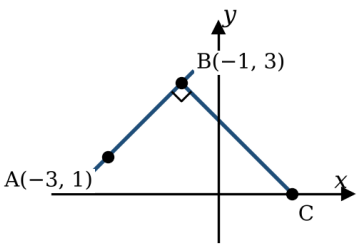
Day 216	A Level Maths: S Tier 10-a-day
1 $f(x) = 2x^3 + ax^2 + bx + 32$, where a and b are constants. $(x - 4)$ is a factor of f(x), and f(x) leaves remainder 56 when divided by $(x + 3)$. Find a and b, and hence solve $f(x) = 0$.	
2 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(3\mathbf{i} + \mathbf{j})$ km relative to a fixed origin and B is at $(-2\mathbf{i} + 11\mathbf{j})$ km. A has velocity $(-5\mathbf{i} + 5\mathbf{j})$ km h^{-1} and B has velocity $(-\mathbf{i} + 2\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	
3 (a) Express $21 \sin\theta + 20 \cos\theta$ in the form $R \sin(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p. (b) Hence solve $21 \sin\theta + 20 \cos\theta = -7$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
4 $f(x) = \frac{kx - 7}{x - 3}$ for $x \neq 3$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.	
5 A bag has 2 yellow counters and some white counters, n in total. Two are taken without replacement. P(both yellow) $= \frac{1}{78}$. Find n.	

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6 A curve has parametric equations $x = \ln t$, $y = 5t^2 - 4t$, $t > 0$.
Find the equation of the tangent where $t = 1$, in the form $y = mx + c$.

7 In the diagram, line l_1 passes through A and B. Line l_2 is perpendicular to l_1 at B and meets the x-axis at C. Find the coordinates of C and the area of triangle ABC.



8 A closed cylinder has volume 128π cm^3. Find, in terms of π, the
minimum possible total surface area, proving that it is a minimum.

9 $X \sim N(\mu, 100)$. H_0: $\mu = 89$ is tested against H_1: $\mu > 89$ using the mean of a sample of size 9 at the 1% level.
(a) Find the critical region for the sample mean.
(b) Find the probability of a Type II error when $\mu = 94$.

10 A plank of mass 5 kg lies on a smooth horizontal table, with a block of mass 3 kg on it ($\mu = 0.25$ between them). A horizontal force P N acts on the plank.
(a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 24.5. Take $g = 9.8$ m s^{-2}.