Hafaliadau Differol

Differential Equations

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Differential Equations

Gelwir unrhyw hafaliad sy'n cynnwys deilliadau fel $\frac{dy}{dx}$ neu $\frac{d^2y}{dx^2}$ yn **hafaliad differol**.

Any equation that includes derivatives such as $\frac{dy}{dx}$ *or* $\frac{d^2y}{dx^2}$ *is called a* ***differential equation***.

Datrysiad hafaliad o'r math yma yw hafaliad sy'n cysylltu x ag y heb gynnwys unrhyw ddeilliadau.
A solution of such an equation is an equation that connects x *and* y *without using derivatives.*

Gallwn integru'r hafaliad differol $\frac{dy}{dx} = 3$ i ddarganfod y **datrysiad cyffredinol** $y = 3x + k$, lle mae k yn gysonyn.
We can integrate the differential equation $\frac{dy}{dx} = 3$ *to obtain the* ***general solution*** $y = 3x + k$, *where* k *is a constant.*

Os yw'r cwestiwn yn cynnwys gwybodaeth ychwanegol am x ag y, e.e. bod $y = 5$ pan fo $x = 1$, yna gallwn ffeindio **datrysiad penodol**.
If the question contains additional information about x *and* y, *e.g. that* $y = 5$ *when* $x = 1$, *then we can find a* ***particular solution***.

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Enghraifft: / *Example:*

$$y = 3x^3 + 2x^2 + 4x$$

$$\frac{dy}{dx} = 9x^2 + 4x + 4$$

$$\frac{d^2y}{dx^2} = 18x + 4$$

$$x\frac{d^2y}{dx^2} = 18x^2 + 4x$$

$$x\frac{d^2y}{dx^2} - \frac{dy}{dx} = 9x^2 - 4$$

Gan mai'r deilliad uchaf yn yr hafaliad uchod yw'r ail ddeilliad, $\frac{d^2y}{dx^2}$, mae'r hafaliad uchod yn hafaliad differol **trefn dau**. Yn uned 4, bydd cwestiynau yn cael eu gosod ar hafaliadau differol **trefn un** yn unig.

*Because the highest derivative in the above equation is the second derivative, $\frac{d^2y}{dx^2}$, the above equation is a **second order** differential equation. In unit 4, questions will only be set on **first order** differential equations.*

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Sut i ddatrys problem hafaliad differol: / *How to solve a differential equation problem:*

1) Os oes angen, echdynnwch hafaliad differol o'r broblem eiriol.
If required, extract a differential equation from the worded problem.

2) Ad-drefnwch yr hafaliad i gael hafaliad o'r ffurf $g(y)\frac{dy}{dx} = f(x)$.
Re-arrange the equation to obtain an equation of the form $g(y)\frac{dy}{dx} = f(x)$.

3) Integrwch y ddwy ochr er mwyn cael datrysiad cyffredinol.
Integrate both sides in order to obtain a general solution.

$$\int g(y)dy = \int f(x)dx$$

4) Defnyddiwch unrhyw wybodaeth ychwanegol i gael datrysiad penodol.
Use any additional information to obtain a particular solution.