Day 32 **A Level Maths: B Tier 10-a-day**

1 A particle moves so that its position vector relative to O at time t s is $\mathbf{r} = (3t^2 + 3t)\mathbf{i} + (t^3 + t)\mathbf{j}$ metres.
Find the velocity when t = 3, and the speed at that time.

2 Prove that $n^2 + 7n + 13$ is odd for all integers n.

3 Find the exact value of
$$\int_0^1 \frac{6x + 3}{x^2 + x + 1}\,dx,$$
giving your answer in the form a ln b.

4 $f(x) = x^3 + 3x^2 + kx$.
Given that (x + 4) is a factor of f(x),
(a) find the value of k,
(b) factorise f(x) completely.

5 The table summarises 46 measurements of t.
(a) Estimate the mean.
(b) Estimate the median using linear interpolation.

t (minutes)	Frequency
$20 \le t < 25$	15
$25 \le t < 30$	6
$30 \le t < 35$	11
$35 \le t < 40$	11
$40 \le t < 45$	3

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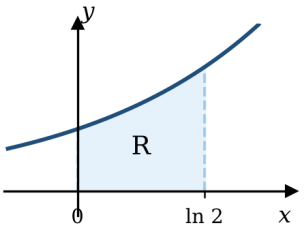
6 A geometric series has first term 1 and sum to infinity 2.
Find the common ratio and the value of the 3rd term.

7 (a) Write $\frac{1}{(x + 2)(x + 3)}$ in partial fractions.

(b) Hence evaluate $\int_0^2 \frac{1}{(x + 2)(x + 3)}\,dx$,
giving the answer as a single logarithm.

8 A bead of mass 5 kg is released from rest 10 m above the ground and falls freely.
Take $g = 9.8$ m s^{-2}.
Use energy to find its speed on reaching the ground.

9 The region R is bounded by the curve $y = e^x$, the x-axis
and the lines $x = 0$ and $x = \ln 2$.
R is rotated through 360° about the x-axis. Find the exact volume generated.



10 The scores on a test are normally distributed.
$P(X < 52) = 0.1587$ and $P(X > 76) = 0.0228$.
Find the mean and standard deviation (3 s.f.).