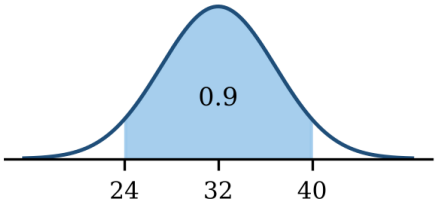
Day 221	A Level Maths: S Tier 10-a-day
1 A radioactive sample has mass $m = m_0 e^{-kt}$ grams, t in days. Initially m = 100 and after 3 days m = 50. Find k, and the time for the mass to fall to 5 grams, to 3 s.f.	
2 Each seed is faulty with probability 0.02, independently. Find the least number n of seeds that must be tested so that the probability of finding at least one faulty is greater than 0.99.	
3 The first row of a theatre has 11 seats. Each row has 3 more seats than the row in front. Find (a) the number of seats in row 58, (b) the least number of rows for at least 1094 seats.	
4 A ball is projected from a point O on horizontal ground with speed 63.7 m s^{-1} at an angle θ above the horizontal, where $\tan\theta = \frac{12}{5}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take g = 9.8 m s^{-2}.	
5 (a) Express $8\sin\theta + 15\cos\theta$ in the form $R\sin(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p. (b) Hence solve $8\sin\theta + 15\cos\theta = 7$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	

Day 221 **A Level Maths: S Tier 10-a-day**

6 The sum of the first n terms of a sequence is $S_n = 3n^2 + 7n$.
(a) Find an expression for u_n.
(b) Find the least n for which $u_n > 316$.

7 The pdf of $X \sim N(32, \sigma^2)$ is shown; the shaded area is symmetrical.
(a) Find σ. (b) Find $P(X > 51)$.



8 Two drones P and Q move so that, t seconds after launch, their position vectors in metres are $\mathbf{r}_P = \begin{pmatrix} -2 \\ -5 \\ 2 \end{pmatrix} + t\begin{pmatrix} 3 \\ 3 \\ 1 \end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix} -2 \\ -6 \\ 5 \end{pmatrix} + t\begin{pmatrix} 3 \\ 3 \\ 0 \end{pmatrix}$.
Find the time at which they are closest and the exact minimum distance between them.

9 Solve simultaneously:
$x - y = 6$
$x^2 - xy - y^2 = 9$

10 Three forces $(-2\mathbf{i} + 2\mathbf{j})$ N, $(3\mathbf{i} + k\mathbf{j})$ N and $(3\mathbf{i} + 3\mathbf{j})$ N act on a particle of mass 2 kg. The resultant is parallel to $(4\mathbf{i} + \mathbf{j})$.
Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.