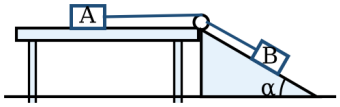
**Day 116** **A Level Maths: S Tier 10-a-day**

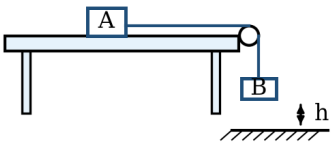
**1** For n = 12 pairs of values: $\Sigma x = 120$, $\Sigma y = 132$, $\Sigma x^2 = 1337$, $\Sigma xy = 1731$.
(a) Find the equation of the regression line of y on x.
(b) The x values lie between 6 and 15. Estimate y when x = 15 and comment on its reliability.

**2** Particle A (4 kg) lies on a rough table with $\mu = 0.1$, and is joined by a light string over a smooth pulley (see diagram) to particle B (8 kg) on a smooth slope, $\alpha = 30°$.
Released from rest, the string is cut when B has moved 3.75 m. Find the further distance A slides before stopping.




**3** Express $\frac{7 + 2\sqrt{2}}{3 - 3\sqrt{2}}$ in the form $p + q\sqrt{2}$, where p and q are rational numbers.

**4** Particles A (4 kg) and B (3 kg) are joined by a light string over a smooth pulley (see diagram). A lies on a rough table with $\mu = 0.5$, and B is 2.8 m above the floor.
The system is released from rest. Find the total distance A moves before coming to rest (A does not reach the pulley).




**5** Use the substitution $u = \cos x$ to find the exact value of

$$\int_0^{\pi/3} \sin x \cos^4 x \, dx$$

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|---|---|
| **6** Sam claims that $n^2 - n + 41$ is prime for every positive integer n.<br>Show that Sam is wrong by finding the smallest value of n that is a counter-example. | |
| **7** The mass of a apple is $N(56, 7^2)$ g. A apple is 'heavy' if it exceeds 63.<br>(a) Find the probability that a apple is heavy.<br>(b) 11 apples are chosen at random. Find the probability that at least 4 are heavy. | |
| **8** The curves $y = e^x$ and $y = 81\,e^{-x}$ meet at the point P.<br>Find the exact area of the region bounded by the two curves<br>and the y-axis. | |
| **9** One root of $x^2 + kx - 27 = 0$ is the square of the other root. Find the possible values of k. | |
| **10** The line l has equation $\mathbf{r} = \begin{pmatrix} -5 \\ 4 \\ 4 \end{pmatrix} + t\begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix}$.<br>The point P has coordinates $(-5, -1, 7)$.<br>Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF. | |