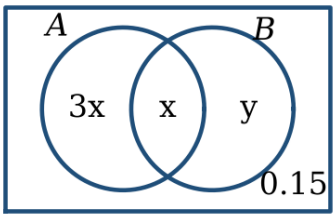
Day 254	A Level Maths: S Tier 10-a-day
1 A lift of mass M kg, carrying a passenger of mass 75 kg, hangs from a vertical cable. The tension in the cable is 5565 N and the floor exerts a force of 795 N on the passenger. Find (a) the acceleration of the lift, with its direction, (b) the value of M. Take g = 9.8 m s^{-2}.	
2 The Venn diagram shows probabilities; A and B are independent. Find x and y. 	
3 A particle P moves with constant acceleration. At t = 0 seconds P is at $(-3\mathbf{i} + \mathbf{j})$ m with velocity $(-4\mathbf{i} - 3\mathbf{j})$ m s^{-1}. At t = 8, P has velocity $(12\mathbf{i} + 21\mathbf{j})$ m s^{-1}. Find (a) the acceleration of P, (b) the time at which P moves parallel to $(\mathbf{j})$, (c) the position vector of P at that time.	
4 The equation $x^3 = 2x + 4$ has a root α. (a) Show that the equation can be written as $x = \sqrt[3]{(2x + 4)}$. (b) Use $x_{n+1} = \sqrt[3]{(2x_n + 4)}$ with $x_0 = 3$ to find x_1, x_2, x_3 to 4 d.p., and hence state α to 3 d.p.	
5 Solve $\lvert -4x - 3 \rvert < 2x + 6$.	

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6 Find the exact coordinates of the stationary points of $y = 2x + 4\cos x$ for $0 \leq x \leq \pi$, and determine their nature.	
7 $f(x) = x^3 - x^2 - 4$. Show that $(x - 2)$ is a factor of $f(x)$, and that the equation $f(x) = 0$ has exactly one real root.	
8 A bulb's lifetime, in hours, is $N(86, 5^2)$. Given that it exceeds 91, find the probability that it exceeds 99.	
9 Solve $\frac{2}{(x+1)} < \frac{3}{(x-4)}$.	
10 Two drones P and Q move so that, t seconds after launch, their position vectors in metres are $\mathbf{r}_P = \begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix} + t\begin{pmatrix} 3 \\ -3 \\ -2 \end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix} 4 \\ -7 \\ -1 \end{pmatrix} + t\begin{pmatrix} 3 \\ -2 \\ -2 \end{pmatrix}$. Find the time at which they are closest and the exact minimum distance between them.	