Day 289	A Level Maths: A Tier 10-a-day
1 Given that $(x - 5)$ is a factor of $f(x) = x^3 - 21x - 20$, solve $f(x) > 0$.	
2 A particle is projected up a line of greatest slope of a smooth plane inclined at α. It passes A, 4.9 m from the start, after 1 s and again after 4 s. Find (a) the speed of projection, (b) α to 1 d.p. Take $g = 9.8$.	
3 Express $\frac{1+\sqrt{6}}{2+\sqrt{6}}$ in the form $p + q\sqrt{6}$, where p and q are rational numbers.	
4 $y = 2 \times 5^x$. The gradient of the curve at P is $50 \ln 5$. Find the x-coordinate of P.	
5 A driver at constant speed sees a hazard 63.75 m ahead. After a reaction time of 0.5 s she brakes with deceleration 2 m s^{-2} and stops exactly at the hazard. Find (a) her initial speed, (b) the total time from seeing the hazard to stopping.	

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6 (a) Express $12 \sin \theta + 5 \cos \theta$ in the form $R \sin(\theta + \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. Give α to 1 d.p. (b) Solve $12 \sin \theta + 5 \cos \theta = 3$ for $0° \leq \theta < 360°$, giving answers to 1 d.p.	
7 $X \sim B(36, p)$. H_0: $p = 0.3$ is tested against H_1: $p < 0.3$ using a 5% significance level. (a) Find the critical region. (b) State the probability of a Type I error. (c) Find the probability of a Type II error when $p = 0.15$ (3 s.f.).	
8 A circle touches both coordinate axes and passes through the point $(1, -8)$. Its centre lies in the fourth quadrant. Find the equations of the two possible circles.	
9 The random variable X has pdf $f(x) = \frac{2}{25}(5 - x)$ for $0 \leq x \leq 5$, and 0 otherwise. (a) Find the cumulative distribution function F(x) for $0 \leq x \leq 5$. (b) Find $P(X > \frac{5}{2})$. (c) Find the median of X to 3 s.f.	
10 A curve has equation $3x^2y + 2y^3 + 2x = -7$. Find $\frac{dy}{dx}$ in terms of x and y, and the gradient of the normal at $(-1, -1)$.	