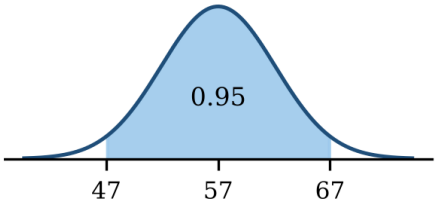
Day 206	A Level Maths: S Tier 10-a-day
1 A lift of mass 250 kg, carrying a passenger of mass 90 kg, is supported by a vertical cable. The lift is moving upwards and decelerating at 1.6 m s^{-2}. Find (a) the force the floor exerts on the passenger, (b) the tension in the cable. Take g = 9.8 m s^{-2}.	
2 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours. Initially P = 200 and after 2 hours P = 300. Find k, and the time for the population to reach 2000, to 3 s.f.	
3 A seed supplier says that 40% of its seeds germinate. 30 seeds are planted, and 10 germinate. Test, at the 1% significance level, the claim that the proportion is lower. Give your conclusion in context.	
4 Use the trapezium rule with 4 strips to estimate $\int_0^1 e^{x^2}\,dx$, to 4 s.f. Is it an overestimate or an underestimate? Explain.	
5 A pile of logs has 9 logs in its bottom row. Each row above has 1 fewer logs than the row below, and the pile has as many rows as possible, each with at least one log. Find the number of rows and the total number of logs.	

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6 The pdf of $X \sim N(57, \sigma^2)$ is shown; the shaded area is symmetrical.
(a) Find σ. (b) Find $P(X > 77)$.



7 $f(x) = 3x^3 + ax^2 + bx + 48$, where a and b are constants.
$(x + 2)$ is a factor of $f(x)$, and $f(x)$ leaves remainder 0 when divided by $(x - 4)$.
Find a and b, and hence solve $f(x) = 0$.

8 A box of weight 135 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{7}{24}$, $\mu = \frac{3}{4}$) by a force P N at angle β above the plane.
(a) Find P when $\tan\beta = \frac{4}{3}$. (b) Find the least possible value of P as β varies.

9 Find the binomial expansion of $(4 + 6x)^{-\frac{3}{2}}$ in ascending powers of x up to and including the term in x^3.
State the values of x for which it is valid.

10 Find the coordinates of the points of inflection of
$y = \frac{1}{x^2 + 12}$.