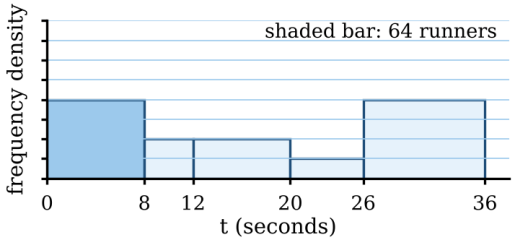
Day 122 **A Level Maths: S Tier 10-a-day**

1 The curve $y = ax^n$ passes through (1, 5) and (9, 135).
Find the values of a and n.

2 The histogram shows the times, t seconds, of some runners.
Find (a) the total number of runners, (b) an estimate of the number with $11 \leq t < 30$.



3 The function f is defined by $f(x) = x^2 - 2x - 4$ for $x \leq k$. Given that k is the greatest value for which
f is one-one, find k, $f^{-1}(x)$, and the domain of f^{-1}.

4 A is acute and B is acute. $\cos A = \frac{3}{5}$ and $\cos B = \frac{12}{13}$.
Find the exact values of $\sin(A + B)$ and $\cos(A + B)$.

5 A sequence is defined by $u_1 = -3$ and $u_{n+1} = \frac{2u_n + 1}{u_n - 2}$.
Show that the sequence is periodic and find $\sum_{r=1}^{60} u_r$.

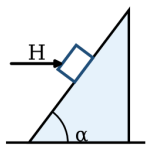
Day 122 **A Level Maths: S Tier 10-a-day**

6 A radioactive sample has mass $m = m_0e^{-kt}$ grams, t in days.
Initially m = 200 and after 2 days m = 100.
Find k, and the time for the mass to fall to 10 grams, to 3 s.f.

7 Particles A and B are projected from a point O at the same instant, with initial velocities $(\mathbf{i} + 40\mathbf{j})$ m s^{-1} and $(6\mathbf{i} + 28\mathbf{j})$ m s^{-1} respectively (i horizontal, j vertically upwards).
Both are still in flight after 2 s. Find (a) the distance AB at this time, (b) the angle AB makes with the horizontal, to 1 d.p.

8 X takes values 1, 2, 3, 4 with P(X = x) = k(x + 2). X_1 and X_2 are independent copies of X.
(a) Find k.
(b) Find $P(X_1 + X_2 = 6)$.
(c) Find $P(X_1 = X_2)$ and $E(X_1 + X_2)$.

9 A particle of weight 160 N rests on a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{4}{3}$ and μ = 0.25.
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.



10 $f(x) = \frac{7x - 1}{(1 - 3x)(1 - x)}$.
(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.