Day 191	A Level Maths: A Tier 10-a-day
1 $f(x) = x + 6$ and $g(x) = x^2 - 5$. Solve $gf(x) = 44$.	
2 The times in seconds of two groups: group X has n = 28, mean 27, sd 9; group Y has n = 20, mean 63, sd 6. Find the mean and standard deviation of all 48 values (3 s.f. for the sd).	
3 $f(x) = 2x^2 - 8x + 5$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the minimum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
4 θ is acute and $\tan\theta = 6$. Show that $\cos 2\theta = -\frac{35}{37}$ and find the exact value of $\sin 2\theta$.	
5 The random variable X has probability density function $f(x) = k(3 - x)$ for $0 \leq x \leq 3$, and 0 otherwise. (a) Find k. (b) Find E(X). (c) Find P(X > 1).	

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6 A 800 kg car tows a 400 kg trailer by a light tow-bar on a horizontal road. Driving force 1150 N; resistances 400 N (car), 150 N (trailer). Find (a) the acceleration and the tow-bar tension. At 10 m s^{-1} the tow-bar breaks. (b) How far does the trailer then travel? Give answers to 3 s.f. if not exact.	
7 The line l has equation $\mathbf{r} = \begin{pmatrix}1\\6\\0\end{pmatrix} + t\begin{pmatrix}1\\-2\\2\end{pmatrix}$. Find the coordinates of the foot of the perpendicular from P(5, 2, 3) to l, and the exact distance from P to l.	
8 The line $4x - 3y = 7$ meets the circle $(x - 4)^2 + (y - 2)^2 = 25$ at the points A and B. Find the exact length of AB.	
9 A particle P moves on the x-axis with velocity $v = (3t^2 - 12t + 9)$ m s^{-1} at time t s, $t \geq 0$, and starts at O. Find (a) the times when P is at instantaneous rest, (b) the total distance P travels in the first 6 s.	
10 A curve has equation $x^2 + xy + 3y^2 = 99$. Find the coordinates of the points where the tangent is parallel to the x-axis.	