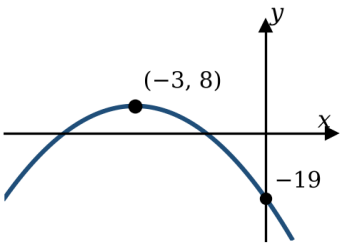
Day 330	A Level Maths: A Tier 10-a-day
1 A 3 kg block is released from rest on a rough plane inclined at α, $\tan\alpha = \frac{3}{4}$, $\mu = 0.25$, and slides 2 m down a line of greatest slope. Use work and energy to find (a) the work done against friction, (b) its speed after 2 m. Take $g = 10$.	
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 $x_0 = 2$ to find x_2 as an approximation to $\sqrt{7}$, to 4 d.p.	
3 Summary statistics for the daily mean temperature (°C) in the same month are: Perth: mean 26, standard deviation 4.8; Jacksonville: mean 8, standard deviation 1.9. Make two comparisons.	
4 Given that $(x + 3)$ is a factor of $f(x) = x^3 - 2x^2 - 11x + 12$, solve $f(x) \geq 0$.	
5 For 50 values of x, the coded variable $y = \frac{x - 100}{4}$ gives $\Sigma y = 150$ and $\Sigma y^2 = 900$. Find the mean and standard deviation of x.	

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6 Forces $F_1 = (-4\mathbf{i} - 9\mathbf{j})$ N, $F_2 = (-3\mathbf{i} - 4\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 2 kg particle in equilibrium. Find (a) a and b. F_2 is then removed; (b) find the magnitude of the acceleration.

7 A curve has parametric equations $x = 3t - 1$, $y = t^3$.
Find $\frac{dy}{dx}$ in terms of t, and the equation of the normal at the point where $t = -\frac{1}{2}$, in the form $ax + by + c = 0$ (integers).

8 The diagram shows the curve with equation $y = f(x)$, where f is a quadratic.
The turning point is marked, and the curve crosses the y-axis as shown.
Find f(x), giving it in the form $ax^2 + bx + c$.



9 Prove by contradiction that there are no integers m and n such that $10m + 15n = 117$.

10 $l_1: \mathbf{r} = \begin{pmatrix} -5 \\ 0 \\ -3 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$

$l_2: \mathbf{r} = \begin{pmatrix} 13 \\ 3 \\ 9 \end{pmatrix} + \mu \begin{pmatrix} -3 \\ 1 \\ -3 \end{pmatrix}$

Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.