Day 348 **A Level Maths: B Tier 10-a-day**

1 A geometric series has first term a and common ratio r, where $|r| < 1$.

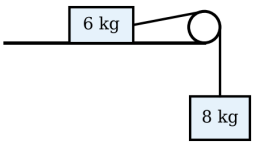
The sum to infinity is $\frac{36}{5}$ times the second term.

Find the possible values of r.

2 A particle of mass 6 kg lies on a smooth horizontal table. It is attached by a light string over a smooth pulley at the edge of the table to a particle of mass 8 kg hanging freely.

Take $g = 9.8$ m s^{-2}.

The system is released from rest. Find the acceleration and the tension in the string.



3 A has position vector $\begin{pmatrix} 1 \\ -1 \\ 4 \end{pmatrix}$ and B has position vector $\begin{pmatrix} -8 \\ -10 \\ 7 \end{pmatrix}$.

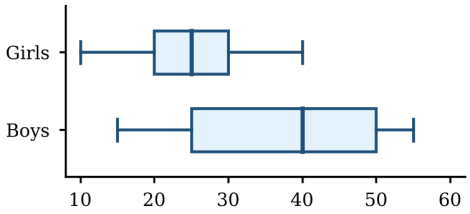
The point P lies on AB with AP : PB = 2 : 1.

Find the position vector of P.

4 The box plots show the marks in a mock exam for two groups.

(a) Find the interquartile range of each group.

(b) Compare the two distributions.



5 A particle is in equilibrium under three forces: P N at angle θ above the positive x-axis, a force of 36 N in the negative x-direction and a force of Q N in the negative y-direction.

$\cos\theta = \frac{12}{13}$. Find P and Q.

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6 Regression line (x from 1 to 9): $y = 12 + 25x$. x is the hours of sunshine, y the number of ice creams sold. (a) Interpret the gradient. (b) Estimate y when x = 12 and comment.	
7 Find the coefficient of x^3 in the expansion of $(1 - 2x)(2 + 2x)^4$.	
8 Points A, B and C have position vectors $\begin{pmatrix} 0 \\ -1 \\ 3 \end{pmatrix}$, $\begin{pmatrix} 1 \\ -1 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ -1 \\ r \end{pmatrix}$ respectively. Given that A, B, C are collinear, find r.	
9 The line $y = -x + 3$ meets the circle $(x + 3)^2 + (y - 1)^2 = 25$ at the points A and B. Find the coordinates of A and B, and the exact length of the chord AB.	
10 Simplify $\frac{\cos 6x}{\cos 3x + \sin 3x}$, giving your answer in its simplest form.	