Day 296 **A Level Maths: A Tier 10-a-day**

1 $g(\theta) = \dfrac{1}{16 + 5\sin\theta + 12\cos\theta}$

(a) Write $5\sin\theta + 12\cos\theta$ in the form $R\sin(\theta + \alpha)$, with α acute.

(b) Find the greatest and least values of $g(\theta)$ and the smallest positive θ at which the greatest value occurs (1 d.p.).

2 A data set has mean 46 and standard deviation 9.

A value is treated as an outlier if it is more than 3 standard deviations from the mean.

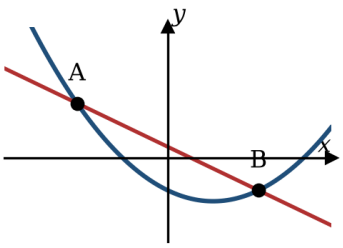
Which of 22, 38, 75, 82 are outliers?

3 Particles A (8 kg) and B (4 kg) move towards each other on a smooth horizontal line at 8 m s^{-1} and 7 m s^{-1}. They collide directly, and A then moves in the opposite direction at 2 m s^{-1}. Find (a) the speed of B after the collision, (b) the magnitude of the impulse of A on B.

4 The diagram shows the curve $y = x^2 - 2x - 3$ and the line $y = -2x + 1$, meeting at A and B.

(a) Find the coordinates of A and B.

(b) Find the coordinates of the midpoint of AB.



5 Particles A (9 kg) and B (1 kg) hang on a light string over a smooth pulley, A being 0.5 m above the ground. Released from rest; A lands without rebounding. Find (a) the tension while both move, (b) the greatest height of B above its start. Take g = 9.8.

Day 296 **A Level Maths: A Tier 10-a-day**

6 A is acute and B is obtuse, with $\sin A = \frac{7}{25}$ and $\cos B = -\frac{12}{13}$.
Find the exact values of $\cos(A-B)$ and $\tan(A-B)$.

7 The table summarises the height, h cm, of seedlings.
Estimate the mean and standard deviation (3 s.f.).

Class	Frequency
$20 \le h < 25$	13
$25 \le h < 30$	13
$30 \le h < 35$	20
$35 \le h < 40$	6
$40 \le h < 45$	2

8 The line $-3x + 4y = -14$ meets the circle $(x-1)^2 + (y+2)^2 = 25$ at the points A and B. Find the exact length of AB.

9 The points A, B and C have coordinates (0, 2, 4), (0, 2, 2) and (4, 0, −2).
Find angle ABC, in degrees to 1 d.p.

10 $f(x) = \frac{12x + 6}{(1 + 3x)(1 + x)}$.
(a) Express f(x) in partial fractions.
(b) Hence expand f(x) up to x^2.
(c) State the range of x for which the expansion is valid.