Day 217	A Level Maths: S Tier 10-a-day

1 A data set has lower quartile 16 and upper quartile 31. An outlier is a value more than 1.5 × IQR beyond the nearest quartile.
(a) Find the range of values that are not outliers.
(b) 8 observations have mean 19. The largest is 60, an outlier, and it is removed. Find the new mean.

2 A ball is projected horizontally at 29.4 m s^{-1} from the top of a vertical cliff of height 122.5 m, and lands on horizontal ground.
Find (a) the time of flight and the distance from the cliff, (b) the speed and direction on landing. Take g = 9.8 m s^{-2}.

3 Find the exact value of

$$\int_0^2 \frac{x}{x^2 + 3}\,dx$$

4 Express $\frac{3 + 3\sqrt{6}}{5 - 2\sqrt{6}}$ in the form $p + q\sqrt{6}$, where p and q are rational numbers.

5 A curve has parametric equations $x = 3t^2 - t$, $y = t^3 + 4t$.
Find the equation of the tangent at the point where t = 2,
in the form y = mx + c.

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6 A school says that 25% of its pupils walk to school. 20 pupils are surveyed, and 6 walk. Test, at the 1% significance level, the claim that the proportion is higher.
Give your conclusion in context.

7 Express $\frac{x^3 - 8x^2 + 19x - 6}{(x - 3)(x - 4)}$ in the form $ax + b + \frac{C}{(x - 3)} + \frac{D}{(x - 4)}$.

8 A particle P moves on a line. Its displacement from a fixed point O at time t seconds is s metres, where $s = 6 \sin 3t + 8 \cos 3t$.
Find (a) the greatest distance of P from O, (b) the greatest speed of P, (c) the first time P is at its greatest distance from O (3 s.f.).

9 Line l_1: $\mathbf{r} = \begin{pmatrix} 0 \\ 2 \\ -3 \end{pmatrix} + s\begin{pmatrix} 3 \\ 1 \\ -1 \end{pmatrix}$,
line l_2: $\mathbf{r} = \begin{pmatrix} -6 \\ 4 \\ 1 \end{pmatrix} + t\begin{pmatrix} 3 \\ -3 \\ -3 \end{pmatrix}$.
Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.

10 In the diagram, line l_1 passes through A and B. Line l_2 is perpendicular to l_1 at B and meets the x-axis at C. Find the coordinates of C and the area of triangle ABC.

