Day 173	A Level Maths: A Tier 10-a-day
1 Solve the differential equation $y\frac{dy}{dx} = 2x$, given that $y = 2$ when $x = 0$ ($y > 0$). Give y in terms of x.	
2 The 5th term of an arithmetic sequence is 15 and the 9th term is 31. Find the first term and common difference, and the sum of the first 15 terms.	
3 A ball is thrown vertically upwards at 14.7 m s^{-1} from a point h m above horizontal ground, and hits the ground 6 s later. Find (a) h, (b) the greatest height above the ground. Take g = 9.8.	
4 15 values have $\Sigma x = 570$ and $\Sigma x^2 = 21795$. One value was recorded as 45 but should have been 35. Find the correct mean and standard deviation (3 s.f.).	
5 A window is a rectangle of width 2x m and height h m, topped by a semicircle of radius x m. Its perimeter is 30 m. Show that its area is $A = 30x - (2 + \frac{\pi}{2})x^2$, and find the maximum area to 3 s.f.	

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6 Solve $x(\sqrt{2} - 3) = -4 - \sqrt{2}$, writing x in the form $p + q\sqrt{2}$.	
7 A 900 kg car tows a 300 kg trailer by a light tow-bar on a horizontal road. Driving force 980 N; resistances 400 N (car), 100 N (trailer). Find (a) the acceleration and the tow-bar tension. At 20 m s^{-1} the tow-bar breaks. (b) How far does the trailer then travel?	
8 X ~ B(28, p). H_0: p = 0.2 is tested against H_1: p ≠ 0.2 at the 5% level. (a) Find the critical region. (b) Find the actual significance level of the test (3 s.f.).	
9 Water drains from a tank so that the depth h metres falls at a rate proportional to $\sqrt{h}$. Initially h = 25, and after 5 hours h = 4. Form and solve a differential equation to find how long, in total, the tank takes to empty.	
10 The diagram shows a circle that touches the x-axis at A(1, 0) and passes through B(−1, 2). Find the equation of the circle. 	