Day 92	A Level Maths: A Tier 10-a-day
1 A crate of mass 12 kg is pulled at constant speed along rough horizontal ground, $\mu = 0.5$, by a force of P N at angle θ above the horizontal, $\tan\theta = \frac{5}{12}$. Find P and the normal reaction. Take g = 9.8. Give answers to 3 s.f. if not exact.	
2 A company employs 144 people: 48 Sales, 72 Admin and 24 Production. A stratified sample of size 18 is taken. Find the number of people sampled from each group.	
3 $f(x) = x^2 - 4\cos x - 12$. Show that the equation $f(x) = 0$ has a root α in the interval [2, 3] (x in radians).	
4 A(2, 0) and B(−6, −6) 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(−2, 2) lies on the circle.	
5 Faults are reported at random at an average of 6 per hour. Find the probability that in a 90-minute period there are (a) zero events (b) at least 3. (c) Find the probability that at least one occurs in each of two separate 90-minute periods.	

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6 A ball is projected from the ground at 11 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{12}{5}$. At time T s, while in flight, it is moving perpendicular to its initial direction. Find (a) T, (b) the height of the ball then. Take g = 9.8. Give answers to 3 s.f. if not exact.	
7 The line through the origin is a tangent to the curve $y = x^2 + 4$. Find the gradients of the two possible tangents and the points of contact.	
8 A sequence is defined by $u_1 = k$ and $u_{n+1} = 3u_n - 3$. Given that $u_3 = 42$, find (a) the value of k, (b) $\sum_{r=1}^{4} u_r$.	
9 The vectors $\begin{pmatrix} k \\ k \\ -6 \end{pmatrix}$ and $\begin{pmatrix} k \\ 5 \\ -1 \end{pmatrix}$ are perpendicular. Find the possible values of k and, for the larger value, the exact length of the first vector.	
10 In the expansion of $(1 + kx)^n$, where n is a positive integer, the coefficient of x is −20 and the coefficient of x^2 is 180. Find n and k.	