

Reverse Engineering

TI-30XIIS Calculator

Purpose

What we want to learn :

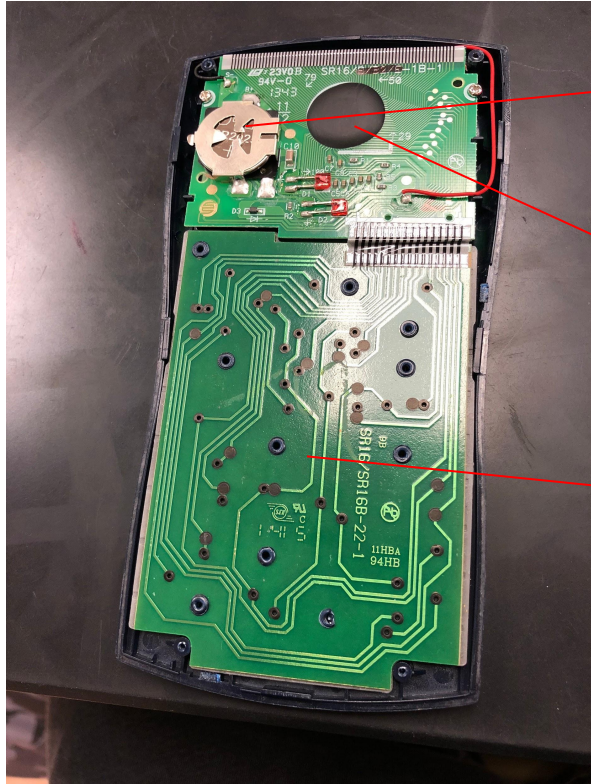
To learn how the TI-30
calculators systems work
together to display an output
when an input is typed in

Hypothesis

-How does a calculator work?

When a button is pressed on a calculator, it sends a specific electronic signal through the circuit board to calculate and display an output on the screen.

Teardown of Calculator



Lithium
Battery

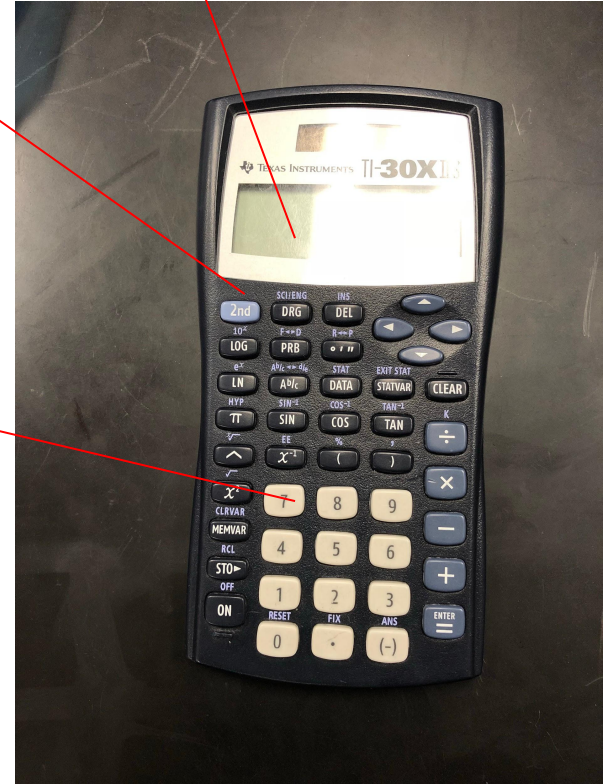
Micro-
processor

Circuits

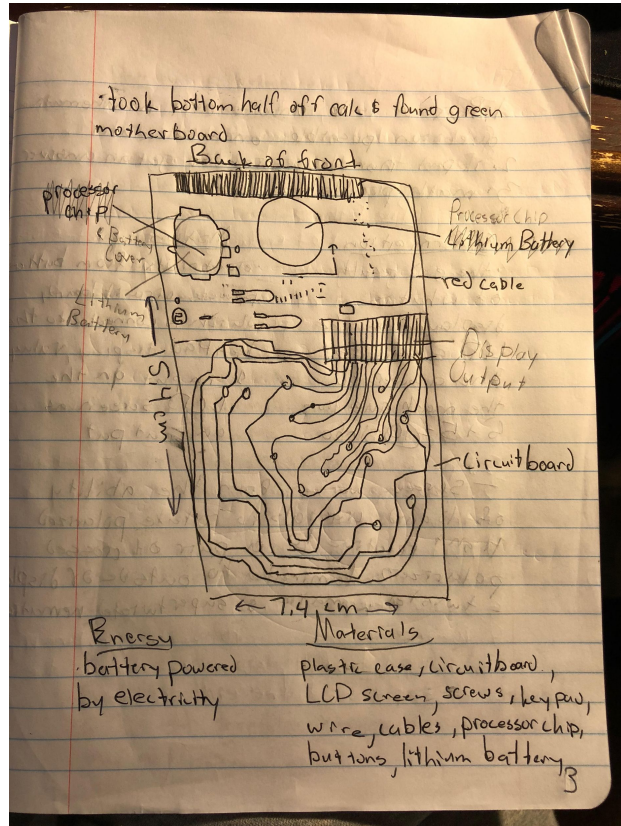
Plastic
Casing

Rubber
Buttons

LCD
Screen



Conceptual Sketch



Button Pressed



Specific circuit is completed



Data transferred to microprocessor



Microprocessor computes output



Output displayed on LCD

Materials of Broken Down Calculator

— — —

Parts of Calculator

- Plastic case
- Circuit board
- LCD Screen
- Screws
- Keypad display
- Wire
- Cables
- Microprocessor
- Buttons
- Lithium Battery

Relationship & Connections

- Electricity from lithium battery powers circuit board
- Circuit board circuits to keypad display which has the buttons
- Input value through keypad and the output appears on the LCD screen after being computed through the microprocessor
- Screws hold together plastic case.

Energy

Lithium battery powered by
electricity which transports
through device

Information

The end result of what is being
displayed on the LCD screen as the
computed numerical value.

5+5=10

Motion

Electricity from lithium battery powers the circuit board, which travels through the copper foil after inputting values and outputting an answer.



Analyzing The Elements

Functional Analysis

— — —

- Electricity from battery powers the circuit board which transports information to the LCD screen which displays numbers
- Circuit board has microprocessor, which computes inputted numerical equations

Structural Analysis

- Plastic housing allows more safety, easy transportation, and stable configuration of all parts
- Plastic cover can be put on calculator to protect the cover further
- 4 screws keep outside hardware together
- LCD screen receives and converts signals from circuit board
- Rubber buttons in cb send signals to microprocessor
- Lithium Battery provides power to entire device

Material Analysis

- Hardshell cover made of plastic - lightweight, protection, and easy transportation
- Circuit board made of fiberglass epoxy resin with copper foil bonded together on both sides
- Resin provides sturdy base for circuit board, which is electrically conducted through the copper foil
- Copper has highest electrical conductivity of all metals

Manufacturing Analysis

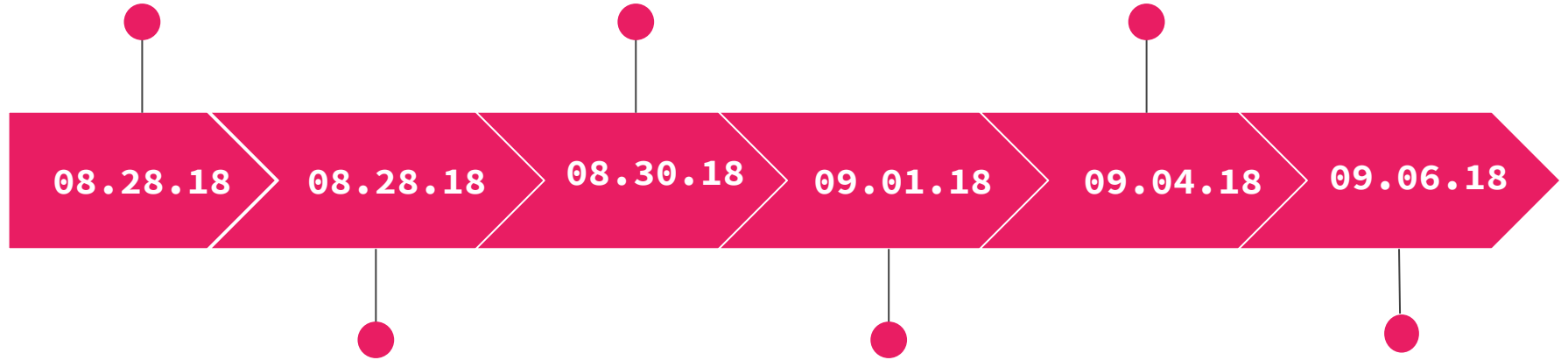
- Fiberglass epoxy resin and copper filaments are layered and then pressed at 340 degrees F for an hour to seal
- Holes are drilled, some are lined with copper
- Copper is laid out in the shape of the circuits
- Individual pieces are soldered on by machines, bigger ones are added manually
- This is an example of forming and joining methods

Schedule

Determine
purpose of
activity

Take apart item
and sketch

Choose one item
to focus on



Bring in
something to
take apart

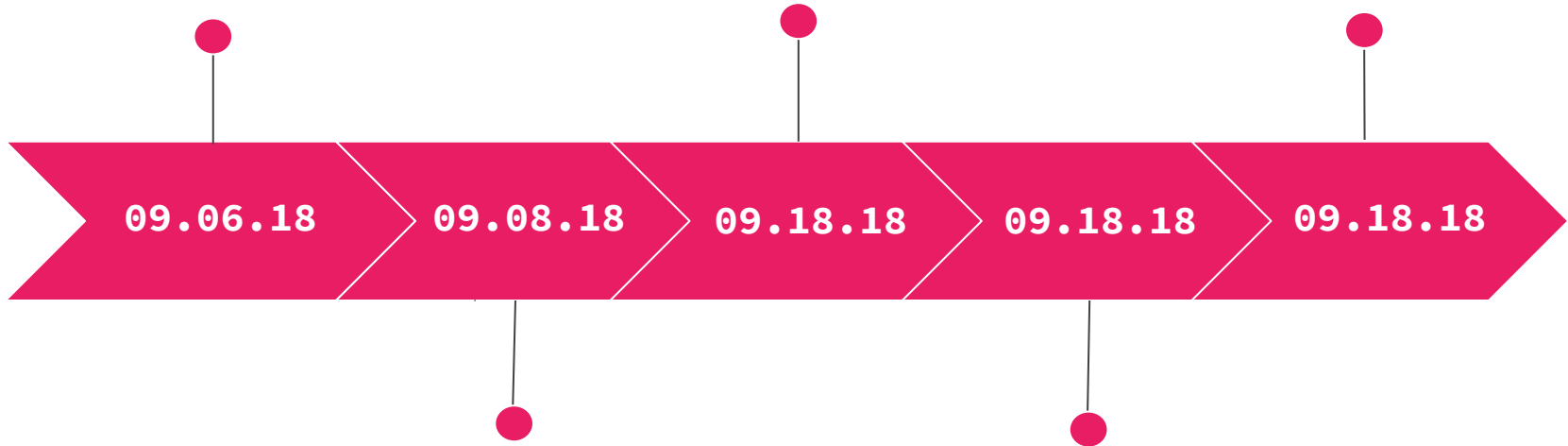
Peer review
sketches

Take picture
of item (Ben)

Create hypothesis

Combine all information into a report (Lara & Lara)

Present report



Complete step 4 on website

Create visual representation (Ben & Caitlin)

Conclusion

Through Reverse
Engineering...

- Confirmed hypothesis
 - Learned :
 - pressing a button completes a circuit -> signal sent -> corresponds to a specific output on LCD screen
 - What materials were used and how they fulfill requirements
 - Microprocessor - main component in computing process
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THANK YOU FOR LISTENING & WATCHING