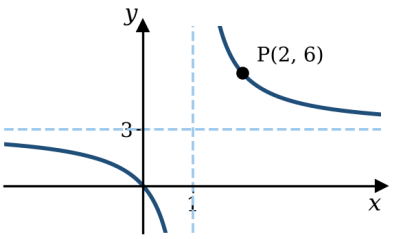
Day 80 **A Level Maths: S Tier 10-a-day**

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 A box holds 7 components, each faulty with probability 0.15, independently. A box is rejected if it has at least 2 faulty components.
(a) Find the probability that a box is rejected.
(b) 13 boxes are inspected. Find the probability that at least 3 are rejected.

3 Find the exact value of
$\tan(\tan^{-1}(\frac{1}{5}) + \tan^{-1}(1))$.

4 Each year Jo pays £800 into an account on 1 January.
Interest of 4% is added each 31 December.
Find the first year-end at which the balance exceeds £20,000.

5 Particles of mass 4 kg and 1 kg hang on a light string over a smooth fixed pulley. The 4 kg particle is 3.75 m above the ground; the 1 kg one is on the ground.
Released from rest, find (a) the tension, (b) the greatest height reached by the 1 kg particle.
Take $g = 9.8$ m s^{-2}.

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6 $f(x) = x^3 + 3x^2 + 4x - 8$. Show that $(x - 1)$ is a factor of f(x), and that the equation f(x) = 0 has exactly one real root.	
7 The curves $y = \cos x$ and $y = \cos 2x$ meet at $x = 0$ and at $x = \frac{2\pi}{3}$. Find the exact area enclosed between them for $0 \leq x \leq \frac{2\pi}{3}$.	
8 A spinner is said to show heads with probability 0.2. In 20 trials it does so 1 times. Test at the 10% level whether the probability is different from 0.2.	
9 $f(\theta) = \frac{1}{16 + 5\sin\theta + 12\cos\theta}$ (a) Write $5\sin\theta + 12\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	
10 At time t = 0 hours, ship A is at the point with position vector $(-40\mathbf{j})$ km relative to a port O, and moves with constant velocity $(5\mathbf{i} - 2\mathbf{j})$ km h^{-1}. Ship B leaves O at t = 0 with constant speed 13 km h^{-1} and intercepts A. Find (a) the time at which B intercepts A, (b) the velocity of B as a vector.	