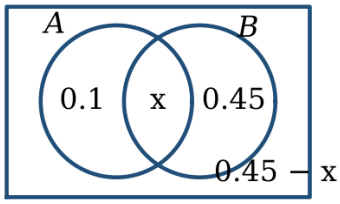
Day 105	A Level Maths: S Tier 10-a-day

1 $f(x) = 3x^3 + ax^2 + bx + 27$, where a and b are constants.
$(x - 1)$ is a factor of f(x), and f(x) leaves remainder 45 when divided by $(x + 2)$.
Find a and b, and hence solve $f(x) = 0$.

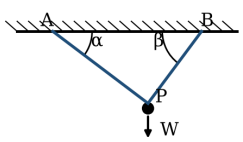
2 The Venn diagram shows probabilities; A and B are independent.
Find the possible values of x.



3 The function f is defined by $f(x) = x^2 - 8x + 24$ for $x \geq k$. Given that k is the least value for which
f is one-one, find k, $f^{-1}(x)$, and the domain of f^{-1}.

4 The curve $y = 3^x - 2x$ has one stationary point. Find its coordinates to 3 s.f. and show that it is a minimum.

5 A particle P of weight 141 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan \alpha = \frac{3}{4}$ and $\tan \beta = \frac{4}{3}$.
Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 136.8 N.



Day 105	A Level Maths: S Tier 10-a-day
6 A curve has parametric equations $x = 3t^2 + 3t$, $y = 2t^3 - 4t$. Find the equation of the tangent at the point where $t = 2$, in the form $y = mx + c$.	
7 A rare allele is present in 2% of a population. A test is positive for 95% of those with it and for 5% of those without it. Find P(positive) and P(has it | positive).	
8 An open-topped box has a square base of side x m and volume 4 m^3. Show that the surface area is $A = x^2 + \frac{16}{x}$, and find the minimum value of A, justifying that it is a minimum.	
9 The line $3y = 4x + k$ is a tangent to the circle $(x - 1)^2 + (y + 1)^2 = 9$. Find the two possible values of k.	
10 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(-2\mathbf{i} - 3\mathbf{j})$ km relative to a fixed origin and B is at $(5\mathbf{i} - 4\mathbf{j})$ km. A has velocity $(5\mathbf{i} + 2\mathbf{j})$ km h^{-1} and B has velocity $(2\mathbf{i} + 6\mathbf{j})$ km h^{-1}. Find (a) the time at which the ships are closest together, (b) the least distance between them.	