Day 267	A Level Maths: S Tier 10-a-day
1 A river is 80 m wide and flows at 8 m s^{-1}. A boatman can row at 10 m s^{-1} in still water and wants to reach the point directly opposite his starting point. Find (a) the angle to the bank at which he should head, to 1 d.p., (b) the time taken, to 3 s.f.	
2 A sector of a circle has radius r cm and angle θ radians, where $\theta < 2\pi$. Its perimeter is 46 cm and its area is 130 cm^2. Find the two possible pairs of values of r and θ.	
3 X ~ B(150, 0.01). (a) Explain why a Poisson approximation is suitable and state its distribution. (b) Use it to estimate P(X > 1), to 4 s.f. (c) Find the exact value of P(X > 1), to 4 s.f.	
4 Solve $e^{2x} - 7 \times e^{x} + 12 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
5 Class Q has 12 students with mean mark 38 and standard deviation 3. Class S has 40 students with mean mark 39 and standard deviation 7. (a) Find the mean mark of all 52 students. (b) Find the standard deviation of all 52 students.	

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6 Find the exact value of $\sin(\sin^{-1}(\frac{20}{29}) + \cos^{-1}(\frac{20}{29}))$.	
7 $f(x) = 2x^3 + ax^2 + bx - 16$, where a and b are constants. $(x - 2)$ is a factor of f(x), and f(x) leaves remainder -60 when divided by $(x + 1)$. Find a and b, and hence solve $f(x) = 0$.	
8 Solve $\frac{2}{(x + 1)} < \frac{-2}{(x + 2)}$.	
9 A plank of mass 2 kg lies on a smooth horizontal table, with a block of mass 6 kg on it ($\mu = 0.4$ between them). A horizontal force P N acts on the block. (a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when $P = 282.24$. Take $g = 9.8$ m s^{-2}.	
10 $f(x) = \frac{2x + 4}{(1 - x)(1 + 2x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	