Day 76	A Level Maths: S Tier 10-a-day
1 Solve the simultaneous equations $\log_3 x - \log_3 y = 1$ $x + y = 36$	
2 Ball A is projected vertically upwards from ground level with speed 33 m s^{-1}. At the same instant, ball B is released from rest 33 m directly above A. The balls collide. Find (a) the height above the ground at which they collide, (b) the velocity of A just before the collision. Take g = 9.8 m s^{-2}.	
3 A chord AB of a circle, centre O and radius 5 cm, subtends an angle of $\frac{\pi}{3}$ at O. Find the exact area and the exact perimeter of the minor segment cut off by AB.	
4 A circle has its centre in the first quadrant and touches both the x-axis and the y-axis. It passes through the point (9, 2). Find the two possible equations of the circle.	
5 The curve C has equation $x^3 + xy^2 = 100$. Find the equation of the tangent to C at the point (4, −3), in the form ax + by + c = 0 with integers a, b, c.	

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6 The first row of a theatre has 19 seats. Each row has 3 more seats than the row in front. Find (a) the number of seats in row 41, (b) the least number of rows for at least 611 seats.	
7 A coin is said to show heads with probability 0.5. In 25 trials it does so 20 times. Test at the 10% level whether the probability is different from 0.5.	
8 The cdf of X is $F(x) = 0$ for $x < 0$, $F(x) = 1 - (1 - \frac{x}{5})^3$ for $0 \leq x \leq 5$, and $F(x) = 1$ for $x > 5$. (a) Find the pdf of X. (b) Find E(X). (c) Find $P(1.25 < X < 2.5)$ and the median, to 3 significant figures.	
9 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 $\sum_{r=1}^{99} u_r$.	
10 A ball is projected from a point O on horizontal ground at 37 m s^{-1}, at angle θ above the horizontal. It passes through the point P, 74 m horizontally and 26 m vertically from O. Find the two possible values of $\tan\theta$, and the two possible values of θ to 1 d.p. Take g = 9.8 m s^{-2}.	