Level 2 Further Maths

Second Derivative $\frac{d^2y}{dx^2}$

Ensure you have: Pencil or pen

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Revision for this topic

www.corbettmaths.com/more/further-maths/
1. \[ y = x^3 - 2x^2 \]

Work out \( \frac{d^2y}{dx^2} \)

\[ \frac{dy}{dx} = 3x^2 - 4x \]

\[ \frac{d^2y}{dx^2} = 6x - 4 \]

\[ \text{(2)} \]

2. \[ y = x^4 + 5x \]

Work out \( \frac{d^2y}{dx^2} \)

\[ \frac{dy}{dx} = 4x^3 + 5 \]

\[ \frac{d^2y}{dx^2} = 12x^2 \]

\[ \text{(2)} \]
3. \( y = x^4 + 3x^3 - 6x^2 + x \)

Work out the value of \( \frac{d^2y}{dx^2} \) when \( x = 1 \)

\[
\frac{dy}{dx} = 4x^3 + 9x^2 - 12x + 1
\]

\[
\frac{d^2y}{dx^2} = 12x^2 + 18x - 12
\]

when \( x = 1 \)

\[
\frac{d^2y}{dx^2} = 12 + 18 - 12
\]

-----------

4. \( y = 4x^3 - 2x^2 + x \)

Work out the value of \( \frac{d^2y}{dx^2} \) when \( x = 2 \)

\[
\frac{dy}{dx} = 12x^2 - 4x + 1
\]

\[
\frac{d^2y}{dx^2} = 24x - 4
\]

when \( x = 2 \)

\[
\frac{d^2y}{dx^2} = 48 - 4
\]

-----------
5. \( y = x^3 - 2x^2 \)

Work out the value of \( \frac{d^2y}{dx^2} \) when \( x = -3 \)

\[
\frac{d^y}{dx} = 3x^2 - 4x
\]

\[
\frac{d^2y}{dx^2} = 6x - 4
\]

when \( x = -3 \)

\[
\frac{d^2y}{dx^2} = -18 - 4
\]

\[-22\]

(3)

6. \( y = \frac{2}{3}x^6 - \frac{1}{2}x^4 \)

Work out the value of \( \frac{d^2y}{dx^2} \) when \( x = -1 \)

\[
\frac{d^y}{dx} = 4x^5 - 2x^3
\]

\[
\frac{d^2y}{dx^2} = 20x^4 - 6x^2
\]

when \( x = -1 \)

\[
\frac{d^2y}{dx^2} = 20 - 6
\]

\[14\]

(3)
7. \[ y = \frac{4x^6 - x^5}{2x} \]

Work out \( \frac{d^2y}{dx^2} \)

\[ y = 2x^5 - \frac{1}{2} x^4 \]

\[ \frac{dy}{dx} = 10x^4 - 2x^3 \]

\[ \frac{d^2y}{dx^2} = 40x^3 - 6x^2 \]

8. \[ y = (x^2 + 5)(2 - x) \]

Work out the value \( \frac{d^2y}{dx^2} \) when \( x = -2 \)

\[ y = 2x^2 - x^3 + 10 - 5x \]

\[ y = 2x^2 - x^3 - 5x + 10 \]

\[ \frac{dy}{dx} = 4x - 3x^2 - 5 \]

\[ \frac{d^2y}{dx^2} = 4 - 6x \]

when \( x = -2 \)

\[ \frac{d^2y}{dx^2} = 4 - 12 \]

\[ \frac{d^2y}{dx^2} = -8 \]
9. \[ y = ax^3 - x^2 \]

Given \( \frac{d^2y}{dx^2} = -23 \) when \( x = -\frac{1}{2} \)

\[ \frac{dy}{dx} = 3ax^2 - 2x \]

\[ \frac{d^2y}{dx^2} = 6ax - 2 \]

when \( x = -\frac{1}{2} \)

\[ \frac{d^2y}{dx^2} = -3a - 2 \]

\[-3a - 2 = -23 \]

\[ +2 +2 \]

\[-3a = -21 \]

\[ a = 7 \]