Day 183	A Level Maths: A Tier 10-a-day
1 A(−6, 11) and B(4, −13) are the ends of a diameter of a circle. (a) Find the equation of the circle, in the form $x^2 + y^2 + ax + by + c = 0$. (b) Show that C(4, 11) lies on the circle.	
2 A sector of a circle of radius 15 cm has perimeter 36 cm. Find (a) the angle of the sector in radians, (b) the area of the sector.	
3 For a sample of 24 pairs of values of time spent on social media and exam score, r = 0.438. The critical value for a two-tailed test at the 1% level is 0.5151. Test, at this level, whether there is any correlation between the two variables.	
4 A lift of mass 300 kg carries a person of mass 40 kg. The cable tension is 3536 N and the lift is accelerating. Find (a) the magnitude and direction of the acceleration, (b) the force of the floor on the person. Take g = 9.8.	
5 A group of 7 boys and 7 girls. A team of 3 is chosen at random. Find the probability that the team contains at least one of the girls.	

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6 A 6 kg particle moves on a smooth horizontal line. At time t s a single force of $(30 - 6t)$ N acts along the line. When t = 0 its speed is 1 m s^{-1}. Find (a) its speed when t = 7, (b) its greatest speed.	
7 A curve has equation $3x^2y - y^3 + 4x = -14$. Find $\frac{dy}{dx}$ in terms of x and y, and the gradient of the normal at (1, 3).	
8 (a) Expand $(1 - 2x)^{\frac{1}{2}}$ in ascending powers of x up to x^2. (b) Use x = 0.02 to estimate $\sqrt{24}$ to 4 decimal places.	
9 The curve y = f(x), where $f(x) = \frac{1}{x - 1} - 1$, is translated by $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$. Write down the equations of the asymptotes of the new curve, and find where it crosses the x-axis.	
10 Prove the identity $\sec^2 x + \operatorname{cosec}^2 x \equiv 4\operatorname{cosec}^2 2x$	