Day 117	A Level Maths: S Tier 10-a-day
1 The curve $y = x^2 - 4x + 4$ is translated by $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and then a stretch, scale factor 3, parallel to the y-axis. Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.	
2 Emails arrive in an inbox at an average rate of 12 per hour, independently and at random. (a) Find the probability of at least 2 in a 20-minute period. (b) Find the probability that, of 8 separate 20-minute periods, exactly 3 have no arrivals.	
3 Solve $2\sec^2\theta + \tan\theta - 5 = 0$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
4 Find the term independent of x in the expansion of $(2x^2 - \frac{2}{x^2})^8$.	
5 (a) Show that $\frac{x^2 + 6x + 3}{(x + 3)(x + 5)} \equiv 1 + \frac{A}{x + 3} + \frac{B}{x + 5}$. (b) Hence find the exact value of $\int_0^1 \frac{x^2 + 6x + 3}{(x + 3)(x + 5)}\,dx$.	

Day 117	A Level Maths: S Tier 10-a-day
6 $u_{n+1} = u_n + 2n - 2$, $u_1 = 4$. (a) Show that $u_n = an^2 + bn + c$ and find a, b, c. (b) Find the least n for which $u_n > 222$.	
7 A car of mass 800 kg, with engine power 8.136 kW, climbs a straight road with $\sin\alpha = \frac{1}{25}$ against a constant resistance of 500 N. Find (a) the greatest steady speed up the hill, (b) the acceleration at 5 m s^{-1}. Take g = 9.8 m s^{-2}.	
8 The points A, B, C have coordinates (−3, 1, 4), (2, 3, −2), (4, −3, 0). Find angle ABC to 1 d.p., and the exact area of triangle ABC.	
9 A game costs £1. Two fair dice are rolled: a total of at least 11 wins £14, a total of at most 3 wins £3, otherwise nothing. (a) Find the expected profit. (b) Find the standard deviation of the profit (3 s.f.). (c) Find the stake that makes the game fair.	
10 At time t = 0 hours, ship A is at the point with position vector (30**i** + 15**j**) km relative to a port O, and moves with constant velocity (−2**i** + **j**) km h^{-1}. Ship B leaves O at t = 0 with constant speed 10 km h^{-1} and intercepts A. Find (a) the time at which B intercepts A, (b) the velocity of B as a vector.	