| Day 160 | A Level Maths: A Tier 10-a-day |
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| **1** A circle has equation $x^2 + y^2 + 2x + 6y = 0$.<br>(a) Find the centre and radius of the circle.<br>(b) Determine whether P(4, −1) lies inside or outside the circle. | |
| **2** The random variable X has probability density function $f(x) = kx(4 - x)$ for $0 \leq x \leq 4$, and 0 otherwise.<br>(a) Find k. (b) Find E(X). (c) Find P(X > 2). | |
| **3** Solve $\sin 2\theta = \sin \theta$ for $0 \leq \theta \leq 2\pi$. | |
| **4** Prove that the square of any integer is either a multiple of 3 or one more than a multiple of 3. | |
| **5** n = 9 pairs of (x, y): $\Sigma x = 105$, $\Sigma y = 408$, $\Sigma x^2 = 1641$, $\Sigma xy = 5523$.<br>(a) Find the equation of the regression line of y on x (3 s.f.).<br>(b) Estimate y when x = 15. | |

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| **6** Expand $(1 - \frac{x}{2})^{\frac{3}{2}}$ in ascending powers of x up to and including the term in $x^2$.<br>State the range of values of x for which the expansion is valid. | |
| **7** A particle P moves on the x-axis with velocity v = $(3t^2 - 12t + 9)$ m $s^{-1}$ at time t s, $t \geq 0$, and starts at O. Find (a) the times when P is at instantaneous rest, (b) the total distance P travels in the first 5 s. | |
| **8** $g(\theta) = \frac{1}{20 + 15 \sin \theta + 8 \cos \theta}$<br>(a) Write $15 \sin \theta + 8 \cos \theta$ in the form $R \sin(\theta + \alpha)$, with $\alpha$ acute.<br>(b) Find the greatest and least values of $g(\theta)$ and the smallest positive $\theta$ at which the greatest value occurs (1 d.p.). | |
| **9** Use integration by parts, with $u = \ln x$ and $\frac{dv}{dx} = 1$, to find the exact value of<br>$\int_1^4 \ln x \, dx$. | |
| **10** A uniform ladder AB (13 m, 30 kg) rests with A on rough ground, $\mu = \frac{1}{3}$, and B against a smooth wall, B being 12 m above the ground. A man of mass 90 kg climbs the ladder. How far along the ladder from A can he climb before it slips? | |