Day 318	A Level Maths: S Tier 10-a-day
1 $f(x) = x^3 + x^2 - 5x - 21$. Show that $(x - 3)$ is a factor of f(x), and that the equation f(x) = 0 has exactly one real root.	
2 A train accelerates uniformly from rest at 1.5 m s^{-2} to a speed of V m s^{-1}, travels at this speed, then decelerates uniformly at 1.5 m s^{-2} to rest. The journey takes 74 s and covers 792 m. Find V and the time spent at constant speed.	
3 $f(x) = \frac{kx + 9}{x - 6}$ for $x \neq 6$. Given that f is self-inverse, find k, and hence solve f(x) = x.	
4 The equation $x^3 = x + 10$ has a root α. (a) Show that the equation can be written as $x = \sqrt[3]{(x + 10)}$. (b) Use $x_{n+1} = \sqrt[3]{(x_n + 10)}$ with $x_0 = 1$ to find x_1, x_2, x_3 to 4 d.p., and hence state α to 3 d.p.	
5 Two fair 10-sided dice, numbered 1 to 10, are rolled. M is the larger of the two scores. (a) Show that $P(M = m) = \frac{(2m - 1)}{100}$ for m = 1, 2, ..., 10. (b) Find P(M = 3) and E(M).	

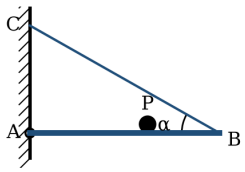
Day 318 **A Level Maths: S Tier 10-a-day**

6 A curve has parametric equations $x = t^2$, $y = t^3 + 24t$.
Find the coordinates of the points on the curve where
the gradient is 9.

7 A bag has 3 red, 6 blue and 2 green counters. A player takes two without replacement. Two reds win £3, two blues win £8, anything else wins nothing.
(a) Find the expected winnings.
(b) The player pays £2 to play. Find the expected profit.

8 $f(x) = \dfrac{5}{x^2 - 4x + 10}$ for all real x.
Find the greatest value of f(x), the value of x at which it occurs, and the range of f.

9 A uniform rod AB (3 m, 40 N) is hinged at A to a vertical wall and held horizontal by a string BC, C on the wall above A, with $\tan \alpha = \dfrac{5}{12}$, 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.).



10 A population N satisfies $\dfrac{dN}{dt} = -0.005N^2$, with N = 50 when t = 0.
Find N when t = 12, and the time taken for N to halve.