Day 163	A Level Maths: S Tier 10-a-day
1 A data set has lower quartile 31 and upper quartile 51. An outlier is a value more than 1.5 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 10 observations have mean 35. The largest is 85, an outlier, and it is removed. Find the new mean.	
2 $f(x) = x^3 - 2x^2 - 2x - 24$. Show that $(x - 4)$ is a factor of f(x), and that the equation $f(x) = 0$ has exactly one real root.	
3 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 46 cm and its area is 126 cm^2. Find the two possible pairs of values of r and θ.	
4 A school has 60 students in Year 10, 60 in Year 11 and 120 in the sixth form. A stratified sample of 60 students is taken. (a) Find the number sampled from each group. (b) Two students are chosen at random from the sample. Find the probability they are from the same group.	
5 Express $\frac{-14x^2 + 32x - 48}{(x + 4)(2x - 2)^2}$ in the form $\frac{A}{(x + 4)} + \frac{B}{(2x - 2)} + \frac{C}{(2x - 2)^2}$.	

Day 163	A Level Maths: S Tier 10-a-day
6 A non-uniform rod AB of length 8 m and mass 8 kg rests on supports at C and D, where AC = 2 m and AD = 5 m, with $R_C = 1.5 R_D$. Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.	
7 Find the exact coordinates of the stationary points of $y = 5x + 10\cos x$ for $0 \leq x \leq \pi$, and determine their nature.	
8 A ball is dropped from a height of 4 m. After each bounce it rises to $\frac{1}{2}$ of its previous height. (a) Find the total distance it travels before it stops. (b) After how many bounces does it rise less than 0.01 m?	
9 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 27.2 m, at a horizontal distance of 40 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}.	
10 Line l_1: $\mathbf{r} = \begin{pmatrix}7\\3\\3\end{pmatrix} + s\begin{pmatrix}2\\2\\-2\end{pmatrix}$, line l_2: $\mathbf{r} = \begin{pmatrix}2\\1\\7\end{pmatrix} + t\begin{pmatrix}3\\0\\-2\end{pmatrix}$. Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.	