Day 277 **A Level Maths: A Tier 10-a-day**

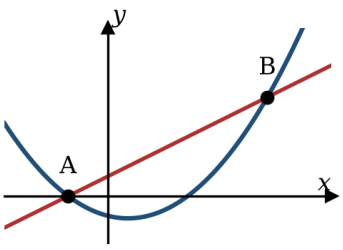
1 The random variable X has $P(X = x) = k(x^2 + 1)$ for $x = 0, 1, 2, 3, 4$.

(a) Show that $k = \frac{1}{35}$. (b) Find E(X) and Var(X). (c) Find $P(X \geq 1)$.

2 Solve $\sin 2x = \sqrt{3} \cos x$ for $0 \leq x \leq 2\pi$.

3 A stone is projected from a cliff top 140.4 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.

4 The diagram shows the curve $y = x^2 - x - 2$ and the line $y = 2x + 2$, meeting at A and B.
(a) Find the coordinates of A and B.
(b) Find the coordinates of the midpoint of AB.



5 A 8 kg block is released from rest on a rough plane inclined at α, $\tan \alpha = \frac{4}{3}$, $\mu = 0.5$, and slides 10 m down a line of greatest slope. Use work and energy to find (a) the work done against friction, (b) its speed after 10 m. Take $g = 10$.

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6 A bag has 5 green and 2 yellow counters. Two are taken at random without replacement. Given that the second counter is green, find the probability that the first was green.	
7 Solve $3\text{cosec}^2\,\theta + 6\cot\theta - 27 = 0$ for $-180° < \theta < 180°$, $\theta \neq 0$. Give answers to 1 d.p.	
8 A sequence is defined by $u_1 = -3$ and $u_{n+1} = \frac{1}{1 - u_n}$. (a) Find u_2 and u_3. (b) Find u_{50} and $\sum_{r=1}^{50} u_r$.	
9 Find the coefficient of x^6 in the expansion of $(2x^2 - \frac{2}{x^2})^7$.	
10 Use the trapezium rule with 4 strips to estimate $\int_0^4 3(\ln(x + 2))\,dx$, giving your answer to 3 s.f. State, with a reason, whether your estimate is an overestimate or an underestimate.	