Day 16	A Level Maths: A Tier 10-a-day
1 $y = \ln(3x^2 + 5)$. Find $\frac{dy}{dx}$ and the gradient of the curve at $x = -1$.	
2 Car A passes P at constant speed 20 m s^{-1}. 10 s later car B leaves P from rest, in the same direction, with acceleration 3 m s^{-2}. B overtakes A at Q. Find (a) the time B takes to reach Q, (b) PQ, (c) the speed of B at Q.	
3 A circle has equation $x^2 + y^2 + 8x - 10y + 32 = 0$. (a) Find the centre and radius of the circle. (b) Determine whether $P(-6, 5)$ lies inside or outside the circle.	
4 Given that $\log_a 2 = p$ and $\log_a 3 = q$, express $\log_a(\sqrt{12})$ in terms of p and q.	
5 $f(x) = \frac{4x + 6}{2x - 4}$, $x \in \mathbb{R}$, $x \neq 2$. Find $f^{-1}(x)$ and state its domain.	

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6 A data set has mean 66 and standard deviation 9. A value is treated as an outlier if it is more than 2 standard deviations from the mean. Which of 47, 51, 60, 86 are outliers?	
7 A 1200 kg car has engine power 45 kW and constant resistance 500 N. Find (a) its greatest steady speed on a horizontal road, (b) its acceleration at 12 m s^{-1} up a hill where $\sin\alpha = \frac{1}{20}$. Take g = 10. Give answers to 3 s.f. if not exact.	
8 θ is small and measured in radians. Use small angle approximations to show that $3\sin\theta + 4\cos 2\theta = 3.5$ can be written as $a\theta^2 + b\theta + c = 0$ with integers a, b, c. Hence find the approximate solution with $0 < \theta < 0.8$, to 3 s.f.	
9 $X \sim B(37, p)$. H_0: $p = 0.3$ is tested against H_1: $p \neq 0.3$ at the 10% level. (a) Find the critical region. (b) Find the actual significance level of the test (3 s.f.).	
10 Solve $3 \times 2^{2x} - 9 \times 2^x + 6 = 0$.	