Day 128	A Level Maths: S Tier 10-a-day
1 Data pairs (x, y) are coded by $u = x - 8$ and $v = \frac{y}{4}$. The regression line of v on u is $v = 4.2 + 0.5u$. (a) Find the regression line of y on x in the form $y = a + bx$. (b) Use it to estimate y when $x = 12$.	
2 Express $\frac{-2 + 4\sqrt{5}}{4 - \sqrt{5}}$ in the form $p + q\sqrt{5}$, where p and q are rational numbers.	
3 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 32 cm and its area is 55 cm^2. Find the two possible pairs of values of r and θ.	
4 A ball is thrown vertically upwards from ground level. It is more than 137.2 m above the ground for 12 s. Find the speed of projection and the greatest height reached. Take $g = 9.8$ m s^{-2}.	
5 Find the exact value of $\sin(\sin^{-1}(\frac{4}{5}) + \cos^{-1}(\frac{3}{5}))$.	

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6 Solve $x - 7\sqrt{x} + 10 = 0$.	
7 A particle P moves on a straight line. The velocity of P is v m s^{-1} and its acceleration is $-0.05v$ m s^{-2}. At t = 0, v = 6. Find (a) the time taken for the speed of P to halve, to 3 s.f., (b) the distance P travels in this time.	
8 A and B take turns, A first, to score; the first to score wins. P(A scores) = $\frac{1}{6}$, P(B scores) = $\frac{1}{2}$ each attempt. Find P(A wins (a) on attempt 1 or 2, (b) overall).	
9 $f(x) = \frac{x + 3}{(1 + 3x)(1 + x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	
10 The line l has equation $\mathbf{r} = \begin{pmatrix} -2 \\ 0 \\ -2 \end{pmatrix} + t\begin{pmatrix} -2 \\ 0 \\ -3 \end{pmatrix}$. The point P has coordinates $(-4, -5, 8)$. Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.	