Day 194 **A Level Maths: S Tier 10-a-day**

1 Find the coefficient of x^3 in the expansion of $(3x - 3)(1 - 2x)^5$.

2 Solve $\cos(2\theta - 45°) = -\frac{1}{2}$
for $0° \leq \theta \leq 360°$.

3 The table shows the times, t minutes, taken by some runners.
Using linear interpolation, the median is estimated as 50 minutes. Find the value of k.

t (min)	0-20	20-40	40-60	60-80	80-120
Frequency	k	10	11	7	12

4 Solve $6\text{cosec}^2\theta - 2\cot\theta - 10 = 0$
for $0 \leq \theta < 360°$, giving answers to 1 d.p.

5 A ball is projected from the top of a vertical cliff, 24.5 m high, at 24.5 m s^{-1} at angle α above the horizontal ($\tan\alpha = \frac{4}{3}$), and lands on horizontal ground.
Find (a) the time of flight and the distance from the cliff, (b) the speed and direction on landing.
Take g = 9.8 m s^{-2}.

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6 Emails arrive in an inbox at an average rate of 4 per hour, independently and at random. (a) Find the probability of at least 3 in a 30-minute period. (b) Find the probability that, of 8 separate 30-minute periods, exactly 2 have no arrivals.	
7 $f(x) = \frac{kx + 11}{x - 4}$ for $x \neq 4$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.	
8 A circle passes through A(−5, 11), B(3, 15) and C(13, 5). Find its equation.	
9 A uniform plank AB of length 10 m and mass 50 kg rests on supports at C and D, where AC = 3 m and DB = 3 m. A girl of mass 40 kg stands on it at distance x m from A. Find the range of x for which the plank stays in equilibrium on both supports.	
10 $f(\theta) = \frac{4}{24 + 8\sin\theta + 15\cos\theta}$ (a) Write $8\sin\theta + 15\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	