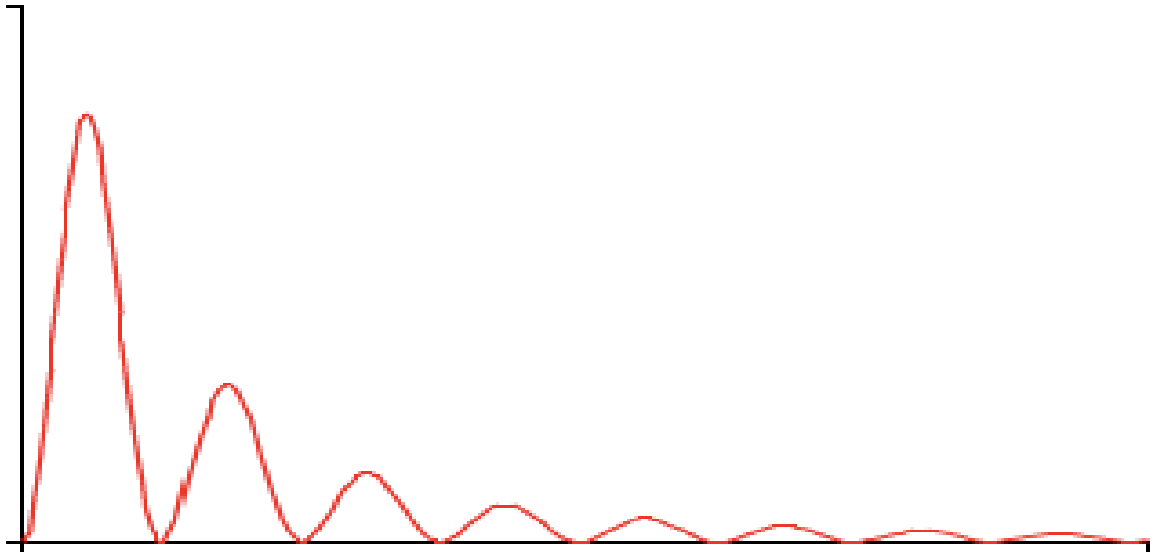
Communication for maths

Term 2, Week 3: On describing the behaviour of functions

Introduction

Example

- Consider the curve below

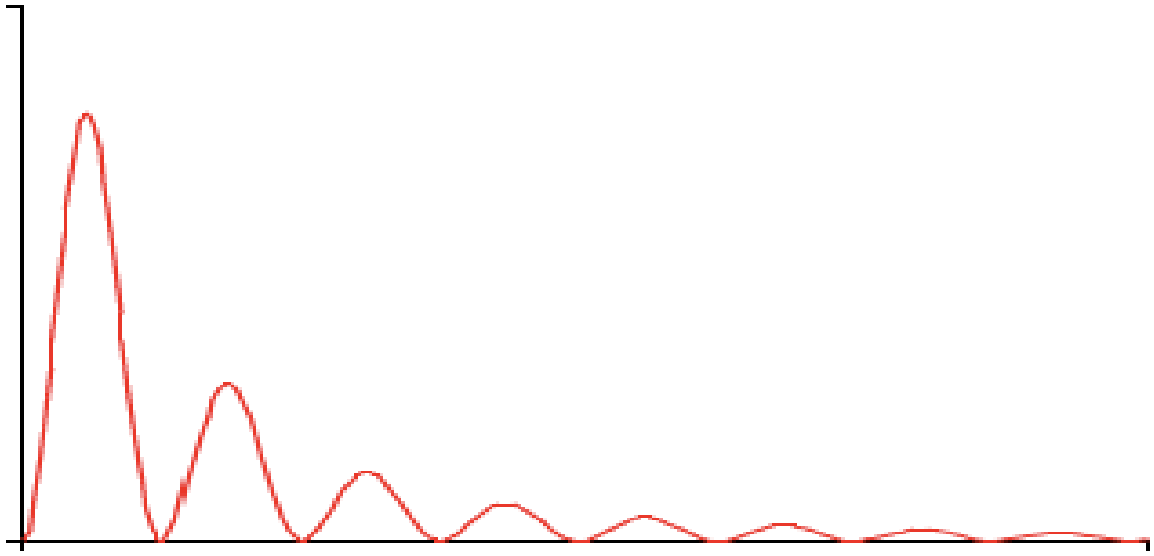


From p87, “Mathematical Writing for undergraduate students”, Franco Vivaldi, Queen Mary, University of London

Introduction

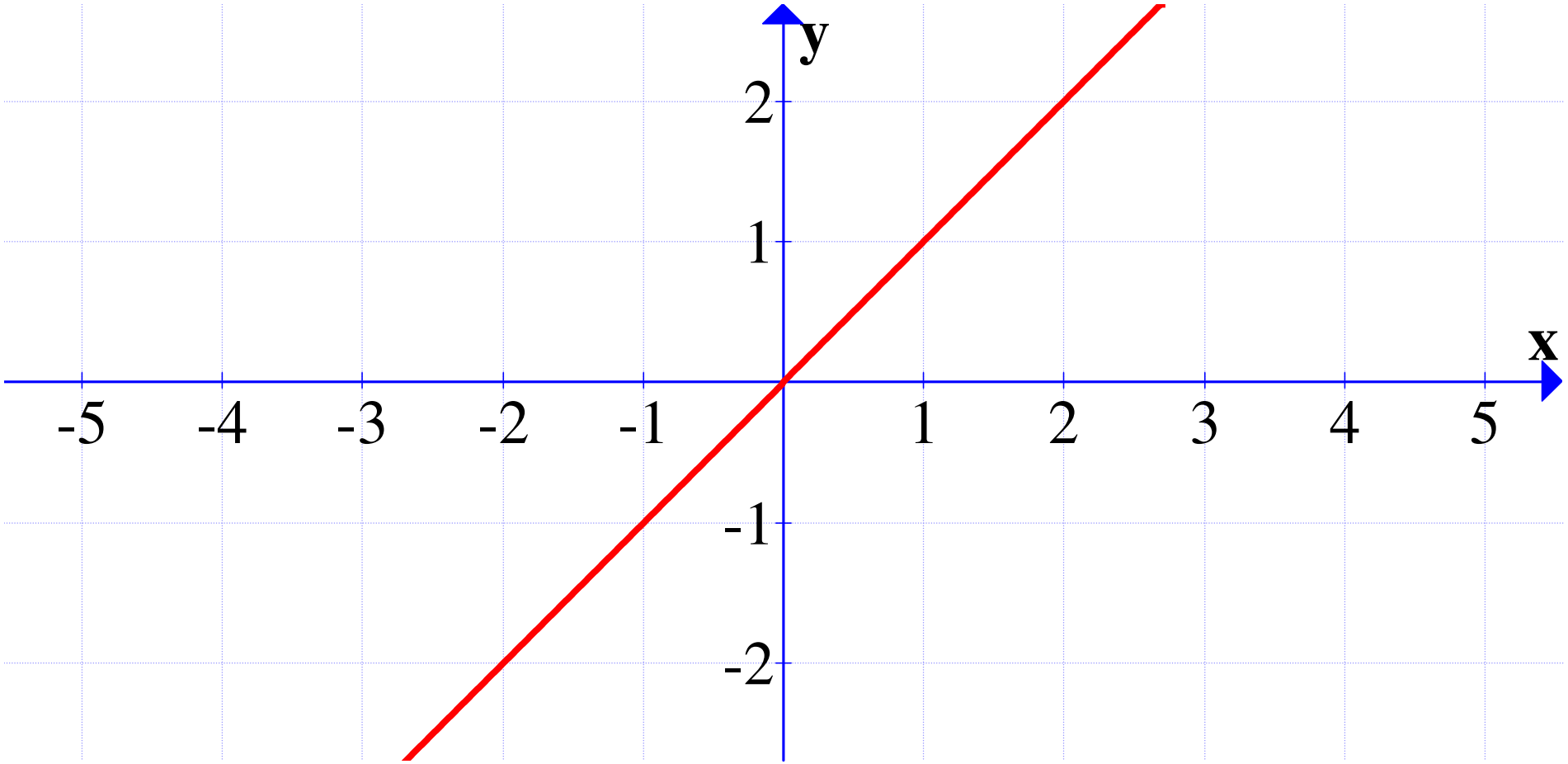
Example: We might describe this as:

This is a smooth function, which is bounded and non-negative. It features an infinite sequence of evenly spaced local maxima, whose height decreases monotonically to zero. The function has a zero between any two consecutive maxima.



Ways of speaking

Consider the following graph of $y = mx + c$



Ways of speaking

- An arithmetic description of this line is

  "y equals m times x plus c"

- A geometric description of this line is

  "This is a straight line of gradient m,
  y-intercept c and x-intercept –c/m."

Ways of speaking

So

- *Arithmetic description* : a verbalisation of the symbols.

- *Geometric description* : a description of the mathematical meaning or effect of the transformation.

Ways of speaking

Examples

1) $f(x) \rightarrow a.f(x)$

"$f(x)$ gets transformed by doing a times $f(x)$." **No**

"Multiply $f(x)$ values by a" **No**

"- - - has the effect of stretching - - -" **Yes**

Ways of speaking

Examples

1) $f(x) \rightarrow a.f(x)$

"$f(x)$ gets transformed by doing a times $f(x)$." **No**

"Multiply $f(x)$ values by a" **No**

"- - - has the effect of stretching - - - in the y-direction"

Yes

Ways of speaking

Examples

2) $f(x) \rightarrow f(x) + a$

"Here we add a to $f(x)$." **No**

"This is a plus $f(x)$" **No**

"- - - has the effect of translating - - - upwards" **Yes**

See your Ramesh/Rena's handout for more.

Ways of speaking

- We always want to speak about the behaviour of the function (conceptual description), not the mechanics of the function (arithmetic description)

- So we need appropriate terminology in order to do this (see next two slides).

Ways of speaking

- A selection of appropriate terminology. Use other terminology as necessary.

Stretch/squash	Interval	Reflect
Continuous/ Discontinuous	Translate up/down or left/right	Asymptotes (horizontal/vertical)
Curve	Bounded	Differentiable

Ways of speaking

- A selection of appropriate terminology. Use other terminology as necessary.

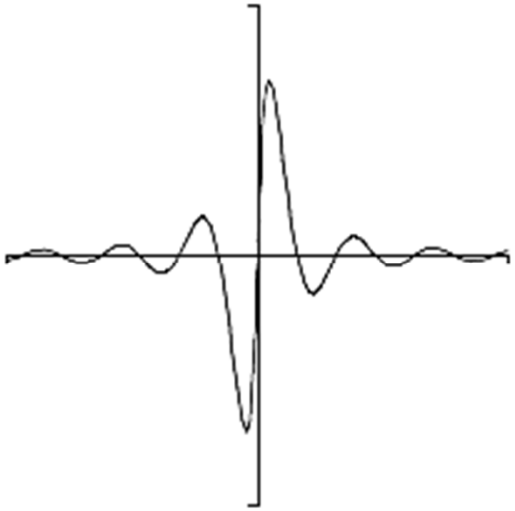
Function	Sequence	Maxima or minima
Monotonic	Roots/zeros; x or y intercepts	Step function
Concave/convex	First/second derivative	Smooth

Exercise (from F. Vivaldi; See moodle for reference)

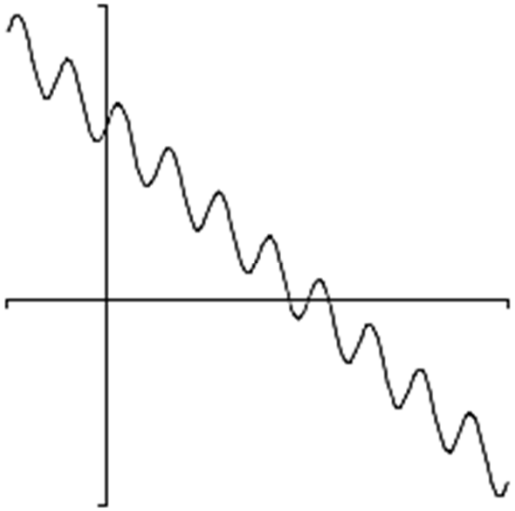
- Describe the behaviour of the following functions.

Exercise 4.7. Describe the behaviour of the following functions.

1)



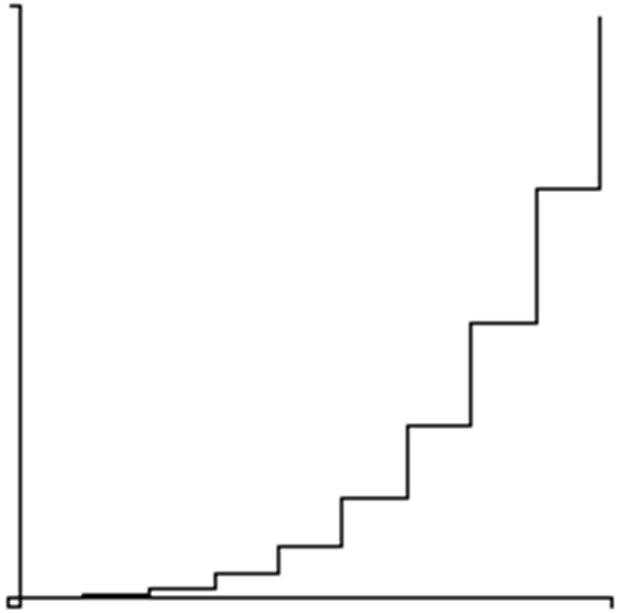
2)



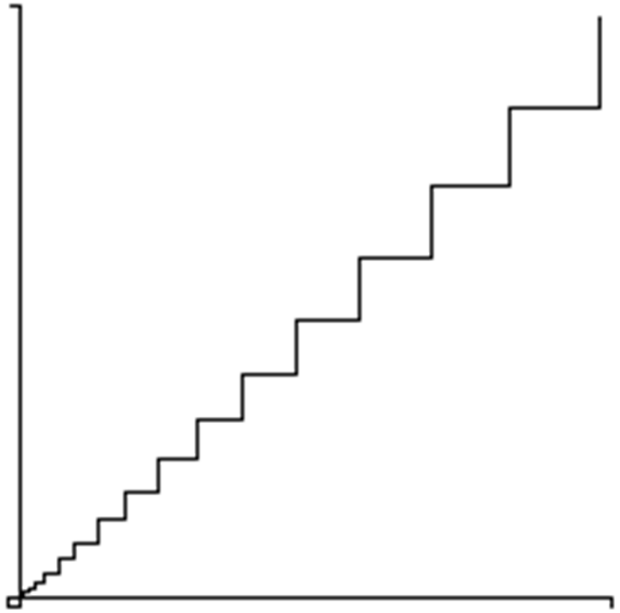
Exercise (from F. Vivaldi; See moodle for reference)

- Describe the behaviour of the following functions.

3)



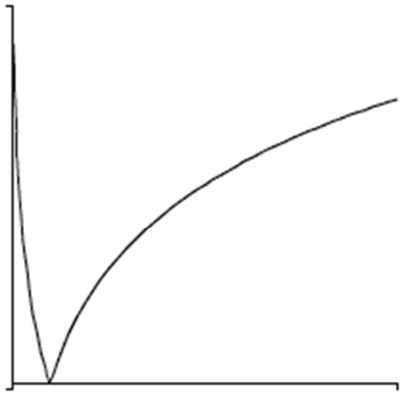
4)



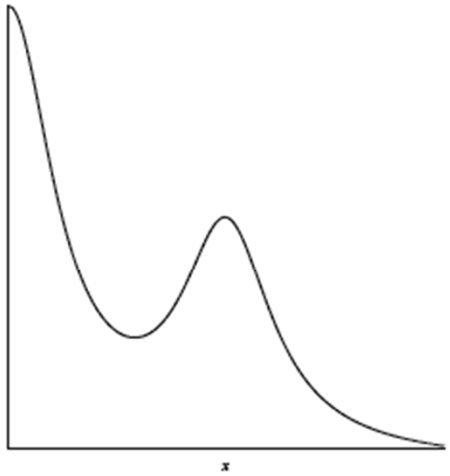
Exercise (from F. Vivaldi; See moodle for reference)

- Describe the behaviour of the following functions.

7)



8)



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