Day 317	A Level Maths: A Tier 10-a-day
1 $f(x) = -2x^2 - 20x - 45$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the maximum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
2 $f(x) = x^2 - 7$. Show that the Newton-Raphson formula gives $x_{n+1} = \frac{1}{2}(x_n + \frac{7}{x_n})$, and use it with $x_0 = \frac{3}{2}$ to find x_2 as an approximation to $\sqrt{7}$, to 4 d.p.	
3 P(A) = 0.65, P(B) = 0.75 and $P(A \cap B) = 0.5$. Find (a) $P(A \cup B)$ (b) $P(A \mid B)$ (c) $P(A' \cap B')$	
4 Simplify fully $\frac{x^2 + 2x - 3}{3x^2 - 8x + 5}$.	
5 A ball is projected from a point O on horizontal ground at 22 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{12}{5}$, and lands at A. Find (a) the time of flight, (b) the greatest height, (c) OA. Take g = 9.8. Give answers to 3 s.f. if not exact.	

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6 Express $\frac{2-2\sqrt{7}}{6+2\sqrt{7}}$ in the form $p+q\sqrt{7}$, where p and q are rational numbers.	
7 The random variable X has probability density function $f(x) = kx^3$ for $0 \leq x \leq 6$, and 0 otherwise. (a) Find k. (b) Find E(X). (c) Find P(X > 4).	
8 A curve has parametric equations $x = t + \frac{1}{t}$, $y = t - \frac{1}{t}$. Find $\frac{dy}{dx}$ in terms of t, and the equation of the normal at the point where t = 2, in the form ax + by + c = 0 (integers).	
9 A stone is projected from a cliff top 26.1 m above the sea at 10 m s^{-1}, at angle α above the horizontal, $\tan\alpha = \frac{3}{4}$. Find (a) the time to reach the sea, (b) the horizontal distance travelled, (c) the speed on impact. Take g = 9.8. Give answers to 3 s.f. if not exact.	
10 The line l has equation $\mathbf{r} = \begin{pmatrix}1\\3\\-1\end{pmatrix} + t\begin{pmatrix}-2\\-2\\0\end{pmatrix}$. Find the coordinates of the foot of the perpendicular from P(−2, 2, −1) to l, and the exact distance from P to l.	