## Background

Calculus II

This is a continuation of Calculus I (MAT1512). It deals with the mathematics of change.

Outcomes:

- Calculate and use the derivatives of a function to sketch a graph of the function

- First derivative. Determine the relationship between the rates of change of various quantities in the rates-of-change word problem.

- Solve maximum or minimum word problems using the theory of derivatives.

- Ability to use L’Hopital’s rule to determine limits of indeterminate forms.

- Calculation of the volumes of solids of revolution.

- An improper integral is tested for convergence or divergence and evaluated if convergent.

- Integration techniques to evaluate integrals.

- Taylor polynomial of any order at a given point.

A close up of a map

Description automatically generated

**Lesson 0**

Revision: Limits

Limits are used to calculate

We do not care about the output (of a function) at a certain point, but more what happens around the point.

Limits help solve the problem of indeterminate form

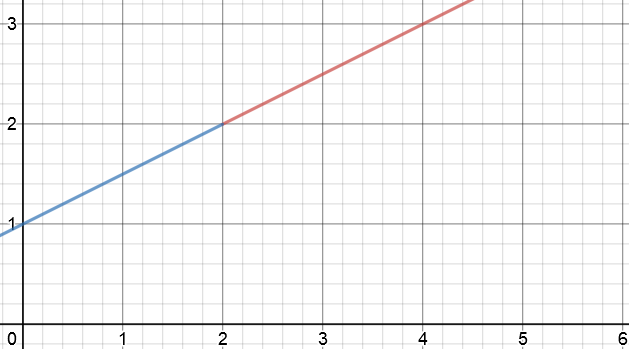
Calculating instantaneous velocity is an example of a limit

Example: The function and the limit differ

*LHS: The limit as x approaches 2 is 2*

*RHS: The limit as x approaches 2 is 2*

*The limit as x approaches 2 is 2*

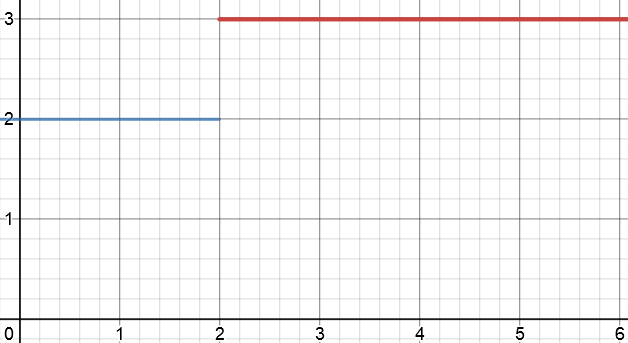


Example: The LHS and RHS limit differ

*LHS: The limit as x approaches 2 is 2*

*RHS: The limit as x approaches 2 is 2*

*The limit as x approaches 2 does not exist*



A close up of a device

Description automatically generatedExample: The limits at inifinity

*LHS: The limit as x approaches -infinity is -1*

*RHS: The limit as x approaches infinity is -1*

*Reciprocal graph. Asymptotes @ x=2, y=-1*

<https://www.youtube.com/watch?v=nJZm-zp639s>

**Common** **(PFGE)** Use these methods in order. If one fails, try the next

[1] Plug in values

*Always start by plugging in the x value*

[2] Algebra. Factorization

*Indeterminate form . Factorize and the plug-in x value*

If you use [2] and you get an answer over zero, then DNE (does not exist)

Other DNE examples

[3] Algebra. Get common Denominator

*Reciprocal Substitute*

[4] Expand Parentheses

*Expand then simplify*

**Uncommon (STA)**

[5] Square root in numerator (in rational expression)

*Multiply by conjugate (differentiation). Remember to change sign of 2nd term*

[6] Trig functions (indeterminate form)

*Special property: or*

*Special property: or*

*because*

[7] Absolute Value

*Piecewise definition of ABS function:*

*Find see if LHS limit = RHS limit*

<https://www.youtube.com/watch?v=nViVR1rImUE>

**Limits at infinity**

[8] Polynomial/Constant

*Lower degree terms (2x and 5) dont matter here*

[9] Rational

[10] Trig functions

[11] Exponential