Day 192	A Level Maths: S Tier 10-a-day
1 A tennis ball is projected from a point O on horizontal ground with speed 24.5 m s^{-1} at an angle θ above the horizontal, where $\tan\theta = \frac{3}{4}$. Find (a) the greatest height, (b) the speed when it is at half of this height (3 s.f.). Take g = 9.8 m s^{-2}.	
2 When a polynomial f(x) is divided by (x + 1) the remainder is 4; when divided by (x − 2) the remainder is −5. Find the remainder when f(x) is divided by (x + 1)(x − 2).	
3 A data set has lower quartile 19 and upper quartile 29. An outlier is a value more than 1 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 8 observations have mean 23. The largest is 50, an outlier, and it is removed. Find the new mean.	
4 $f(x) = -x - 3$ and $g(x) = x^2 - 4$. Solve fg(x) = gf(x).	
5 A curve has parametric equations $x = 2t^2 - t$, $y = 2t^3 - 3t$. Find the equation of the tangent at the point where t = 2, in the form y = mx + c.	

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6 At time t = 0 hours, ship A is at the point with position vector (28**i** + 60**j**) km relative to a port O, and moves with constant velocity (**i**) km h^{-1}. Ship B leaves O at t = 0 with constant speed 17 km h^{-1} and intercepts A. Find (a) the time at which B intercepts A, (b) the velocity of B as a vector.	
7 X ~ B(16, $\frac{1}{5}$). (a) Show that P(X = r + 1) ÷ P(X = r) = $\frac{16 - r}{r + 1} \times \frac{1}{4}$. (b) Find the most likely value of X and its probability (3 s.f.).	
8 Use the substitution u = x + 4 to find the exact value of $\int_0^5 \frac{x}{\sqrt{x + 4}}\, dx$	
9 f(x) = $\frac{13x - 5}{(1 - 3x)(1 - x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	
10 A curve has parametric equations x = 4 sin t, y = 3 cos t, for $0 \leq t \leq \frac{\pi}{2}$. Find the exact area bounded by the curve and the coordinate axes.	