Day 262	A Level Maths: A Tier 10-a-day
1 A(7, 7) and B(1, −1) are the ends of a diameter of a circle. (a) Find the equation of the circle, in the form $x^2 + y^2 + ax + by + c = 0$. (b) Show that C(4, 8) lies on the circle.	
2 A 1500 kg car tows a 300 kg trailer by a light tow-bar on a horizontal road. Driving force 1060 N; resistances 500 N (car), 200 N (trailer). Find (a) the acceleration and the tow-bar tension. At 12 m s^{-1} the tow-bar breaks. (b) How far does the trailer then travel?	
3 On each independent trial, the probability that a bulb is faulty is $\frac{1}{3}$. X is the number of trials up to and including the first success. (a) Find P(X = 5) and E(X). (b) Find the least m with P(X ≤ m) > 0.95.	
4 At 12:00 ship P has position (13**i**) km and velocity (−3**i** − 3**j**) km h^{-1}; ship Q has position (**i** − 18**j**) km and velocity (3**i** + 6**j**) km h^{-1}. Show that the ships collide and find the time and position vector of the collision.	
5 A curve has equation $3x^2 + 2xy + 2y = -1$. Show that P(1, −1) lies on the curve and find the equation of the tangent at P in the form ax + by + c = 0 with integer a, b, c.	

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6 $X \sim N(\mu, \sigma^2)$, with $P(X < 48) = 0.3085$ and $P(X > 57) = 0.1587$. Find μ and σ.	
7 The radius of a sphere increases at $\frac{3}{2}$ cm s^{-1}. Find the rate of increase of its volume when r = 2 cm, in terms of π.	
8 $f(x) = x^2 + 4x + 6$, $x \in \mathbb{R}$, and $g(x) = \frac{8}{x+1}$, $x > -1$. (a) Find the range of f. (b) Show that gf is defined and find its range.	
9 (a) Expand $(1 + 2x)^{\frac{1}{2}}$ in ascending powers of x up to x^2. (b) Use x = 0.01 to estimate $\sqrt{102}$ to 4 decimal places.	
10 Find the exact coordinates of the stationary point of $y = \frac{e^{3x}}{x}$ for $x > 0$.	