| Day 306 | A Level Maths: S Tier 10-a-day |
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| **1** A binomial random variable X has mean 14 and variance $\frac{28}{3}$.<br>(a) Find n and p.<br>(b) Find P(X = 15), correct to 3 significant figures. | |
| **2** $f(x) = x^3 + 4x^2 + 13x + 18$.<br>Show that (x + 2) is a factor of f(x), and that the equation f(x) = 0 has exactly one real root. | |
| **3** The journey time is $N(\mu, 16)$ with known variance 16. The mean was claimed to be 83 minutes.<br>A random sample of 64 has mean 82.5. Test at the 1% level whether the mean is greater than 83. | |
| **4** A lift of mass 450 kg, carrying a passenger of mass 65 kg, is supported by a vertical cable. The lift is moving downwards and accelerating at 2.4 m $s^{-2}$.<br>Find (a) the force the floor exerts on the passenger, (b) the tension in the cable. Take g = 9.8 m $s^{-2}$. | |
| **5** A sector of a circle has radius r cm and angle $\theta$ radians, where $\theta < 2\pi$.<br>Its perimeter is 50 cm and its area is 154 $cm^2$.<br>Find the two possible pairs of values of r and $\theta$. | |

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**6** When a polynomial f(x) is divided by (x + 2) the remainder is $-7$; when divided by (x − 2) the remainder is 1. Find the remainder when f(x) is divided by (x + 2)(x − 2).

**7** A golf ball is hit from a point O on horizontal ground. It lands 50 m from O, and reaches a maximum height of 25 m above the ground. Find the angle of projection and the speed of projection, to 3 s.f. Take g = 9.8 m $s^{-2}$.

**8** $f(\theta) = \dfrac{3}{9 + 3\sin\theta + 4\cos\theta}$

(a) Write $3\sin\theta + 4\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$.

(b) Find the greatest and least values of $f(\theta)$, and the smallest positive $\theta$ at which the greatest value occurs, to 1 d.p.

**9** Solve $2x^3 - 10x^2 - 4x + 48 \geq 0$.

**10** The line l has equation $\mathbf{r} = \begin{pmatrix} -2 \\ 9 \\ 10 \end{pmatrix} + t\begin{pmatrix} -2 \\ 3 \\ 3 \end{pmatrix}$.

The point P has coordinates (5, −1, 10). Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.