Day 341	A Level Maths: S Tier 10-a-day
1 For 50 observations x, $\Sigma(x - 100) = 10$ and $\Sigma(x - 100)^2 = 402$. (a) Find the mean of x. (b) Find the standard deviation of x. (c) Find the value of Σx^2.	
2 Solve $\cos 2\theta + \sin \theta = 0$ for $0 \leq \theta < 2\pi$, giving answers in terms of π.	
3 Express $\frac{-2x^2 + 30x - 40}{(x + 1)(2x - 4)^2}$ in the form $\frac{A}{(x + 1)} + \frac{B}{(2x - 4)} + \frac{C}{(2x - 4)^2}$.	
4 Find the exact value of $\tan(\tan^{-1}(\frac{1}{7}) + \tan^{-1}(\frac{2}{3}))$.	
5 A data set has lower quartile 34 and upper quartile 47. An outlier is a value more than 1 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 10 observations have mean 42. The largest is 71, an outlier, and it is removed. Find the new mean.	

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6 Solve $\sec^2\theta + \tan\theta - 3 = 0$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
7 $f(x) = 3x^3 + ax^2 + bx - 24$, where a and b are constants. $(x - 2)$ is a factor of f(x), and f(x) leaves remainder 30 when divided by $(x + 3)$. Find a and b, and hence solve $f(x) = 0$.	
8 A non-uniform rod AB of length 5 m and mass 12 kg rests on supports at C and D, where AC = 1 m and AD = 4 m, with R_C = 3 R_D. Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.	
9 $f(x) = \frac{3x + 9}{(1 + 2x)(1 - x)}$. (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.	
10 At time t = 0 hours, ship A is at the point with position vector $(26\mathbf{i} + 24\mathbf{j})$ km relative to a port O, and moves with constant velocity $(-5\mathbf{i} + 3\mathbf{j})$ km h^{-1}. Ship B leaves O at t = 0 with constant speed 17 km h^{-1} and intercepts A. Find (a) the time at which B intercepts A, (b) the velocity of B as a vector.	