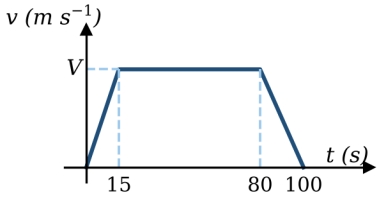
**Day 253** **A Level Maths: A Tier 10-a-day**

**1** The diagram shows the speed-time graph for a train journey of 660 m. Find (a) V, (b) the deceleration in the final stage.




**2** The equation $e^x = 4x + 2$ has a root α. Use the iteration $x_{n+1} = \ln(4x + 2)$ with $x_0 = 3$ to find $x_1$, $x_2$ and $x_3$ to 4 d.p., and hence the value of α to 2 d.p. (continue until the 2 d.p. value is settled).

**3** A 800 kg car tows a 250 kg trailer by a light tow-bar on a horizontal road. Driving force 965 N; resistances 400 N (car), 250 N (trailer). Find (a) the acceleration and the tow-bar tension. At 8 m $s^{-1}$ the tow-bar breaks. (b) How far does the trailer then travel?

**4** Simplify fully $\dfrac{4x^2 + 4x - 15}{4x^2 - 2x - 6}$.

**5** Use the trapezium rule with 4 strips to estimate $\int_0^4 \ln(x + 2)\,dx$, giving your answer to 3 s.f.
State, with a reason, whether your estimate is an overestimate or an underestimate.

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| **6** The sum of the first n terms of an arithmetic series is $S_n = 2n^2 + 5n$.<br>(a) Find the first term and the common difference.<br>(b) Find $u_{19}$. | |
| **7** $\theta$ is small and measured in radians. Use small angle approximations to show that<br>$3\sin 3\theta + 4\cos\theta = 7$<br>can be written as $a\theta^2 + b\theta + c = 0$ with integers a, b, c. Hence find the approximate solution with $0 < \theta < 0.8$, to 3 s.f. | |
| **8** Complaints occur as a Poisson process at a mean rate of 3 per day.<br>After a change, the number recorded in one day is 6.<br>Test at the 1% level whether the mean rate has increased. | |
| **9** The mean mass of a sack (kg) is normally distributed with standard deviation 4; it was previously 25.<br>A random sample of 36 has mean 25.6.<br>Test, at the 5% level, whether the mean has increased. | |
| **10** (a) Expand $(1 + 2x)^{\frac{1}{2}}$ in ascending powers of x up to $x^2$.<br>(b) Use $x = 0.025$ to estimate $\sqrt{105}$ to 3 decimal places. | |