Day 102 **A Level Maths: B Tier 10-a-day**

1 Prove that $2x^2 + 12x + 23 > 0$ for all real values of x.

2 Given that $y = e^{3x - 3}$,
find $\frac{dy}{dx}$, and the gradient of the curve when x = 1.

3 The table shows the number of siblings, x, of 47 students.
Calculate the mean and standard deviation (3 s.f.).

x	0	1	2	3	4
Frequency	8	11	7	10	11

4 A circle has equation $x^2 + y^2 + 6x - 2y + 6 = 0$.
Find the coordinates of its centre and its radius.

5 A sledge of mass 6 kg is pulled across smooth horizontal ice by a rope with tension 26 N, inclined at α above the horizontal, where $\tan \alpha = \frac{5}{12}$.
Take $g = 9.8$ m s^{-2}.
Find (a) the acceleration of the sledge, (b) the normal reaction of the ice.

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6 The height of the tide in a harbour is modelled by $H = 7 + 6\sin(\frac{\pi t}{12})$, where t is in hours after midnight. Find (a) the greatest and least values, (b) the values of t with $0 \leq t \leq 24$ when it equals 4 m.	
7 A coach accelerates uniformly from rest at 0.5 m s^{-2} for 6 s, then travels at constant speed for 20 s, and finally decelerates uniformly at 1.5 m s^{-2} to rest. Find the total distance travelled and the total time of the journey.	
8 A coin is thought to land heads with probability 0.25. It is tossed 30 times and lands heads 3 times. Test, at the 5% significance level, whether the probability of heads is different from 0.25.	
9 Solve $(x - 4)(x - 3)(x - 1) \geq 0$.	
10 An open tank has a square base of side x m and volume 108 m^3. Show that its surface area is $S = x^2 + \frac{432}{x}$, and find the minimum value of S.	