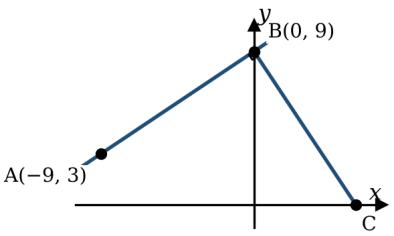
Day 227	A Level Maths: S Tier 10-a-day
1 A uniform plank AB of length 8 m and mass 80 kg rests on supports at C and D, where AC = 3 m and DB = 3 m. A girl of mass 50 kg stands on it at distance x m from A. Find the range of x for which the plank stays in equilibrium on both supports.	
2 Data satisfy $y = ax^n$. The line of best fit for lg y against lg x is lg y = 0.95 + 0.5 lg x. (a) Find a and n, giving a to 3 significant figures. (b) Estimate y when x = 5, to 3 significant figures.	
3 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{\sin 1\theta \tan 5\theta}{1 - \cos 5\theta}$ approaches as $\theta \to 0$.	
4 Sam claims that $n^2 + 3n + 79$ is prime for every positive integer n. Show that Sam is wrong by finding the smallest value of n that is a counter-example.	
5 An arrow is projected from a point O on horizontal ground with speed 63.7 m s^{-1} at an angle α above the horizontal, where $\tan \alpha = \frac{12}{5}$. Find the horizontal distance between the two points at which the arrow is 171.5 m above the ground. Take g = 9.8 m s^{-2}.	

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6 The curve $y = ab^x$ passes through (0, 4) and (4, 1024).
Find the exact values of a and b, and the value of y when x = 6.

7 In the diagram, line l_1 passes through A and B. Line l_2 is perpendicular to l_1 at B and meets the x-axis at C. Find the coordinates of C and the area of triangle ABC.



8 A coin is said to show heads with probability 0.4. In 20 trials it does so 14 times.
Test at the 10% level whether the probability is different from 0.4.

9 Solve $x^{\frac{2}{3}} - 3x^{\frac{1}{3}} + 2 = 0$.

10 (a) Show that $\frac{x^2 + 13x + 37}{(x + 5)(x + 4)} \equiv 1 + \frac{A}{x + 5} + \frac{B}{x + 4}$.

(b) Hence find the exact value of $\int_0^1 \frac{x^2 + 13x + 37}{(x + 5)(x + 4)}\,dx$.