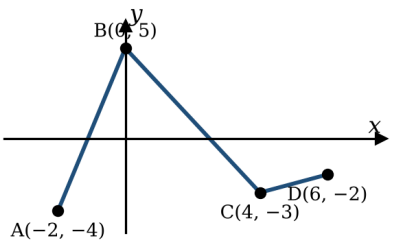
Day 265 **A Level Maths: S Tier 10-a-day**

1 Solve $\frac{-2x + 2}{x + 5} > 1$.

2 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours.
Initially P = 200 and after 3 hours P = 300.
Find k, and the time for the population to reach 2000, to 3 s.f.

3 The diagram shows y = f(x), made of three straight line segments. Find the coordinates of the images of A, B, C and D on the graph of $y = 2f(-\frac{1}{2}x - 1)$.



4 The equation $e^x = 3x + 2$ has a root α.
(a) Show that the equation can be written as $x = \ln(3x + 2)$.
(b) Use $x_{n+1} = \ln(3x_n + 2)$ with $x_0 = 3$ to find x_1, x_2, x_3
to 4 d.p., and hence state α to 3 d.p.

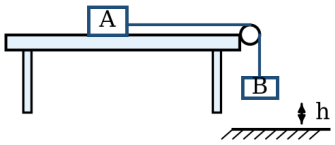
5 Express $\frac{-6 - \sqrt{7}}{5 + 2\sqrt{7}}$ in the form $p + q\sqrt{7}$, where p and q are rational numbers.

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6 Each shot Amira takes scores with probability $\frac{1}{2}$, independently.

(a) Find the probability that her third score comes on shot number 10.
(b) Find the probability that her third score comes on or before shot number 10.

7 Particles A (4 kg) and B (4 kg) are joined by a light string over a smooth pulley (see diagram). A lies on a rough table with $\mu = 0.1$, and B is 0.5 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).



8 The cdf of X is $F(x) = 0$ for $x < 0$, $F(x) = 1 - (1 - \frac{x}{5})^4$ for $0 \le x \le 5$, and $F(x) = 1$ for $x > 5$.

(a) Find the pdf of X.
(b) Find E(X).
(c) Find $P(1.25 < X < 2.5)$ and the median, to 3 significant figures.

9 A plank of mass 5 kg lies on a smooth horizontal table, with a block of mass 5 kg on it ($\mu = 0.2$ between them). A horizontal force P N acts on the block.
(a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 29.4. Take $g = 9.8$ m s^{-2}.

10 Line l_1: $\mathbf{r} = \begin{pmatrix} 4 \\ 0 \\ -1 \end{pmatrix} + s\begin{pmatrix} 3 \\ 1 \\ -2 \end{pmatrix}$,

line l_2: $\mathbf{r} = \begin{pmatrix} -5 \\ -4 \\ 1 \end{pmatrix} + t\begin{pmatrix} -3 \\ -2 \\ -2 \end{pmatrix}$.

Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.