

Week 3 Group Video Lab

The Derivative Newsroom

A three-minute report about how quickly five countries are changing.

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The group of five

Form a group of exactly five students. Each student represents one country and must speak in the final video.

- Choose your home country whenever possible.
- The group chooses one measurable quantity for all five countries.
- Each student estimates the rate of change in their country during the same period.
- Present the result as a short international news report with five country correspondents.

Five students, five countries, one derivative question.

The common data question

Choose **one** quantity for which reliable data are available for all five countries. Suitable choices include:

- annual electricity consumption
- total population
- annual carbon dioxide emissions.

Let $q(t)$ denote the chosen quantity in year t . The group must use:

1. the same central year t_0 for every country
2. the three values $q(t_0 - h)$, $q(t_0)$ and $q(t_0 + h)$
3. the same value of h and preferably the same public data source
4. the original units and a visible citation to the data source.

Choose a year for which all five countries have complete data.

Estimating the derivative

Calculate the rates immediately before and after t_0 :

$$m_- = \frac{q(t_0) - q(t_0 - h)}{h}, \quad m_+ = \frac{q(t_0 + h) - q(t_0)}{h}.$$

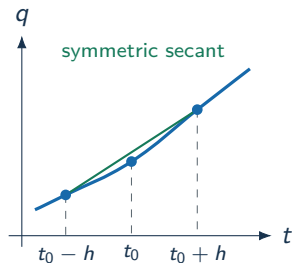
Then estimate the derivative by the symmetric difference:

$$q'(t_0) \approx \frac{q(t_0 + h) - q(t_0 - h)}{2h}.$$

State the units and interpret the sign:

$q'(t_0) > 0$ means increasing,

$q'(t_0) < 0$ means decreasing.



The derivative measures change per unit of time, not the size of the quantity.

A fair comparison between countries

Large countries often have larger absolute changes. Also calculate the relative rate

$$r(t_0) = 100 \frac{q'(t_0)}{q(t_0)} \quad \text{percent per year.}$$

Each correspondent must report:

- the country, the quantity and the central year
- the three data values and the estimate of $q'(t_0)$
- the relative rate $r(t_0)$
- one sentence explaining what the sign and size mean.

Show a final table:

country	$q(t_0 - h)$	$q(t_0)$	$q(t_0 + h)$	$r(t_0)$ in %/year
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The three-minute news report

- 0:00–0:20 Introduce the quantity, the central year and the data source.
- 0:20–1:05 One correspondent presents a complete derivative calculation.
- 1:05–2:20 The other four correspondents report their countries and interpretations.
- 2:20–3:00 Show the comparison table and state the main conclusion.

The conclusion must identify the greatest relative increase or decrease. It must also explain why three data points give only an estimate of the derivative.

Submission checklist

Submit one video file or one accessible video link for the whole group. Check that it includes:

- five students and five countries
- one common quantity, period, data source and set of units
- one complete calculation of m_- , m_+ , $q'(t_0)$ and $r(t_0)$
- the derivative estimate and interpretation for every country
- the five-country comparison table
- the names of all five students and a visible source citation.

Send it to: sheldon.dantas@gmail.com