'DEF' WHAT IS CALCULUS? The study of change

Example I am driving at 50 MPH. (How quickly is my position changing)

"Derivative"

How Far Did I Travel in 2 Hours?

"Integral"

Remark: Think natural world. Even beyond biology and physics, change happens everywhere.

Our Focus will be on Functions change.

Question: What is a Function?

Examples: Think of these functions. (Check implies Fn.)

1. Graph Temp

\[ \text{Time} \quad \text{Weight} \quad \text{Age} \]
\[
\begin{array}{c|c|c|c|c|c|c}
\text{Child's wt.} & 8.1 & 22.4 & 32.1 & 38.3 & 46 & 50.1 \\
\text{Weight} & 1 & 2 & 3 & 4 & 5 & (yrs.) \\
\text{lbs.} & & & & & &
\end{array}
\]

1. Table of Values

13. Word Problems

I drove 30 MPH for 1 hr, then 50 MPH for 2 hrs.

14. Equations

\[ y = 5x^2 + 2 \]

15. "

\[ f(t) = t^2 - 4t + 3 \]

1. "

\[ x^2 + y^2 = 4 \]

MAYBE with work.

NOT a standard function
Answer: For each input quantity, you get a unique output qty.

Examples revisited:

1) Temp

\[ \text{Temp} \]

\[ 2 \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \]

2) Child has only one weight.

3) Give X then you can say what Y is.

4) Same as 4)

5) Same as 4)

6) \[ \text{Graph} \]

If you give one x-value, you get 2 y-values.

Not unique!

Remark: Graphs allow us to use vertical line test.

(i) does not pass vertical line test, (what is a nice test

of our answer/definition)

3) What is my output? Could be distance, speed,

We must determine if it is a function, then

Both

how can we study it? I use a Graph.

Graph I

Distance (miles) 130

\[ \text{Time (hrs)} \]

Graph 2

Speed (mph)

50

30

\[ \text{realistically, we cannot} \]

"jump" to 50 from 30.

but we "ideally" and ignore the problem

at that pt.
**Example 5.4: Graphs**

4. \( y = 5x^2 + 2 \)

![Graph of \( y = 5x^2 + 2 \)](image)

**Main Idea:** First get basic shape
- Always adding so always greater than 2
- \( 3, 0 \) or \( 3, \) get \( y \) 20, -2, set \( y \) so 5x^2
- Symmetric

**Remark: Completing the Square**

\[ f(t) = t^2 - 4t + 3 \]

1. Rewrite using help of coefficient in front of \( t \).
2. Check if equal. No!
3. Adjust to make equal
4. New in standard form

\[ f(t) = (t-2)^2 - 1 \]