Day 153	A Level Maths: S Tier 10-a-day
1 Three forces $(-2\mathbf{i} + 8\mathbf{j})$ N, $(4\mathbf{i} + k\mathbf{j})$ N and $(2\mathbf{i} - 3\mathbf{j})$ N act on a particle of mass 3 kg. The resultant is parallel to $(4\mathbf{i} - 3\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
2 Solve $\cot(2\theta - 20°) = 1$ for $0° \leq \theta \leq 360°$.	
3 (a) Expand $(16 - x)^{-\frac{1}{2}}$ up to and including the term in x^2. (b) Use $x = 0.01$ to estimate $\frac{1}{\sqrt{15.99}}$ to 5 decimal places.	
4 Find the exact value of $\sin(\sin^{-1}(\frac{8}{17}) + \cos^{-1}(\frac{3}{5}))$.	
5 Class R has 24 students with mean mark 31 and standard deviation 7. Class S has 30 students with mean mark 30 and standard deviation 9. (a) Find the mean mark of all 54 students. (b) Find the standard deviation of all 54 students.	

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6 A particle is projected at 18 m s^{-1} up a line of greatest slope of a rough plane inclined at α to the horizontal, where $\sin\alpha = \frac{3}{5}$ and $\mu = 0.4$. Find (a) the distance it travels up the plane, to 3 s.f., (b) its speed on returning to its starting point. Take g = 9.8 m s^{-2}.	
7 Solve $\|2x - 1\| \geq \|-4x + 5\|$.	
8 A circle passes through P(3, −2), Q(−1, 6) and R(0, 7). Find its equation.	
9 Faults in a cable occur at random at a mean rate of 2 per week. After a modification, 8 faults are found in 1 week. Test at the 10% level whether the rate of faults has increased.	
10 A curve has parametric equations x = 2 sin t, y = 6 cos t, for $0 \leq t \leq \frac{\pi}{2}$. Find the exact area bounded by the curve and the coordinate axes.	