2, 3, 4, 5. (a) Show that k = $\frac{1}{14}$. (b) Find E(X) and Var(X). (c) Find P(X ≥ 4).	
3 A cyclist passes P with speed 7 m s^{-1} and accelerates uniformly. She travels 100 m in the next 10 s, reaching Q. Find (a) her acceleration, (b) her speed at Q, (c) her speed at the midpoint of PQ. Give answers to 3 s.f. if not exact.	
4 The equation $e^x = 6x + 5$ has a root α. Use the iteration $x_{n+1} = \ln(6x + 5)$ with $x_0 = 2$ to find x_1, x_2 and x_3 to 4 d.p., and hence the value of α to 2 d.p. (continue until the 2 d.p. value is settled).	
5 $f(x) = \frac{-2x + 4}{4x + 4}$, $x \in \mathbb{R}$, $x \neq -1$. Find $f^{-1}(x)$ and state its domain.	

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6 X has a binomial distribution with mean 25 and variance 12.5. (a) Find n and p. (b) Find P(X = 23) to 3 significant figures.	
7 $f(x) = x^2 - 6x + 3$. (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.	
8 A window is a rectangle of width 2x m and height h m, topped by a semicircle of radius x m. Its perimeter is 50 m. Show that its area is $A = 50x - (2 + \frac{\pi}{2})x^2$, and find the maximum area to 3 s.f.	
9 Solve $2^{2x} - 12 \times 2^x + 32 = 0$.	
10 $y = x \ln x$ for $x > 0$. Find the exact coordinates of the stationary point and show that it is a minimum.	