Day 303	A Level Maths: S Tier 10-a-day
1 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where $v = 8\sin(\frac{\pi t}{3})$ for $t \geq 0$. Find (a) the greatest magnitude of the acceleration of P, (b) the distance P travels between the first two times at which it is at rest. Give (b) to 3 s.f.	
2 A cone with its vertex downwards and semi-vertical angle α, where $\tan\alpha = \frac{1}{2}$, is filled at 9π cm^3s^{-1}. Find the rate at which the depth h is rising when h = 2 cm. ($V = \frac{1}{3}\pi r^2 h$)	
3 Three forces $(7\mathbf{i} + 2\mathbf{j})$ N, $(-5\mathbf{i} + k\mathbf{j})$ N and $(\mathbf{i})$ N act on a particle of mass 3 kg. The resultant is parallel to $(3\mathbf{i} + 8\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
4 $f(x) = 3x^3 + ax^2 + bx - 18$, where a and b are constants. $(x - 3)$ is a factor of f(x), and f(x) leaves remainder -360 when divided by $(x + 3)$. Find a and b, and hence solve f(x) = 0.	
5 For n = 8 pairs of values: $\Sigma x = 24$, $\Sigma y = 272$, $\Sigma x^2 = 114$, $\Sigma xy = 942$. (a) Find the equation of the regression line of y on x. (b) The x values lie between -1 and 8. Estimate y when x = 7 and comment on its reliability.	

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6 Solve $4\text{cosec}^2\theta + 10\cot\theta - 10 = 0$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
7 Evaluate $\sum_{r=4}^{12}(5 \times 3^r + 3r)$.	
8 Solve simultaneously: $x + y = -3$ $2x^2 + 2y^2 = 34$	
9 $X \sim N(\mu, 9)$. H_0: $\mu = 85$ is tested against H_1: $\mu < 85$ using the mean of a sample of size 25 at the 10% level. (a) Find the critical region for the sample mean. (b) Find the probability of a Type II error when $\mu = 84$.	
10 (a) Express $\frac{-6x - 20}{(x + 2)(x + 4)}$ in partial fractions. (b) Hence find the exact value of $\int_0^3 \frac{-6x - 20}{(x + 2)(x + 4)}\,dx$.	