Day 53	A Level Maths: S Tier 10-a-day
1 The function f is defined by $f(x) = x^2 - 2x + 9$ 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}.	
2 Solve $\sin(2\theta + 30°) = \frac{1}{2}$ for $0° \leq \theta \leq 360°$.	
3 A sequence is defined by $u_1 = \frac{1}{2}$ and $u_{n+1} = \frac{1}{1 - u_n}$. Show that the sequence is periodic and find $\sum_{r=1}^{75} u_r$.	
4 A data set has lower quartile 13 and upper quartile 21. An outlier is a value more than 1.5 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 12 observations have mean 13. The largest is 35, an outlier, and it is removed. Find the new mean.	
5 The curve C has equation $x^2 - xy + 2y^2 = 53$. Find the equation of the normal to C at the point $(-3, 4)$, in the form $ax + by + c = 0$ with integers a, b, c.	

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6 A stone is projected from level ground with horizontal and vertical velocity components 44.1 and 68.6 m s^{-1}.
Find (a) the two times at which it moves at 45° to the horizontal, (b) the horizontal distance between those two points. Take g = 9.8 m s^{-2}.

7 The curve C has equation $y = \frac{-3x - 11}{x + 1}$.
(a) Write down the equations of the asymptotes of C.
(b) The line y = 2x + k is a tangent to C.
Find the possible values of k.

8 The points A, B, C have coordinates (1, 2, 4), (−2, −1, −2), (−3, −2, −2).
Find angle ABC to 1 d.p., and the exact area of triangle ABC.

9 A plank of mass 5 kg lies on a smooth horizontal table, with a block of mass 3 kg on it (μ = 0.2 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 = 47.04. Take g = 9.8 m s^{-2}.

10 The table shows the times, t minutes, taken by some runners.
Using linear interpolation, the median is estimated as 11.5 minutes. Find the value of k.

t (min)	0-5	5-10	10-15	15-20	20-30
Frequency	13	k	5	11	10