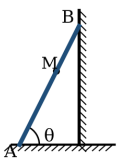
| Day 266 | A Level Maths: S Tier 10-a-day |
|---|---|
| **1** A box of weight 130 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{3}{4}$, $\mu = \frac{7}{24}$) by a force P N at angle $\beta$ above the plane.<br>(a) Find P when $\tan\beta = \frac{4}{3}$. (b) Find the least possible value of P as $\beta$ varies. | |
| **2** The circle $x^2 + y^2 - 2x - 24 = 0$ passes through P(−2, 4). The tangent at P meets the axes at A and B. Find the area of triangle OAB. | |
| **3** Solve the simultaneous equations<br>$\log_2 x - \log_2 y = 3$<br>$x + y = 9$ | |
| **4** For 8 pairs of values, $S_{xx} = 256$, $S_{yy} = 576$ and $S_{xy} = 128$.<br>(a) Calculate the product moment correlation coefficient r.<br>(b) The critical value for a one-tailed test at the 5% level with n = 8 is 0.6215. Carry out the test of $H_0$: $\rho = 0$ against $H_1$: $\rho > 0$. | |
| **5** A sequence is defined by $u_1 = \frac{5}{2}$ and $u_{n+1} = \frac{1}{1 - u_n}$.<br>Show that the sequence is periodic and find $\sum_{r=1}^{75} u_r$. | |

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| **6** Use integration by parts to find the exact value of<br>$\int_0^{\pi/2} e^{3x} \sin x \, dx$ | |
| **7** The mass of a apple is N(76, $9^2$) g. A apple is 'heavy' if it exceeds 77.<br>(a) Find the probability that a apple is heavy.<br>(b) 8 apples are chosen at random. Find the probability that at least 4 are heavy. | |
| **8** Solve simultaneously:<br>$x + 2y = 5$<br>$x^2 + 2xy + y^2 = 36$ | |
| **9** A uniform ladder AB of length 4 m and weight 150 N has A on rough ground ($\mu = 0.3$) and B against a smooth vertical wall. It makes angle $\theta$ with the ground, $\tan\theta = 2.5$.<br>A man of weight 500 N climbs the ladder. How far along the ladder can he go before it slips?<br> | |
| **10** An open-topped box has a square base of side x m and volume 108 $m^3$.<br>Show that the surface area is $A = x^2 + \frac{432}{x}$, and find the<br>minimum value of A, justifying that it is a minimum. | |