Day 231	A Level Maths: A Tier 10-a-day
1 Forces $F_1 = (5\mathbf{i} + 9\mathbf{j})$ N, $F_2 = (-8\mathbf{i} + 15\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 4 kg particle in equilibrium. Find (a) a and b. F_2 is then removed; (b) find the magnitude of the acceleration.	
2 An arithmetic series has first term 9 and common difference 4. The sum of the first n terms is 429. Find n.	
3 A data set has lower quartile 27 and upper quartile 32. A value is an outlier if it is more than 1.5 × IQR above Q_3 or below Q_1. Which of 15, 22, 29, 41 are outliers?	
4 $f(x) = x^3 - 2x - 10$. Show that the equation $f(x) = 0$ has a root α in the interval [2, 3].	
5 X has a binomial distribution with mean 8 and variance 6. (a) Find n and p. (b) Find P(X = 9) to 3 significant figures.	

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6 θ is acute and $\tan\theta = \frac{7}{3}$.

Show that $\cos 2\theta = -\frac{20}{29}$ and find the exact value of $\sin 2\theta$.

7 Find the coefficient of x^{14} in the expansion of $(3x^3 + \frac{3}{x})^6$.

8 A curve has equation $-x^2 + 3xy + 3y^2 - 4x + 2y = 5$.

Show that P$(-1, 1)$ 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.

9 At t = 0, P and Q have position vectors $(-\mathbf{i})$ m and $(4\mathbf{i})$ m and velocities $(5\mathbf{i} + 2\mathbf{j})$ m s^{-1} and $(3\mathbf{i} + 3\mathbf{j})$ m s^{-1}. Find (a) the time when they are closest, (b) the least distance between them. Give answers to 3 s.f. if not exact.

10 The diagram shows a circle that touches the x-axis at A$(-1, 0)$ and passes through B$(2, 3)$. Find the equation of the circle.

