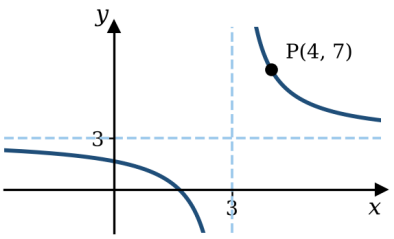
Day 84 **A Level Maths: S Tier 10-a-day**

1 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours.
Initially P = 250 and after 6 hours P = 625.
Find k, and the time for the population to reach 1250, to 3 s.f.

2 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.



3 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{\cos 2\theta - \cos 6\theta}{\theta^2}$ approaches as $\theta \to 0$.

4 Solve simultaneously:
$x - y = -3$
$2x^2 - y^2 = -9$

5 Particles of mass 9 kg and 1 kg hang on a light string over a smooth fixed pulley. The 9 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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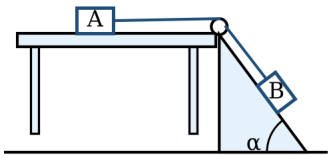
6 A school has 60 students in Year 10, 180 in Year 11 and 120 in the sixth form.
A stratified sample of 60 students is taken.
(a) Find the number sampled from each group.
(b) Two students are chosen at random from the sample. Find the probability they are from the same group.

7 Find the coordinates of the stationary points of $y = \cos 2x + 2\cos x$ for $0 < x < 2\pi$,
and determine their nature.

8 Solve $x - 9\sqrt{x} + 20 = 0$.

9 Particle A (3 kg) lies on a rough table with $\mu = 0.2$, and is joined by a light string over a smooth pulley (see diagram) to particle B (7 kg) on a smooth slope, $\sin\alpha = \frac{4}{5}$.

Released from rest, the string is cut when B has moved 0.5 m. Find the further distance A slides before stopping.



10 A battery's life, in hours, is $N(78, 12^2)$.
Given that it exceeds 66, find the probability that it exceeds 75.