Day 174 **A Level Maths: A Tier 10-a-day**

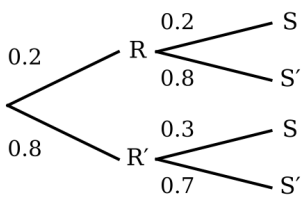
1 n = 10 pairs of (x, y): $\Sigma x = 164$, $\Sigma y = 297$, $\Sigma x^2 = 3264$, $\Sigma xy = 5506$.
(a) Find the equation of the regression line of y on x (3 s.f.).
(b) Estimate y when x = 21.

2 $f(x) = x^3 - 3x - 11$.
Show that the equation f(x) = 0 has a root α in the interval [2, 3].

3 A cyclist passes P with speed 5 m s^{-1} and accelerates uniformly. She travels 117.6 m in the next 12 s, reaching Q. Find (a) her acceleration, (b) her speed at Q, (c) her speed at the midpoint of PQ. Give answers to 3 s.f. if not exact.

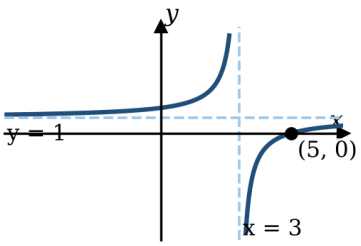
4 A and B have position vectors $\begin{pmatrix} -5 \\ -5 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$.
The point P lies on AB with AP : PB = 3 : 1.
Find the position vector of P and the exact distance OP.

5 The tree diagram shows probabilities for events R and S.
(a) Find P(S′).
(b) Find P(R′ | S′).



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6 The diagram shows the curve $y = \frac{k}{x - a} + b$ with asymptotes as shown. Find the values of k, a and b, and the coordinates where the curve crosses the axes.



7 At 12:00 ship P has position $(15\mathbf{i} - 30\mathbf{j})$ km and velocity $(-\mathbf{i} + 6\mathbf{j})$ km h^{-1}; ship Q has position $(-5\mathbf{i} + 10\mathbf{j})$ km and velocity $(3\mathbf{i} - 2\mathbf{j})$ km h^{-1}. Show that the ships collide and find the time and position vector of the collision.

8 Given that $(x - 5)$ is a factor of $f(x) = x^3 + 2x^2 - 25x - 50$, solve $f(x) < 0$.

9 A hemispherical bowl of radius 8 cm is filled at 20 $cm^3 s^{-1}$. When the depth is h, $V = \pi(8h^2 - \frac{1}{3}h^3)$.

Find $\frac{dh}{dt}$ when h = 4 cm.

10 $f(x) = \frac{17x + 6}{(1 + 3x)(1 + 2x)}$.

(a) Express f(x) in partial fractions.

(b) Hence expand f(x) up to x^2.

(c) State the range of x for which the expansion is valid.