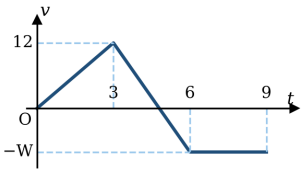
Day 138 **A Level Maths: S Tier 10-a-day**

1 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{\sin 2\theta \tan 4\theta}{1 - \cos 4\theta}$ approaches as $\theta \to 0$.

2 The diagram shows the velocity-time graph of a particle P moving on a straight line (velocity in m s^{-1}, time in s). At time 9 s, P is back at its starting point.
Find (a) the value of W, (b) the greatest distance of P from its starting point.



3 A game costs £2. Two fair dice are rolled: a total of at least 10 wins £8, a total of at most 2 wins £2, otherwise nothing.
(a) Find the expected profit.
(b) Find the standard deviation of the profit (3 s.f.).
(c) Find the stake that makes the game fair.

4 Three forces $(\mathbf{i} - 2\mathbf{j})$ N, $(3\mathbf{i} + k\mathbf{j})$ N and $(-7\mathbf{i} - 3\mathbf{j})$ N act on a particle of mass 2 kg. The resultant is parallel to $(-\mathbf{i})$.
Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.

5 A drink cools according to $\theta = 15 + Ae^{-kt}$, where θ °C is the temperature after t minutes. Initially $\theta = 90$, and after 10 minutes $\theta = 60$.
Find A and k, then find when $\theta = 31$ (3 s.f.).

Day 138	A Level Maths: S Tier 10-a-day
6 A school has 200 students in Year 10, 80 in Year 11 and 200 in the sixth form. A stratified sample of 36 students is taken. (a) Find the number sampled from each group. (b) Two students are chosen at random from the sample. Find the probability they are from the same group.	
7 Solve $\|x - 6\| > -3x - 4$.	
8 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 3x^2 - 30x + 79$.	
9 Find the exact coordinates of the stationary points of $y = 3x + 6\cos x$ for $0 \leq x \leq \pi$, and determine their nature.	
10 Find the binomial expansion of $(27 + 2x)^{\frac{1}{3}}$ in ascending powers of x up to and including the term in x^3. State the values of x for which it is valid.	