Day 94	A Level Maths: S Tier 10-a-day
1 The curve C has parametric equations $x = 2t$, $y = 3t^2$. The line $y = 3x + 9$ meets C at A and B. Find the exact length AB.	
2 Use the trapezium rule with 4 strips to estimate $\int_1^2 x^2 e^{-x}\,dx$, to 4 s.f. Is it an overestimate or an underestimate? Explain.	
3 A javelin is projected from a point O on horizontal ground with speed 24.5 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{4}{3}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take $g = 9.8$ m s^{-2}.	
4 X ~ B(7, p). It is given that $P(X = 2) = \frac{9}{7} \times P(X = 1)$. (a) Find the value of p. (b) Find P(X = 0), correct to 3 significant figures.	
5 Solve $\lvert -3x - 6\rvert > \lvert x + 6\rvert$.	

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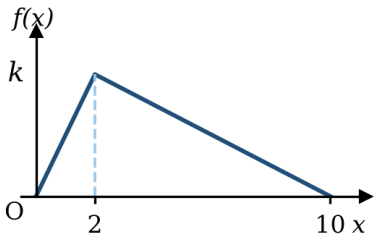
6 $f(\theta) = \dfrac{3}{26 + 24\sin\theta + 7\cos\theta}$

(a) Write $24\sin\theta + 7\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$.

(b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.

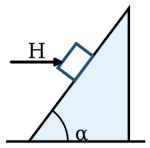
7 The diagram shows the pdf of X.

Find (a) k, (b) E(X), (c) the median of X (3 s.f.).



8 A particle of weight 155 N rests on a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{4}{3}$ and $\mu = 0.5$.

A horizontal force H N, in the vertical plane through a line of greatest slope, holds it in equilibrium. Find the range of possible values of H.



9 Express $\dfrac{2x^3 - 6x^2 - 11x}{(x - 4)(x + 2)}$ in the form $ax + b + \dfrac{C}{(x - 4)} + \dfrac{D}{(x + 2)}$.

10 A curve is given by $x = y^3 + y^2 + 4y$.

Find dy/dx and d^2y/dx^2 when $y = 1$.