Day 268	A Level Maths: A Tier 10-a-day
1 A college has 520 students: 160 Arts, 80 Science and 280 Humanities. A stratified sample of size 26 is taken. Find the number of students sampled from each group.	
2 The line $y = x - 4$ meets the curve $y = x^2 - 2x - 4$ at A and B. (a) Find the coordinates of A and B. (b) Find the exact length AB.	
3 A particle is projected up a line of greatest slope of a smooth plane inclined at α. It passes A, 68.6 m from the start, after 4 s and again after 5 s. Find (a) the speed of projection, (b) α to 1 d.p. Take $g = 9.8$.	
4 Summary statistics for the daily mean visibility (Dm) in the same month are: Heathrow: mean 29.5, standard deviation 2.1; Leuchars: mean 21, standard deviation 3.4. Make two comparisons.	
5 The curve with equation $y = -x^2 - 2x + 6$ is transformed by a translation of $\begin{pmatrix} -2 \\ -2 \end{pmatrix}$, followed by a stretch, scale factor 2, parallel to the x-axis. Find the equation of the image curve.	

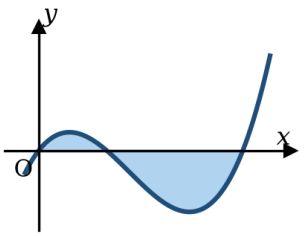
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6 (a) Express $\frac{7x + 27}{(x + 1)(x + 6)}$ in partial fractions.

(b) Hence find $\int_0^3 \frac{7x + 27}{(x + 1)(x + 6)}\,dx$, giving the answer in the form ln k.

7 A geometric series has first term 6 and common ratio 3.
Find the smallest n for which the sum of the first n terms exceeds 500.

8 The diagram shows the curve $y = x(x - 1)(x - 3)$.
Find the total area of the two shaded regions.



9 A curve has parametric equations $x = \sec t$, $y = \tan t$.
Find $\frac{dy}{dx}$ in terms of t and the exact equation of the tangent at the point where $t = \frac{\pi}{4}$, in the form $y = mx + c$.

10 A 1200 kg car tows a 300 kg trailer by a light tow-bar on a horizontal road. Driving force 1450 N; resistances 400 N (car), 150 N (trailer). Find (a) the acceleration and the tow-bar tension. At 8 m s^{-1} the tow-bar breaks. (b) How far does the trailer then travel?