Day 244	A Level Maths: B Tier 10-a-day
1 Points A and B have position vectors $\begin{pmatrix} -3 \\ -3 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} -15 \\ 0 \\ -2 \end{pmatrix}$. Find AB and the distance AB.	
2 The random variable X has E(X) = 5 and Var(X) = 16. Find (a) E(−2X + 5), (b) Var(−2X + 5), (c) E(X^2).	
3 The points A, B and C are (−1, 0), (−3, −1) and (−4, 1). (a) Show that angle ABC = 90°. (b) Find the area of triangle ABC.	
4 A curve has parametric equations x = 6 cos t, y = 4 sin t. Find $\frac{dy}{dx}$ in terms of t, and its exact value when t = $\frac{\pi}{6}$.	
5 A lift of mass 600 kg is raised and lowered by a vertical cable. The lift accelerates downwards at 0.25 m s^{-2}. Take g = 9.8 m s^{-2}. Find the tension in the cable.	

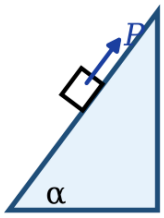
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6 The circle C has equation $(x - 4)^2 + (y - 1)^2 = 65$.
The point P(8, 8) lies on C.
Find an equation of the tangent to C at P, in the form $ax + by + c = 0$ with integer a, b, c.

7 Bottle volumes are normal, s.d. 6 ml. Set mean 250 ml; 50 bottles have mean 251.6 ml.
Test at the 5% level whether the true mean is greater than 250.

8 A cup of tea cools in a room at 15°C: $\frac{dT}{dt} = -k(T - 15)$. Initially T = 95 and after 10 minutes T = 50.
Find k to 3 s.f. and the time to cool to 25°C, to 3 s.f.

9 A block of mass 2 kg is held on a rough plane ($\tan \alpha = \frac{4}{3}$, $\mu = 0.75$) by a force P N up the plane, as shown.
Take $g = 9.8$ m s^{-2}. The block is about to move down the plane. Find P.



10 The line l has equation $y = x + 7$. The point P is (0, 1).
(a) Find the line through P perpendicular to l, as $ax + by + c = 0$ with integer a, b, c.
(b) Find the foot F and the exact distance PF.