Day 249	A Level Maths: S Tier 10-a-day
1 Find the exact coordinates of the stationary points of $y = 2x - 4\sin x$ for $0 \leq x \leq 2\pi$, and determine their nature.	
2 A ball is projected from a point O on horizontal ground at 28 m s^{-1}, at angle θ above the horizontal. It passes through the point P, 44 m horizontally and 27 m vertically from O. Find the two possible values of $\tan\theta$, and the two possible values of θ to 1 d.p. Take $g = 9.8$ m s^{-2}.	
3 Express $\frac{-2+\sqrt{3}}{1-\sqrt{3}}$ in the form $p + q\sqrt{3}$, where p and q are rational numbers.	
4 A drug dose of 20 mg decays by 10% each hour. Find the first whole number of hours after which less than 1 mg remains.	
5 A ball is dropped from a height of 4 m. After each bounce it rises to $\frac{2}{3}$ of its previous height. (a) Find the total distance it travels before it stops. (b) After how many bounces does it rise less than 0.1 m?	

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6 Data satisfy $y = ax^n$. The line of best fit for lg y against lg x is $\lg y = 0.25 - 2 \lg x$. (a) Find a and n, giving a to 3 significant figures. (b) Estimate y when x = 20, to 3 significant figures.	
7 The curve $y = 2x^2\sqrt{45 - x}$, for $0 < x < 45$, has one stationary point. Find its exact coordinates and determine its nature.	
8 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 5x^2 + 40x + 73$.	
9 A plank of mass 2 kg lies on a smooth horizontal table, with a block of mass 4 kg on it ($\mu = 0.3$ between them). A horizontal force P N acts on the plank. (a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 52.92. Take g = 9.8 m s^{-2}.	
10 A box holds 11 components, each faulty with probability 0.05, independently. A box is rejected if it has at least 2 faulty components. (a) Find the probability that a box is rejected. (b) 13 boxes are inspected. Find the probability that at least 3 are rejected.	