Day 263	A Level Maths: S Tier 10-a-day
1 The curve C has equation $3x^2 + 3xy + y^2 = 39$. Find the equation of the tangent to C at the point $(-2, -3)$, in the form $ax + by + c = 0$ with integers a, b, c.	
2 A geometric series has first term 5 and common ratio $\frac{2}{3}$. Find the least n for which S_n exceeds 95% of the sum to infinity.	
3 An arrow is projected from a point O on horizontal ground with speed 24.5 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{3}{4}$. Find the horizontal distance between the two points at which the arrow is 6.125 m above the ground. Take g = 9.8 m s^{-2}.	
4 A test of H_0: p = 0.5 against H_1: p > 0.5 uses a sample of 50 at the 5% level. (a) Find the critical region for X, the number of successes. (b) Find the actual significance level. (c) Find P(Type II error) when in fact p = 0.6.	
5 A population N satisfies $\frac{dN}{dt} = -0.005N^2$, with N = 100 when t = 0. Find N when t = 18, and the time taken for N to halve.	

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6 The mass of a parcel is N(80, 8^2) kg. A parcel is 'heavy' if it exceeds 86.
(a) Find the probability that a parcel is heavy.
(b) 8 parcels are chosen at random. Find the probability that at least 2 are heavy.

7 A circle passes through P(−8, −6), Q(6, 8) and R(0, −10). Find its equation.

8 The curve $y = 2x^2 + 4x + 3$ is translated by $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$
and then a stretch, scale factor 2, parallel to the x-axis.
Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.

9 Squares of side x cm are cut from the corners of a square sheet of
side 30 cm and the sides folded up to make an open box.
Find the value of x that maximises the volume, and that maximum volume.

10 A uniform rod AB (3 m, 100 N) is hinged at A to a vertical wall and held horizontal by a string BC, C on the wall above A, with $\tan \alpha = \frac{5}{12}$, where α is the angle between string and rod. A 50 N particle hangs at P, AP = 0.75 m.
Find (a) the tension, (b) the magnitude and direction of the hinge force (3 s.f. and 1 d.p.).

