Day 45	A Level Maths: S Tier 10-a-day

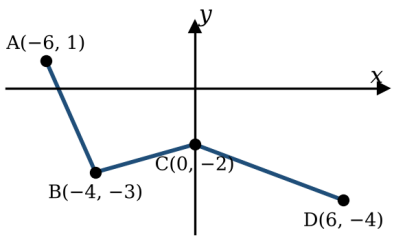
1 Find the exact value of

$$\int_0^2 \frac{10x + 10}{x^2 + 2x + 2}\,dx$$

2 Customers arrive at a till at an average rate of 6 per hour, independently and at random.
(a) Find the probability of at least 2 in a 10-minute period.
(b) Find the probability that, of 9 separate 10-minute periods, exactly 3 have no arrivals.

3 A golf ball is hit from a point O on horizontal ground. It lands 75 m from O, and reaches a maximum height of 25 m above the ground. Find the angle of projection and the speed of projection, to 3 s.f. Take g = 9.8 m s^{-2}.

4 The diagram shows y = f(x), made of three straight line segments. Find the coordinates of the images of A, B, C and D on the graph of y = 2f(x + 2) + 3.



5 A and B are acute angles with tan A = $\frac{1}{4}$ and tan B = $\frac{3}{5}$.
Find tan(A + B) and hence show that A + B = $\frac{\pi}{4}$.

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6 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where $\mathbf{r} = (-2t^2 + 8t)\mathbf{i} + (-t^2 - 2t)\mathbf{j}$. Find (a) the value of t at which P is moving parallel to $(\mathbf{i} + 2\mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).	
7 $X \sim B(12, \frac{1}{5})$. (a) Show that $P(X = r + 1) \div P(X = r) = \frac{12 - r}{r + 1} \times \frac{1}{4}$. (b) Find the most likely value of X and its probability (3 s.f.).	
8 Solve simultaneously: $x + 3y = -2$ $x^2 + 2xy - y^2 = 14$	
9 A curve has parametric equations $x = (\theta - \sin\theta)$, $y = (1 - \cos\theta)$. Find the exact area under one arch, for $0 \leq \theta \leq 2\pi$, between the curve and the x-axis.	
10 The line $12y = 5x + k$ is a tangent to the circle $(x + 3)^2 + (y + 4)^2 = 16$. Find the two possible values of k.	