Day 137	A Level Maths: A Tier 10-a-day
1 Particles A (3 kg) and B (5 kg) move in the same direction on a smooth horizontal line at 7 m s^{-1} and 7 m s^{-1}. They collide and coalesce. Find (a) the speed of the combined particle, (b) the kinetic energy lost in the collision.	
2 Solve $2^{x+3} = 3^{3x}$. Give your answer to 3 significant figures.	
3 Find the quotient and the remainder when $x^4 + 5x^3 + 8x^2 + 24x + 17$ is divided by $(x^2 + 4)$.	
4 $y = 2 \times 3^{2x}$. The gradient of the curve at P is 2916 ln 3. Find the x-coordinate of P.	
5 Given that $(x - 3)$ is a factor of $f(x) = x^3 - 5x^2 - 2x + 24$, solve $f(x) < 0$.	

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6 Faults are reported at random at an average of 3 per hour. Find the probability that in a 90-minute period there are (a) zero events (b) at least 2. (c) Find the probability that at least one occurs in each of two separate 90-minute periods.	
7 A particle P has position vector $\mathbf{r} = (t^3 + 2t)\mathbf{i} + (t^2 - 2t)\mathbf{j}$ metres at time t s. Find (a) the speed of P when t = 2, (b) the value of t when P is moving parallel to $\mathbf{i}$. Give answers to 3 s.f. if not exact.	
8 The mass of an egg is $N(43, 5^2)$. An egg is classed as 'special' if its mass is less than 49. 8 eggs are chosen at random. Find the probability that exactly 3 are special (3 s.f.).	
9 The line $y = kx - 3$ is a tangent to the curve $y = x^2 + 4x - 2$. (a) Find the possible values of k. (b) For the larger value of k, find the coordinates of the point of contact.	
10 Find the exact value of $\int_1^4 \left(\frac{2}{x} + \frac{7}{x^2}\right) dx$.	