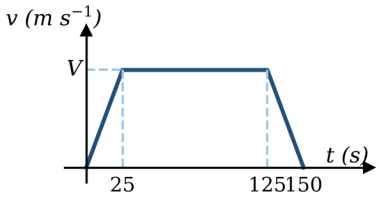
Day 198	A Level Maths: A Tier 10-a-day
1 The volume of a spherical balloon increases at a constant rate of 100 cm^3s^{-1}. Find the rates of increase of its radius and of its surface area when r = 4 cm.	
2 Forces $F_1 = (-4\mathbf{i} - \mathbf{j})$ N, $F_2 = (12\mathbf{i} + 5\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 2 kg particle in equilibrium. Find (a) a and b. F_2 is then removed; (b) find the magnitude of the acceleration.	
3 $f(x) = x - 5$ and $g(x) = x^2 - 2$. Solve $gf(x) = 2$.	
4 A stratified sample of 80 people is taken from three groups. 14 of the sample are from Sales, which has 70 people. (a) Find the total number of people. (b) Admin has 45 people. How many are sampled?	
5 The sum of the first n terms of an arithmetic series is $S_n = n^2 + 3n$. (a) Find the first term and the common difference. (b) Find u_{29}.	

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6 A curve has equation $2x^2y - y^3 - 3x = -1$.
Find $\frac{dy}{dx}$ in terms of x and y, and the gradient of the normal at (0, 1).

7 A(1, 3) and B(7, −5) are the ends of a diameter of a circle.
(a) Find the equation of the circle, in the form $x^2 + y^2 + ax + by + c = 0$.
(b) Show that C(0, −4) lies on the circle.

8 The diagram shows the speed-time graph for a train journey of 2125 m. Find (a) V, (b) the deceleration in the final stage.



9 $l_1: \mathbf{r} = \begin{pmatrix} -2 \\ 1 \\ 7 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 2 \\ -1 \end{pmatrix}$

$l_2: \mathbf{r} = \begin{pmatrix} 0 \\ 3 \\ 5 \end{pmatrix} + \mu \begin{pmatrix} 1 \\ -2 \\ -2 \end{pmatrix}$

Determine whether l_1 and l_2 intersect. If they do, find the point of intersection.

10 The histogram shows the waiting times, t (in minutes), of a sample.
(a) How many were in the class $30 \leq t < 50$?
(b) Estimate how many had $5 < t < 45$.

