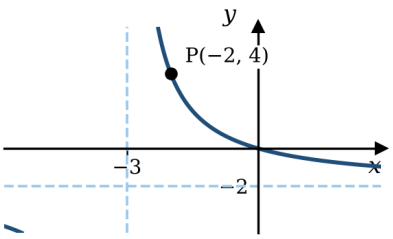
Day 328	A Level Maths: S Tier 10-a-day
1 At time t = 0 hours, ship A is at the point with position vector $(4\mathbf{i} + 24\mathbf{j})$ km relative to a port O, and moves with constant velocity $(3\mathbf{i})$ km h^{-1}. Ship B leaves O at t = 0 with constant speed 13 km h^{-1} and intercepts A. Find (a) the time at which B intercepts A, (b) the velocity of B as a vector.	
2 Solve $e^x + 48\,e^{-x} = 14$, giving your answers exactly in terms of natural logarithms.	
3 Three forces $(4\mathbf{j})$ N, $(-7\mathbf{i} + k\mathbf{j})$ N and $(-5\mathbf{i} - 6\mathbf{j})$ N act on a particle of mass 3 kg. The resultant is parallel to $(-12\mathbf{i} - 5\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
4 A is acute and B is obtuse. $\cos A = \frac{7}{25}$ and $\cos B = -\frac{21}{29}$. Find the exact values of sin(A + B) and cos(A + B).	
5 A circle passes through A(−1, −12), B(11, 4) and C(5, 6). Find its equation.	

Day 328 **A Level Maths: S Tier 10-a-day**

6 Data pairs (x, y) are coded by $u = x - 6$ and $v = \frac{y}{20}$. The regression line of v on u is $v = 12.5 + 1.2u$.
(a) Find the regression line of y on x in the form $y = a + bx$.
(b) Use it to estimate y when $x = 14$.

7 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.



8 Solve simultaneously, giving integer x and y:
$2^x \times 4^y = 32$
$9^x \div 27^y = 27$

9 Line l_1: $\mathbf{r} = \begin{pmatrix} 6 \\ 3 \\ 5 \end{pmatrix} + s\begin{pmatrix} -2 \\ -2 \\ -3 \end{pmatrix}$,
line l_2: $\mathbf{r} = \begin{pmatrix} 4 \\ -2 \\ -2 \end{pmatrix} + t\begin{pmatrix} -2 \\ 1 \\ 1 \end{pmatrix}$.
Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.

10 A school says that 10% of its pupils walk to school. 40 pupils are surveyed, and 7 walk. Test, at the 1% significance level, the claim that the proportion is higher.
Give your conclusion in context.