Day 50	A Level Maths: A Tier 10-a-day
1 Summary statistics for the daily mean windspeed (knots) in the same month are: Perth: mean 13.5, standard deviation 1.8; Jacksonville: mean 7.5, standard deviation 1.7. Make two comparisons.	
2 Forces $F_1 = (\mathbf{i} - 7\mathbf{j})$ N, $F_2 = (-6\mathbf{i} - 8\mathbf{j})$ 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 The sum of the first n terms of an arithmetic series is $S_n = 2n^2 + 3n$. (a) Find the first term and the common difference. (b) Find u_{20}.	
4 A driver at constant speed sees a hazard 40.8 m ahead. After a reaction time of 0.4 s she brakes with deceleration 2 m s^{-2} and stops exactly at the hazard. Find (a) her initial speed, (b) the total time from seeing the hazard to stopping.	
5 A is acute and B is obtuse, with $\sin A = \frac{8}{17}$ and $\cos B = -\frac{12}{13}$. Find the exact values of $\sin(A-B)$ and $\tan(A+B)$.	

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6 The table summarises the journey time, t minutes of 50 items.
Use linear interpolation to estimate the upper quartile.

Class	Frequency
$10 \le t < 20$	2
$20 \le t < 30$	3
$30 \le t < 40$	20
$40 \le t < 50$	8
$50 \le t < 60$	17

7 The line through the origin is a tangent to the curve $y = x^2 + 3$.
Find the gradients of the two possible tangents and the points of contact.

8 The circle $x^2 + y^2 - 8x - 4y - 149 = 0$ passes through P(−8, −3).
(a) Find the equation of the tangent at P, in the form $ax + by = c$.
(b) Find the coordinates of the point where this tangent crosses the x-axis.

9 A circle passes through A(−1, −7) and B(2, −6).
Its centre lies on the line $y = 3x + 1$.
Find the equation of the circle.

10 A curve has equation $-2x^2 + 2xy + 2y^2 - 3x + 3y = 0$.
Show that P(−3, 3) lies on the curve and find the equation of the tangent at P in the form $ax + by + c = 0$ with integer a, b, c.