Day 58	A Level Maths: S Tier 10-a-day
1 Three forces $(\mathbf{i} + 6\mathbf{j})$ N, $(8\mathbf{i} + k\mathbf{j})$ N and $(-3\mathbf{j})$ N act on a particle of mass 2 kg. The resultant is parallel to $(9\mathbf{i} - 4\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
2 For 30 observations x, $\Sigma(x - 40) = 120$ and $\Sigma(x - 40)^2 = 930$. (a) Find the mean of x. (b) Find the standard deviation of x. (c) Find the value of Σx^2.	
3 Find the exact value of $\int_1^e \frac{1}{x(\ln x + 1)}\,dx$	
4 Evaluate $\sum_{r=6}^{13}(4 \times 2^r + 1r)$.	
5 A game costs £1. Two fair dice are rolled: a total of at least 12 wins £14, a total of at most 3 wins £2, otherwise nothing. (a) Find the expected profit. (b) Find the standard deviation of the profit (3 s.f.). (c) Find the stake that makes the game fair.	

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6 Use the substitution $u = x + 9$ to find the exact value of

$$\int_0^{16} \frac{x}{\sqrt{x+9}}\,dx$$

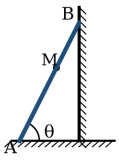
7 $f(x) = \frac{-11x + 3}{(1 - 3x)(1 - x)}$.

(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.

8 A uniform ladder AB of length 6 m and weight 200 N has A on rough ground ($\mu = 0.4$) and B against a smooth vertical wall. It makes angle θ with the ground, $\tan\theta = \frac{4}{3}$.

A man of weight 800 N climbs the ladder. How far along the ladder can he go before it slips?



9 Find the exact value of $\tan^{-1} 2 + \tan^{-1} 3$, giving your answer as a multiple of π.

10 A curve has parametric equations

$x = 3(t + \frac{1}{t})$, $y = (t - \frac{1}{t})$, $t \neq 0$.

Find a Cartesian equation of the curve.