Day 55	A Level Maths: S Tier 10-a-day
1 Solve $\cot(\theta - 10°) = \sqrt{3}$ for $0° \leq \theta \leq 360°$.	
2 Solve $x^3 - x^2 - 16x + 16 < 0$.	
3 (a) Express $4\cos\theta - 3\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p. (b) Hence solve $4\cos\theta - 3\sin\theta = 3$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
4 A data set has lower quartile 16 and upper quartile 28. An outlier is a value more than 1 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 8 observations have mean 16. The largest is 46, an outlier, and it is removed. Find the new mean.	
5 Find the set of values of x for which both $x^2 - 10x + 21 < 0$ and $-x - 4 \leq -8$.	

Day 55 **A Level Maths: S Tier 10-a-day**

6 Use the substitution u = ln x to find the exact value of

$$\int_1^{e^3} \frac{(\ln x)^3}{x}\,dx$$

7 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 25.2 m, at a horizontal distance of 90 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}.

8 A box holds 9 components, each faulty with probability 0.1, independently. A box is rejected if it has at least 3 faulty components.
(a) Find the probability that a box is rejected.
(b) 8 boxes are inspected. Find the probability that at least 2 are rejected.

9 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 4x^2 - 16x + 23$.

10 A uniform rod AB (3 m, 80 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 = 1.5 m.
Find (a) the tension, (b) the magnitude and direction of the hinge force (3 s.f. and 1 d.p.).

