

Product Rule

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Activity overview

This activity allows students to discover the product rule.

Concepts

- Rate of change.
- Derivatives.

Teacher preparation

Download the student .tns file.

Classroom management tips

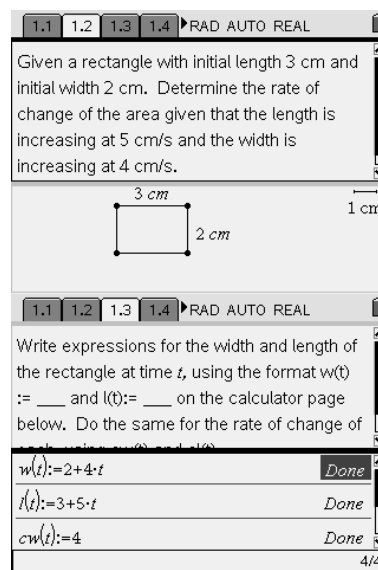
This activity is designed for students who have learned the power rule but have not yet seen the product rule. Students can work individually or in pairs. The initial size of the rectangle and the rates of change can be varied for different groups so that they are not all working with the same numbers.

TI-Nspire Applications

- Lists & spreadsheet (function table)
- Notes
- Calculator

Step-by-step directions

On page 1.2 students are given the scenario for this activity.



On page 1.3 students must come up with expressions for the width and length at time, t , along with expressions for the rate of change of each of these:

$$w(t) := 2 + 4t$$

$$l(t) := 3 + 5t$$

$$cw(t) := 4$$

$$cl(t) := 5$$

These should be defined as functions as they will be used later on in the activity.

On page 1.4 students define the area function along with the rate of change of the area. They can use the functions from page 1.3 and the expand command will allow them to see the result. They can find the rate of change of area using the derivative function or they can work it out themselves as shown.

$$a(t) := 20t^2 + 22t + 6$$

$$ca(t) := 40t + 22$$

On page 1.6 they need to create the function table by clicking on the down arrow to add functions.

Once the table is complete they need to “play” with the numbers and see if they can find the combination that creates the values in $ca(t)$. If they are struggling, give them hints such as “It’s a combination of addition and multiplications.”

Once they think they have found the pattern they can test it out by creating a new function (I called it $pr(t)$ for product rule).

Students return to page 1.6 and test their conjecture by adding their new function to the table. If the values in $ca(t)$ and $pr(t)$ match, then they have found the product rule!

1.1 1.2 1.3 1.4 RAD AUTO REAL

Create an expression for the area of the rectangle at time t , using the definitions from the previous page. Then find the expression for the rate of change of the area, $ca(t)$.

$a(t) := w(t) \cdot l(t)$ Done

$expand(a(t))$ $20 \cdot t^2 + 22 \cdot t + 6$

$ca(t) := 40 \cdot t + 22$ Done

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1.3 1.4 1.5 1.6 RAD AUTO REAL

t	$l(t) := 3 + 5 \cdot t$	$cw(t) := 4$	$cl(t) := 5$	$ca(t) := 40 \cdot t + 22$
0.	3.	4.	5.	22.
1.	8.	4.	5.	62.
2.	13.	4.	5.	102.
3.	18.	4.	5.	142.
4.	23.	4.	5.	182.

22.

1.3 1.4 1.5 1.6 RAD AUTO REAL

t	$w(t) := 2 + 4 \cdot t$	$l(t) := 3 + 5 \cdot t$	$cw(t) := 4$	$cl(t) := 5$	$ca(t) := 40 \cdot t + 22$
0.	2.	3.	4.	5.	22.
1.	6.	8.	4.	5.	62.
2.	10.	13.	4.	5.	102.
3.	14.	18.	4.	5.	142.
4.	18.	23.	4.	5.	182.

2.

1.4 1.5 1.6 1.7 RAD AUTO REAL

Once you have a conjecture test it by defining it as a new function on the calculator page below. Return to the previous page and add your new function to the table and compare the values to those in $ca(t)$.

$pr(t) := w(t) \cdot cl(t) + l(t) \cdot cw(t)$ Done

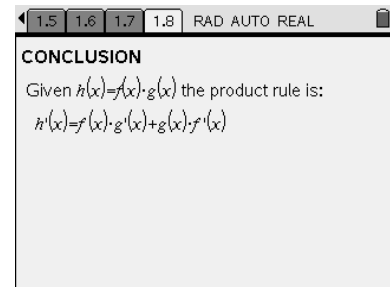
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1.3 1.4 1.5 1.6 RAD AUTO REAL

t	$cw(t) := 4$	$cl(t) := 5$	$ca(t) := 40 \cdot t + 22$	$pr(t) := w(t) \cdot cl(t)$
0.	4.	5.	22.	22.
1.	4.	5.	62.	62.
2.	4.	5.	102.	102.
3.	4.	5.	142.	142.
4.	4.	5.	182.	182.

22.

Page 1.8 allows students to express their conclusion. Use an expression box to do this.



Assessment and evaluation

- *This activity is intended as an investigation. Teachers may wish to assess whether students have completed the activity and should debrief at the end.*

Student TI-Nspire Document: product rule.tns

