Day 209	A Level Maths: S Tier 10-a-day
1 A ball is projected from a point O on horizontal ground at 45° to the horizontal. The ball just passes over the top of a vertical wall of height 19.2 m, at a horizontal distance of 29 m from O. Find (a) the speed of projection, (b) the greatest height of the ball above the ground, to 3 s.f. Take g = 9.8 m s^{-2}.	
2 Prove by contradiction that $\sqrt{2}$ is irrational.	
3 Find the exact value of $\int_0^2 \frac{2x+1}{x^2+x+5}\,dx$	
4 For n = 15 pairs of values: $\Sigma x = 45$, $\Sigma y = 345$, $\Sigma x^2 = 271$, $\Sigma xy = 1443$. (a) Find the equation of the regression line of y on x. (b) The x values lie between −1 and 8. Estimate y when x = 9 and comment on its reliability.	
5 The curve C has equation $x^2y + xy^2 = -30$. Find the equation of the tangent to C at the point (−3, −2), in the form ax + by + c = 0 with integers a, b, c.	

Day 209	A Level Maths: S Tier 10-a-day
6 Each component is faulty with probability 0.2, independently. Find the least number n of components that must be tested so that the probability of finding at least two faulty is greater than 0.95.	
7 The curve $y = 2x^2\sqrt{20 - x}$, for $0 < x < 20$, has one stationary point. Find its exact coordinates and determine its nature.	
8 The circle $x^2 + y^2 - 6x + 6y - 7 = 0$ passes through P(7, 0). The tangent at P meets the axes at A and B. Find the area of triangle OAB.	
9 A box of weight 150 N is pulled at constant speed along rough horizontal ground ($\mu = \frac{7}{24}$) by a force P N at angle θ above the horizontal. (a) Find P when $\tan\theta = \frac{4}{3}$. (b) Find the least possible value of P as θ varies, and the corresponding θ to 1 d.p.	
10 $f(x) = x^3 - 5x - 12$. Show that $(x - 3)$ is a factor of f(x), and that the equation f(x) = 0 has exactly one real root.	