Day 58	A Level Maths: A Tier 10-a-day
1 A geometric series has first term 3 and common ratio $\frac{3}{2}$. Find the smallest n for which the sum of the first n terms exceeds 1000.	
2 A cyclist passes P with speed 5 m s^{-1} and accelerates uniformly. She travels 120 m in the next 15 s, reaching Q. Find (a) her acceleration, (b) her speed at Q, (c) her speed at the midpoint of PQ. Give answers to 3 s.f. if not exact.	
3 X, the length (mm), is N(78, 2^2). Find the symmetric limits about the mean between which the central 95% of values lie (3 s.f.).	
4 A circular ripple has area A cm^2 increasing at a constant 2 $cm^2 s^{-1}$. Find the rate at which the circumference is increasing when the radius is 10 cm.	
5 $f(x) = x^2 + 2x + 6$, $x \in \mathbb{R}$, and $g(x) = \frac{4}{x+1}$, $x > -1$. (a) Find the range of f. (b) Show that gf is defined and find its range.	

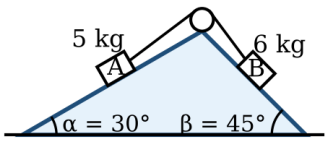
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6 $X \sim B(23, p)$. H_0: $p = 0.4$ is tested against H_1: $p \neq 0.4$ at the 5% level.
(a) Find the critical region.
(b) Find the actual significance level of the test (3 s.f.).

7 The vectors $\begin{pmatrix} k \\ k \\ -2 \end{pmatrix}$ and $\begin{pmatrix} k \\ 3 \\ 5 \end{pmatrix}$ are perpendicular.
Find the possible values of k and, for the larger value, the exact length of the first vector.

8 Solve $2^{2x} - 10 \times 2^x + 16 = 0$.

9 The system is released from rest. Find (a) the magnitude of the acceleration and which particle moves down, (b) the tension. Take g = 9.8. Give answers to 3 s.f. if not exact.



10 The region bounded by the curve $y = x^2 + 1$, the x-axis, $x = 0$ and $x = 1$ is rotated through 360° about the x-axis.
Find the exact volume of the solid formed.