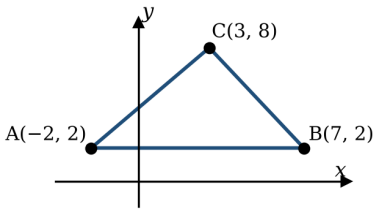
Day 83	A Level Maths: A Tier 10-a-day
1 The 2nd term of an arithmetic sequence is 1 and the 10th term is -31. Find the first term and common difference, and the sum of the first 12 terms.	
2 The random variable X has probability density function $f(x) = kx(3 - x)$ for $0 \leq x \leq 3$, and 0 otherwise. (a) Find k. (b) Find E(X). (c) Find $P(X > 2)$.	
3 $f(x) = x^2 - 2$. Show that the Newton-Raphson formula gives $x_{n+1} = \frac{1}{2}(x_n + \frac{2}{x_n})$, and use it with $x_0 = 2$ to find x_2 as an approximation to $\sqrt{2}$, to 4 d.p.	
4 At one location, the daily maximum gust is modelled by $N(21, 6^2)$. (a) Find the probability that on a randomly chosen day the value exceeds 30 knots. (b) Estimate the number of such days in a period of 31 days.	
5 A stone is dropped from rest from the top of a cliff. In the last 3 seconds before it hits the sea it falls 147 m. Find the height of the cliff. Take $g = 9.8$.	

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6 A curve has parametric equations $x = t^2 - 1$, $y = t^3 - 3t$.
Find $\frac{dy}{dx}$ in terms of t, and the equation of the normal at the point where $t = \frac{1}{2}$, in the form ax + by + c = 0 (integers).

7 The diagram shows triangle ABC.
(a) Find the equation of the line through C perpendicular to AB.
(b) Hence find the coordinates of D, the foot of the perpendicular from C to AB, and the area of triangle ABC.



8 $l_1: \mathbf{r} = \begin{pmatrix} -3 \\ 3 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 3 \\ 0 \end{pmatrix}$
$l_2: \mathbf{r} = \begin{pmatrix} -7 \\ 1 \\ 7 \end{pmatrix} + \mu \begin{pmatrix} -2 \\ -1 \\ 1 \end{pmatrix}$
Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.

9 Solve $2 \times 3^{2x} - 24 \times 3^x + 54 = 0$.

10 A 2 kg particle is in equilibrium on a rough plane inclined at α, $\tan\alpha = \frac{12}{5}$, $\mu = \frac{1}{3}$. A horizontal force of P N, in the vertical plane through a line of greatest slope, pushes it towards the plane. Find the least and greatest values of P. Take g = 9.8. Give answers to 3 s.f. if not exact.