Your notes

Level 2 Further Maths: revision notes

Differentiation and gradients

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The gradient function

- **Differentiation** finds the gradient function, written **dy/dx** or f′(x). It gives the gradient of the curve at any point.
- If $y = ax^n$, then **dy/dx** = nax^{n-1}: multiply by the power, then reduce the power by 1.
- The **derivative** of a constant is 0, and the **derivative** of kx is k.
- Differentiate each term separately: $y = 5x^2 - 3x + 7$ gives **dy/dx** = 10x − 3.

Negative and fractional powers

- Rewrite first. $y = 4/x = 4x^{-1}$, so **dy/dx** = $-4x^{-2} = -4/x^2$.
- $y = 6\sqrt{x} = 6x^{(1/2)}$, so **dy/dx** = $3x^{(-1/2)} = 3/\sqrt{x}$.
- Expand brackets before differentiating: $y = (x + 2)(x - 5) = x^2 - 3x - 10$, so **dy/dx** = 2x − 3.

Using the gradient function

- To find the gradient at a point, substitute its x-value. For $y = x^3 - 2x$ at x = 2: **dy/dx** = $3x^2 - 2 = 10$.
- To find where the gradient has a certain value, set **dy/dx** equal to it and solve. For $y = x^2 + 5x - 2$, a gradient of 9 means 2x + 5 = 9, so x = 2.
- A function is increasing where **dy/dx** > 0 and decreasing where **dy/dx** < 0.

Key terms

Differentiation	Finding the gradient function of a curve.
dy/dx	The gradient function of y with respect to x.
Derivative	The result of differentiating.
Gradient of a curve	The gradient of the tangent at a point.
Increasing function	A function whose gradient is positive.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. Differentiate x^5.
2. Differentiate $5x^2 - 3x + 7$.
3. What is the derivative of a constant?
4. $y = x^3 - 2x$. What is the gradient at $x = 2$?
5. Differentiate $y = 4/x$.
6. Differentiate $y = (x + 2)(x - 5)$.
7. Differentiate $y = 6\sqrt{x}$.
8. What does dy/dx represent?

Answers

1. $5x^4$
2. $10x - 3$
3. 0
4. 10
5. $-4/x^2$
6. $2x - 3$
7. $3/\sqrt{x}$
8. The gradient function

What to do next

Practise 10 questions on this topic

Try 3 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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