Day 231	A Level Maths: S Tier 10-a-day
1 The first term of an arithmetic sequence is 4 and its common difference d is non-zero. The 1st, 5th and 13th terms are the first three terms of a geometric sequence. Find d and the common ratio.	
2 Each bulb is faulty with probability 0.12, independently. Find the least number n of bulbs that must be tested so that the probability of finding at least two faulty is greater than 0.9.	
3 Use the trapezium rule with 6 strips to estimate $\int_0^1 \frac{1}{\sqrt{1+x}}\,dx$, to 4 s.f. Is it an overestimate or an underestimate? Explain.	
4 Data satisfy $y = ab^x$. The line of best fit for lg y against x is lg y = 0.65 + 0.4x. (a) Find a and b to 3 significant figures. (b) Estimate y when x = 14, to 3 significant figures. (c) Interpret the value of b.	
5 The points A, B, C have coordinates (−3, 3, −3), (−3, 2, 0), (1, −3, 0). Find angle ABC to 1 d.p., and the exact area of triangle ABC.	

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6 A geometric series has sum to infinity 18 and second term 4. Find the possible values of the common ratio r and the first term a in each case.	
7 A curve has parametric equations $x = 2t^2 - 2t$, $y = 2t^3 - 2t$. Find the equation of the tangent at the point where $t = -1$, in the form $y = mx + c$.	
8 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(-4\mathbf{i} + 6\mathbf{j})$ km relative to a fixed origin and B is at $(-17\mathbf{i} - 10\mathbf{j})$ km. A has velocity $(-\mathbf{i} + 2\mathbf{j})$ km h^{-1} and B has velocity $(3\mathbf{i} + 5\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	
9 Prove by contradiction that $\log_8 15$ is irrational.	
10 A ball is projected from a point O on horizontal ground at 29 m s^{-1}, at angle θ above the horizontal. It passes through the point P, 58 m horizontally and 18 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}.	