

# Differentiation

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- The gradient is denoted by  $\frac{dy}{dx}$  if  $y$  is given as a function of  $x$
- The gradient is denoted by  $f'(x)$  if the function is given as  $f(x)$

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$$y = x^n \quad \frac{dy}{dx} = nx^{n-1}$$

$$y = ax^n \quad \frac{dy}{dx} = nax^{n-1}$$

$$y = a \quad \frac{dy}{dx} = 0$$

$$y = e^{kx} \quad \frac{dy}{dx} = ke^x$$

$$y = \ln x \quad \frac{dy}{dx} = \frac{1}{x}$$

$$y = a^{kx} \quad \frac{dy}{dx} = (k \ln a) a^{kx}$$

$$y = \cos kx \quad \frac{dy}{dx} = -k \sin kx$$

$$y = \tan kx \quad \frac{dy}{dx} = k \sec^2 kx$$

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## Methods of differentiation

**CHAIN RULE** for differentiating  $y = fg(x)$   $y = f(u)$  where  $u = g(x)$   $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

**PRODUCT RULE** for differentiating  $y = f(x)g(x)$   $\frac{dy}{dx} = f'(x)g(x) + f(x)g'(x)$

**QUOTIENT RULE** for differentiating  $y = \frac{f(x)}{g(x)}$   $\frac{dy}{dx} = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$

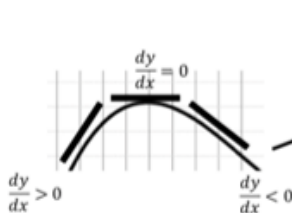
**PARAMETRIC EQUATIONS**  $y = f(t)$   $x = g(t)$   $\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$

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## Stationary Points

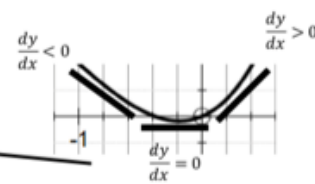
- The points where  $\frac{dy}{dx} = 0$  are stationary points of a graph
- The nature of the turning points can be found by:

### Maximum point



Maximum if  $\frac{d^2y}{dx^2} < 0$

### Minimum Point



Minimum if  $\frac{d^2y}{dx^2} > 0$

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- Points of inflection** occur when  $\frac{d^2y}{dx^2} = 0$

- Convex curve:**  $\frac{d^2y}{dx^2} > 0$  for all values of  $x$  in the convex section of the curve

- Concave curve:**  $\frac{d^2y}{dx^2} < 0$  for all values of  $x$  in the concave section of the curve



# How do we use Knowledge Organisers in Mathematics?

## How can you use knowledge organisers at home to help us?

- **Retrieval Practice:** Read over a section of the knowledge organiser, cover it up and then write down everything you can remember. Repeat until you remember everything.
- **Flash Cards:** Using the Knowledge Organisers to help on one side of a piece of paper write a question, on the other side write an answer. Ask someone to test you by asking a question and seeing if you know the answer.
- **Mind Maps:** Turn the information from the knowledge organiser into a mind map. Then reread the mind map and on a piece of paper half the size try and recreate the key phrases of the mind map from memory.
- **Sketch it:** Draw an image to represent each fact; this can be done in isolation or as part of the mind map/flash card.
- **Teach it:** Teach someone the information on your knowledge organiser, let them ask you questions and see if you know the answers.

## How will we use knowledge organisers in Mathematics?

Knowledge organisers will be used before I complete a Learning Check or Common Assessment. I will spend part of the lesson looking over each of the key topics of the half term before completing the Learning Check or Common Assessment.

I will also use these at home to complete my own independent learning and revision of these key topics.

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