Day 125	A Level Maths: A Tier 10-a-day
1 Find the smallest positive integer n such that $(\frac{9}{10})^n < 0.1$.	
2 A particle P moves on the x-axis with velocity v = $(6t^2 - 42t + 72)$ m s^{-1} at time t s, $t \geq 0$, and starts at O. Find (a) the times when P is at instantaneous rest, (b) the total distance P travels in the first 6 s.	
3 A and B have position vectors $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$. The point P lies on AB with AP : PB = 3 : 1. Find the position vector of P and the exact distance OP.	
4 A particle of mass 3 kg is acted on by forces F_1 = $(-4\mathbf{i} - 18\mathbf{j})$ N and F_2. Its acceleration is $(-3\mathbf{i} - 2\mathbf{j})$ m s^{-2}. Find (a) F_2, (b) the angle between F_2 and $\mathbf{i}$, to 1 d.p.	
5 $f(x) = x^3 + ax^2 + bx + 8$, where a and b are constants. $(x - 4)$ is a factor of f(x). The remainder when f(x) is divided by $(x + 1)$ is 10. (a) Find a and b. (b) Solve f(x) = 0.	

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6 Customers enter a shop at random at an average of 3 per hour. Find the probability that in a 20-minute period there are (a) zero events (b) at least 2. (c) Find the probability that at least one occurs in each of two separate 20-minute periods.	
7 The number of fish in a lake is modelled by $N = 250\,e^{kt}$, where t is time in years. After 4 years, N = 750. Find (a) the exact value of k, (b) the time for N to reach 25000, to 3 s.f.	
8 Solve $\|2x - 3\| > \|x - 3\|$.	
9 Express $\frac{2x^2 - 13x - 29}{(x - 4)(x + 3)^2}$ in the form $\frac{A}{(x - 4)} + \frac{B}{(x + 3)} + \frac{C}{(x + 3)^2}$, and find A, B and C.	
10 The random variable X has probability density function $f(x) = kx$ for $0 \leq x \leq 2$, and 0 otherwise. (a) Find k. (b) Find E(X). (c) Find $P(X > \frac{4}{3})$.	