Day 198	A Level Maths: S Tier 10-a-day
1 A box of weight 20 N is pulled at constant speed along rough horizontal ground ($\mu = 0.75$) by a force P N at angle θ above the horizontal. (a) Find P when $\tan\theta = \frac{24}{7}$. (b) Find the least possible value of P as θ varies, and the corresponding θ to 1 d.p.	
2 An arithmetic sequence has $u_4 = 15$ and $S_{10} = 225$. (a) Find the first term and common difference. (b) Find the least n for which $S_n > 721$.	
3 Class Q has 24 students with mean mark 67 and standard deviation 7. Class R has 10 students with mean mark 31 and standard deviation 5. (a) Find the mean mark of all 34 students. (b) Find the standard deviation of all 34 students.	
4 Find the binomial expansion of $(4 - 6x)^{\frac{3}{2}}$ in ascending powers of x up to and including the term in x^3. State the values of x for which it is valid.	
5 $f(x) = e^x + 2x - 7$. (a) Show that $f(x) = 0$ has a root α with $1 < \alpha < 2$. (b) Use Newton-Raphson with $x_0 = 2$ to find x_1 and x_2 to 4 decimal places.	

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6 $f(x) = x^3 + 2x^2 + 3x + 18$. Show that $(x + 3)$ is a factor of $f(x)$, and that the equation $f(x) = 0$ has exactly one real root.	
7 A particle P moves on a straight line. The velocity of P is v m s^{-1} and its acceleration is $-0.25v$ m s^{-2}. At $t = 0$, $v = 8$. Find (a) the time taken for the speed of P to halve, to 3 s.f., (b) the distance P travels in this time.	
8 (a) Write $\frac{x + 2}{(x + 3)^2}$ in the form $\frac{A}{x + 3} + \frac{B}{(x + 3)^2}$. (b) Find the exact value of $\int_0^1 \frac{x + 2}{(x + 3)^2}\,dx$.	
9 $X \sim N(\mu, 9)$. H_0: $\mu = 53$ is tested against H_1: $\mu > 53$ using the mean of a sample of size 25 at the 1% level. (a) Find the critical region for the sample mean. (b) Find the probability of a Type II error when $\mu = 54$.	
10 A population N satisfies $\frac{dN}{dt} = -0.01N^2$, with $N = 50$ when $t = 0$. Find N when $t = 4$, and the time taken for N to halve.	