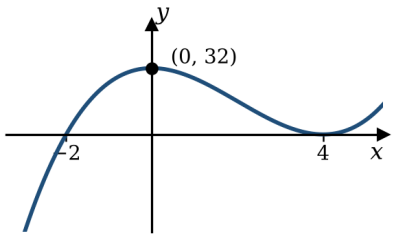
Day 151	A Level Maths: S Tier 10-a-day
1 The function f is defined by $f(x) = x^2 - 2x + 3$ for $x \geq k$. Given that k is the least value for which f is one-one, find k, $f^{-1}(x)$, and the domain of f^{-1}.	
2 Solve the simultaneous equations $\log_5 x + \log_5 y = 3$ $x - y = 20$	
3 The daily output of a machine is $N(\mu, 9)$ with known variance 9. The mean was claimed to be 86 units. A random sample of 16 has mean 84. Test at the 10% level whether the mean is greater than 86.	
4 A box of weight 195 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{5}{12}$, $\mu = \frac{3}{4}$) by a force P N at angle β above the plane. (a) Find P when $\tan\beta = \frac{12}{5}$. (b) Find the least possible value of P as β varies.	
5 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours. Initially P = 80 and after 4 hours P = 160. Find k, and the time for the population to reach 400, to 3 s.f.	

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6 The diagram shows the cubic y = f(x), which touches the x-axis once. Find f(x), giving your answer in expanded form.



7 Use the substitution u = ln x to find the exact value of

$$\int_1^{e^2} \frac{(\ln x)^3}{x}\,dx$$

8 $f(x) = \frac{-11x + 3}{(1 - x)(1 - 3x)}$.

(a) Express f(x) in partial fractions.

(b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.

9 A bulb's lifetime, in hours, is $N(64, 10^2)$. Given that it exceeds 64, find the probability that it exceeds 70.

10 Car P passes a point O travelling at a constant speed of 25 m s^{-1}. 4 s later, car Q leaves O from rest with constant acceleration 3 m s^{-2}, travelling in the same direction.

Q overtakes P at the point X. Find (a) the time Q takes to reach X, (b) the distance OX, (c) the speed of Q at X.