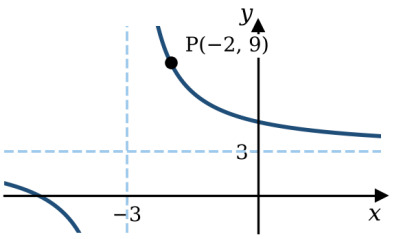
Day 211	A Level Maths: S Tier 10-a-day

1 The diagram shows the curve C, its asymptotes (dashed) and a point P. C has equation $y = \frac{a}{x + p} + q$. Find a, p and q.



2 The curve $y = ax^n$ passes through (2, 16) and (4, 64).
Find the values of a and n.

3 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where
$\mathbf{r} = (-3t^2 + 9t)\mathbf{i} + (2.5t^2 - 6t)\mathbf{j}$.
Find (a) the value of t at which P is moving parallel to $(\mathbf{i} - \mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).

4 Calls arrive at a switchboard at an average rate of 12 per hour, independently and at random.
(a) Find the probability of at least 2 in a 30-minute period.
(b) Find the probability that, of 7 separate 30-minute periods, exactly 2 have no arrivals.

5 Given that $\cos 3\theta \equiv 4\cos^3\theta - 3\cos\theta$, solve $\cos 3\theta = \cos\theta$ for $0 < \theta < 2\pi$, in terms of π.

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6 Particles A and B are projected from a point O at the same instant, with initial velocities $(5\mathbf{i} + 47\mathbf{j})$ m s^{-1} and $(14\mathbf{i} + 35\mathbf{j})$ m s^{-1} respectively (i horizontal, j vertically upwards). Both are still in flight after 3 s. Find (a) the distance AB at this time, (b) the angle AB makes with the horizontal, to 1 d.p.	
7 When a polynomial f(x) is divided by (x + 1) the remainder is 3; when divided by (x − 3) the remainder is 23. Find the remainder when f(x) is divided by (x + 1)(x − 3).	
8 A geometric series has first term 2 and common ratio 4. Find the least n for which $S_n > 18371$.	
9 The line l has equation $\mathbf{r} = \begin{pmatrix} 2 \\ -4 \\ 0 \end{pmatrix} + t\begin{pmatrix} -1 \\ 3 \\ 0 \end{pmatrix}$. The point P has coordinates (5, 7, −7). Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.	
10 X ~ B(120, 0.35). (a) State why a normal approximation is suitable for X. (b) Use a normal approximation to estimate P(X ≥ 43), to 3 significant figures.	