Day 94 **A Level Maths: A Tier 10-a-day**

1 The equation $e^x = 5x + 6$ has a root α. Use the iteration $x_{n+1} = \ln(5x + 6)$ 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).

2 The line $y = -2x + 3$ meets the curve $y = x^2 + x - 1$ at A and B.
(a) Find the coordinates of A and B.
(b) Find the exact length AB.

3 $f(x) = \ln x + 4x - 10$.
Show that the equation $f(x) = 0$ has a root α in the interval [2, 3].

4 A ball is projected from a point O on horizontal ground at 31 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{5}{12}$, and lands at A. Find (a) the time of flight, (b) the greatest height, (c) OA. Take g = 9.8. Give answers to 3 s.f. if not exact.

5 The table summarises the journey time, t minutes of 58 items.
Use linear interpolation to estimate the 90th percentile.

Class	Frequency
$20 \le t < 40$	20
$40 \le t < 60$	9
$60 \le t < 80$	7
$80 \le t < 100$	16
$100 \le t < 120$	6

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6 (a) Solve $3x - 5 \leq -6$. (b) Solve $x^2 + x - 6 \geq 0$. (c) Hence find the values of x satisfying both inequalities.	
7 A radioactive sample decays so that its mass is $M = M_0e^{-kt}$ grams, with t in days. Its half-life is 5 days. Show that $k = \frac{\ln 2}{5}$ and find how long it takes for 95% of the sample to decay.	
8 Parts are defective with probability 0.3, independently. A box of 9 parts is rejected if it has at least 2 defective. From 8 such boxes, find the probability that exactly 4 are rejected (3 s.f.).	
9 A ball is projected from a point O on horizontal ground at angle α above the horizontal, $\tan\alpha = \frac{4}{3}$, and passes through A, 36 m horizontally from O and 25.5 m above the ground. Find the speed of projection. Take $g = 9.8$.	
10 (a) Expand $(1 - 2x)^{\frac{1}{2}}$ in ascending powers of x up to x^2. (b) Use $x = 0.005$ to estimate $\sqrt{99}$ to 4 decimal places.	