Day 20	A Level Maths: S Tier 10-a-day
1 A lift of mass M kg, carrying a passenger of mass 80 kg, hangs from a vertical cable. The tension in the cable is 5512 N and the floor exerts a force of 832 N on the passenger. Find (a) the acceleration of the lift, with its direction, (b) the value of M. Take g = 9.8 m s^{-2}.	
2 15 recorded lengths (cm) have mean 49 and standard deviation 6. One value was recorded as 65 but should have been 54. Find the correct mean and the correct standard deviation.	
3 Solve $\log_2(x + 11) + \log_2(x - 1) = 6$, justifying clearly any root that you reject.	
4 Solve $\sqrt{x + 7} = x + 1$.	
5 A chord AB of a circle, centre O and radius 5 cm, subtends an angle of $\frac{2\pi}{3}$ at O. Find the exact area and the exact perimeter of the minor segment cut off by AB.	

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6 Express $\frac{-2-\sqrt{6}}{2-\sqrt{6}}$ in the form $p + q\sqrt{6}$, where p and q are rational numbers.	
7 A car of mass 1500 kg tows a trailer of mass 300 kg along a horizontal road, with driving force 1310 N. Resistances are 800 N on the car and 150 N on the trailer. (a) Find the tension in the tow bar. At 5 m s^{-1} the tow bar breaks. (b) Find the distance between car and trailer when the trailer stops.	
8 $f(\theta) = \frac{4}{35 + 20\sin\theta + 21\cos\theta}$ (a) Write $20\sin\theta + 21\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	
9 A circle has its centre in the first quadrant and touches both the x-axis and the y-axis. It passes through the point (1, 2). Find the two possible equations of the circle.	
10 A test of H_0: $p = 0.4$ against H_1: $p > 0.4$ uses a sample of 30 at the 5% level. (a) Find the critical region for X, the number of successes. (b) Find the actual significance level. (c) Find P(Type II error) when in fact $p = 0.5$.	