Day 356	A Level Maths: A Tier 10-a-day
1 Express $\frac{3x + 10}{(2x + 3)(x - 4)}$ in partial fractions.	
2 A cyclist passes P with speed 3 m s^{-1} and accelerates uniformly. She travels 90 m in the next 15 s, reaching Q. Find (a) her acceleration, (b) her speed at Q, (c) her speed at the midpoint of PQ. Give answers to 3 s.f. if not exact.	
3 θ is obtuse and $\sin\theta = \frac{21}{29}$. Find the exact values of $\sin 2\theta$, $\cos 2\theta$ and $\tan 2\theta$.	
4 $f(x) = -x^2 - 4x + 1$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the maximum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
5 A bag has 6 black and 2 white counters. Two are taken at random without replacement. Given that the counters are different colours, find the probability that the first is black.	

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6 A circle has equation $x^2 + y^2 + 6x + 4y + 4 = 0$. (a) Find the centre and radius of the circle. (b) Determine whether P(1, −4) lies inside or outside the circle.	
7 $f(x) = x^2 - 6$. Show that the Newton-Raphson formula gives $x_{n+1} = \frac{1}{2}(x_n + \frac{6}{x_n})$, and use it with $x_0 = \frac{5}{2}$ to find x_2 as an approximation to $\sqrt{6}$, to 4 d.p.	
8 A uniform plank AB (mass 10 kg, length 4 m) rests horizontally on supports at C and D, where AC = 1 m and DB = 0.5 m. A 10 kg particle is placed at E, AE = x m, and the plank is about to tilt about C. Find x.	
9 $y = e^{2x} - 6e^x + 4x$. Show that the stationary points occur where $e^x = 1$ and $e^x = 2$, and find the exact y-coordinate of each, with its nature.	
10 Bulbs are defective with probability 0.25, independently. A pack of 7 bulbs is rejected if it has at least 3 defective. From 6 such packs, find the probability that exactly 2 are rejected (3 s.f.).	