

# Increasing Equity and Public Access to Breakthrough Equations Found in Medical Research Through User Friendly Interfaces

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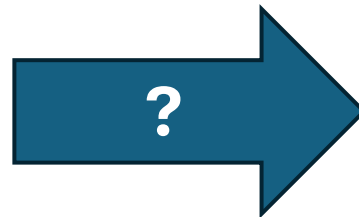
# Background

- Over 5.14 million scientific papers are published per year.
- Often a great need to provide public access to such research
- Example: Body Roundness Index (BRI)
- [Body Roundness Calculator](#)

# Problem

- Options are limited for publishing research equations to the public
- How to go from this to that?

Model coefficients for %FM model		
Term	Coefficient	p-value
Intercept	590.634	0.678
Age	-55.138	<.0001*
Height	-47.705	<.0001*
Weight	0.785	<.0001*
Waist	16.507	0.0015*
WE	28.371	0.985
Sex	6511.553	<.0001*
R1	3.823	<.0001*
R3	0.482	0.174
R4	-1.227	<.0001*
Age*Age	0.006	<.0001*
Age*Age*Age	0.000	<.0001*
Height*Height	0.062	0.0002*
Height*Height*Height	0.000	0.0002*
Age*Height	-0.007	<.0001*
Age*Weight	0.010	<.0001*
Age*Waist	0.311	<.0001*
Age*WE	55.608	<.0001*
Age*Sex	-0.052	<.0001*
Age*R3	0.001	0.888
Height*Weight	-0.003	0.0006*
Height*Waist	0.000	0.937
Height*WE	36.626	<.0001*
Height*Sex	0.222	0.129
Weight*Waist	-0.001	0.377
Weight*Sex	-0.858	<.0001*
Weight*R1	-0.041	<.0001*
Waist*WE	-14.807	0.0022*
Waist*Sex	-31.213	<.0001*
WE*Sex	-6509.418	<.0001*
Sex*R1	-6.407	<.0001*
Sex*R3	-2.243	<.0001*
Age*Weight*Waist	0.000	<.0001*
Age*Waist*WE	-0.303	<.0001*
Age*Sex*R3	0.025	0.0028*
Height*Waist*Sex	0.007	0.0103*
Weight*Waist*Sex	0.006	<.0001*
Weight*Sex*R1	0.067	<.0001*
Waist*WE*Sex	29.163	<.0001*



## Body Roundness Calculator

This calculator calculates the shape of your body roundness from values.

**Demographics**

Sex:  Race:  Age:

Units:  Height:  cm Weight:  kg Waist Circumference:  cm Hip Circumference:

**Results**

**BMI**

Normal 22

**VAT**

The calculator cannot provide information for your demographic. Value too low.

**Fat Percent**

Normal 6.2%

**Roundness**

Normal 0.7

Healthy Range

Your Roundness

# Solution

- Easy-to-use tool for creating user-friendly mobile-friendly interfaces.

**Components**

Row

Switcher

Section

Arial ▾ Header ▾ B I U

Text Display

Selection  
Choose from options ▾

Numeric Input  
560.42 cm<sup>2</sup> ▾

Value Range  
35 lb ▾  
High Risk

Toggle

To get started, drag and drop a component into the grid.

Data

**Equations**  
Waist Eccentricity  
Complex Value

**Complex Value** Units: kg m<sup>-2</sup> [Change Units](#)

Subtraction

IF - Numeric

Use Hip AND Weight > 40.0

THEN

Hip Circumference

ELSE

Height + Weight

Division

Exponent

2

20

Values

Weight

Height

Waist Circumference

Hip Circumference

Sex

Use Hip

Numeric

String

Conditional

Functions

IF - Numeric

IF - String

THEN

ELSE

>

<

≤

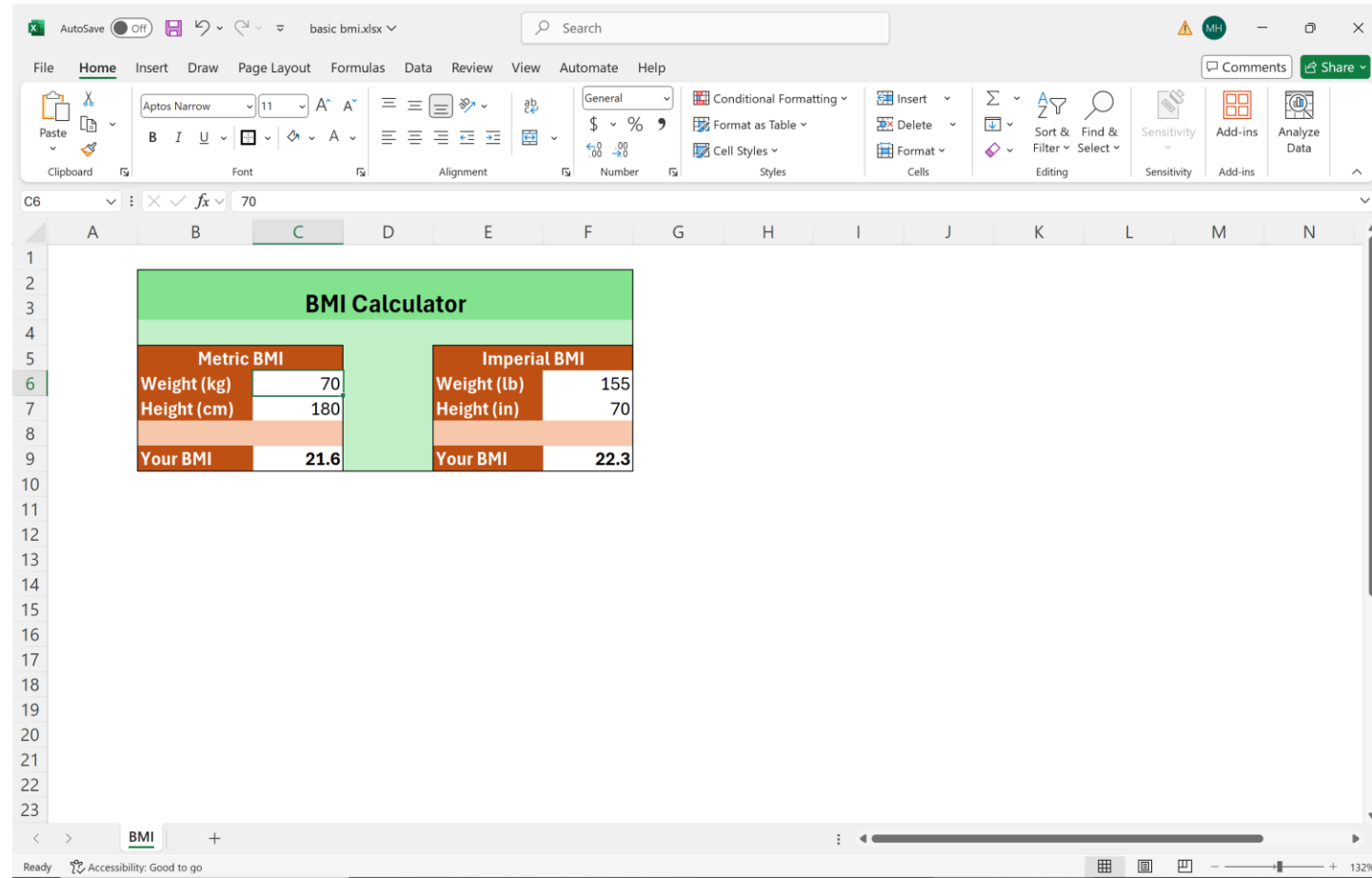
≥

Data

# Analysis of Problem – Current Options

# Option 1 – Excel Spreadsheets

- Easy to create
- Supports advanced functionality
- Cluttered Interface
- Difficult to Use on Mobile Devices
- Requires Paid Software



# Option 2 – Custom Programming

- Can have great user interfaces
- Supports complex functionality
- Limitless customization
- Need programmer for building and any changes
- Long development time
- Potential UI issues
- Hosting costs

**Body Roundness Calculator** **pb** Pennington Biomedical Research Center  
Louisiana State University

This calculator calculates the shape of your body roundness from values.

**Demographics**

Sex:  Race:  Age:

Units:  Height:  cm Weight:  kg Waist Circumference:  cm Hip Circumference:

**Results**

**BMI**

Normal 22

**VAT**

The calculator cannot provide information for your demographic. Value too low.

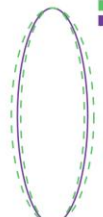
**Fat Percent**

Normal 6.2%

**Roundness**

Normal 0.7

Healthy Range  
Your Roundness



# Solution – Calculator Generator



# The Solution

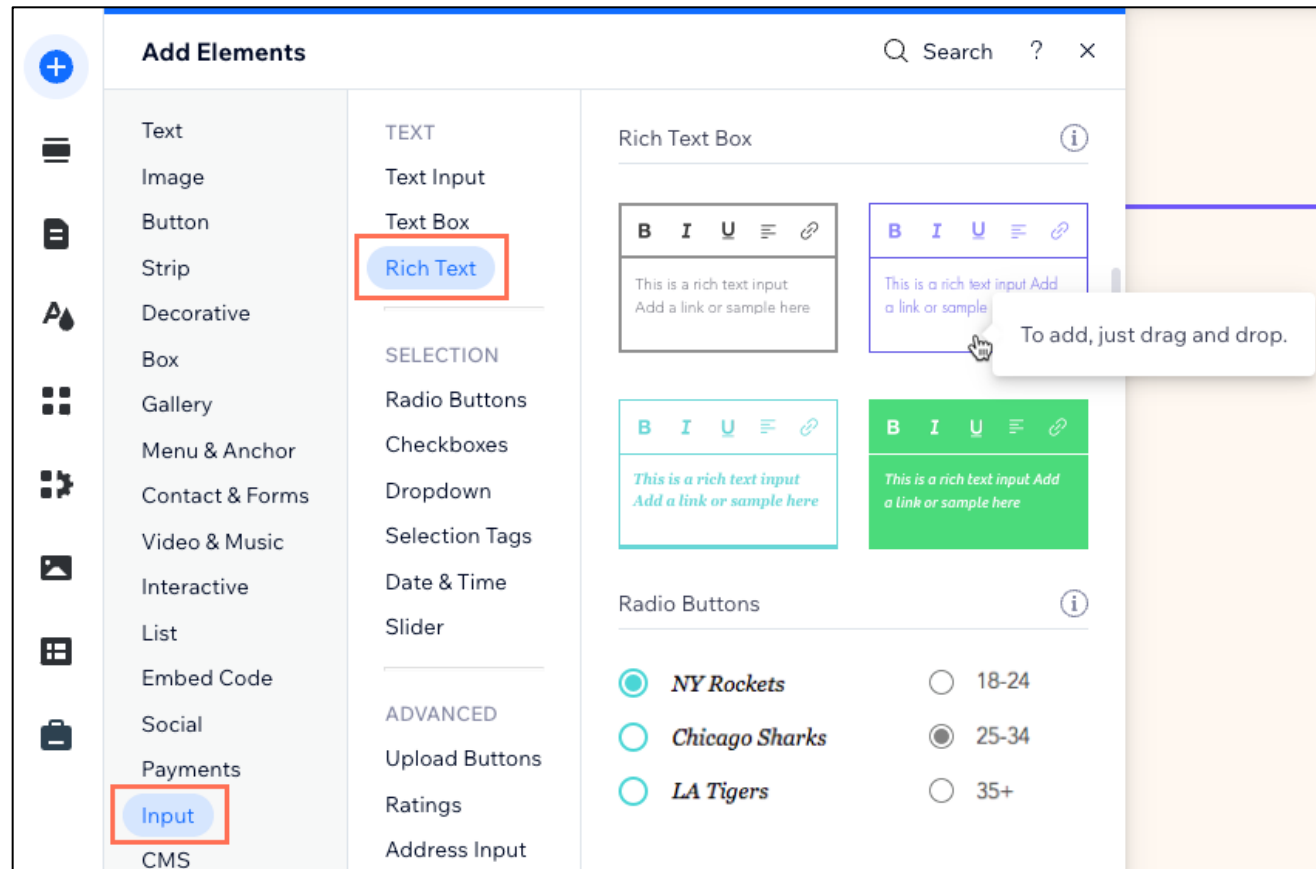
- Calculators often have highly similar features
- Medical calculator will have height, weight, etc. and output range of a value, chart etc.
- Can make the components and allow users to mix-and-match

# Key Stakeholders

- Must consider needs of:
- Researchers
  - Ease of use
  - Data protection
  - Advanced functionality
- End users
  - Mobile friendly
  - User friendly
  - Accessible

# Inspirations

- WYSIWYG website editors



# The Solution

- A general calculator generator which supports the creation of a wide range of tools.

**BMI Calculator**

Height  cm ▾

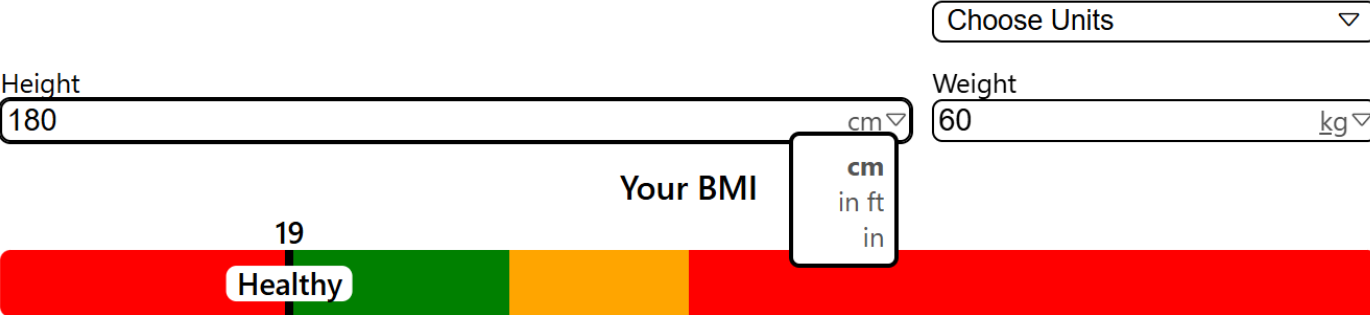
Weight  kg ▾

**Your BMI** 19

**Healthy**

**Choose Units** ▾

**cm**  
in ft  
in

The image shows a BMI calculator interface. At the top, it says "BMI Calculator". Below this, there are two input fields: "Height" with the value "180" and a unit dropdown menu showing "cm", and "Weight" with the value "60" and a unit dropdown menu showing "kg". Below these inputs, it says "Your BMI" followed by the value "19". Underneath the BMI value, there is a horizontal bar divided into three colored segments: red on the left, green in the middle, and red on the right. The word "Healthy" is written in white text on the green segment. To the right of the BMI value, there is a small dropdown menu showing "cm", "in ft", and "in".

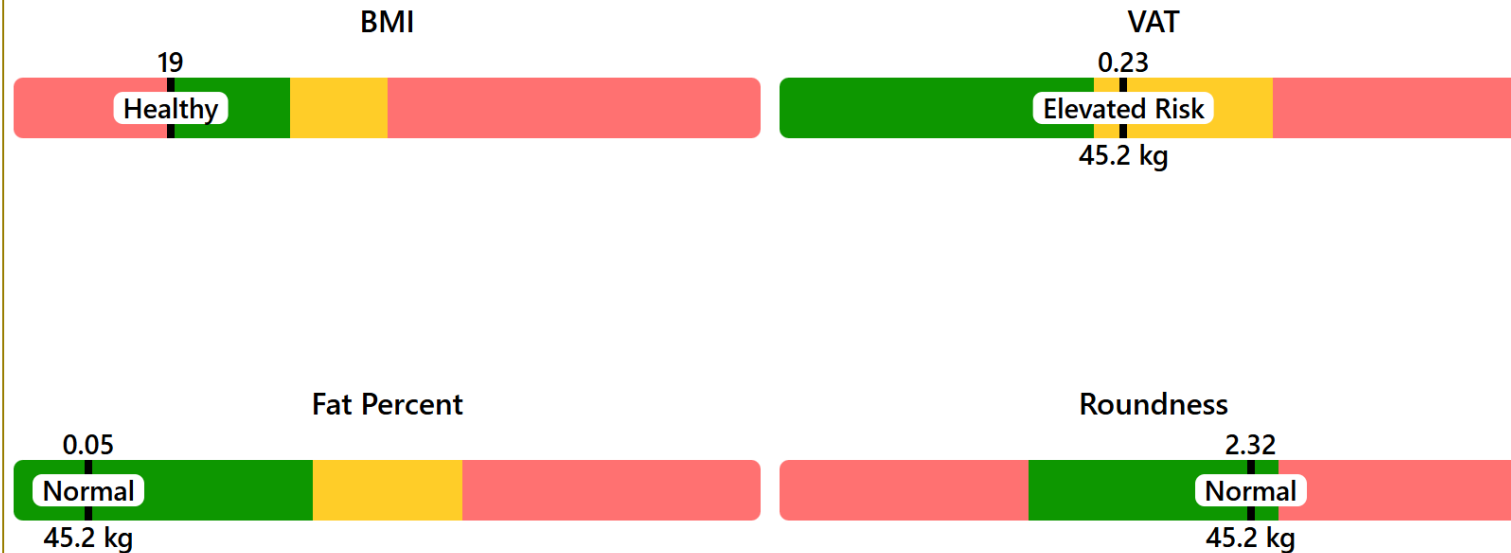
# Body Roundness Calculator

This calculator calculates the shape of your body roundness from values. Important: the equations used here are not the actual equations and values are for demonstration only.

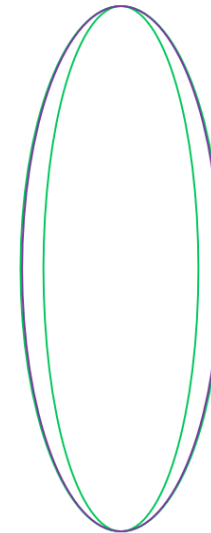
## Demographics

Sex	Male	Race	White	Age	30
Choose Units	Height	Weight	Waist	Hip Circumference	
	180 cm	60 kg	80 cm	60 cm	<input type="checkbox"/>

## Results



Healthy Range  
Your Roundness



# Pythagorean Theorem Demonstration

Enter the leg lengths of the triangle to visualize the pythagorean theorem.

Leg A

Leg B

**The third leg of the triangle**

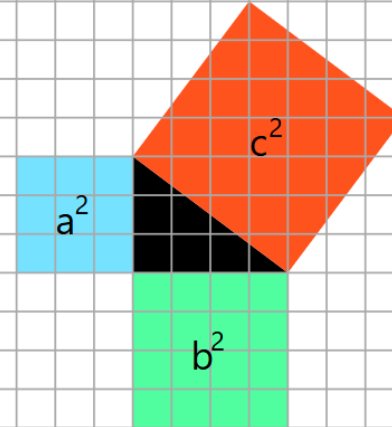
$$a^2 + b^2 = c^2$$

$$(3)^2 + (4)^2 = c^2$$

$$9 + 16 = c^2$$

$$25 = c^2$$

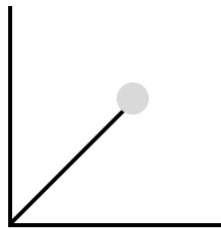
$$c = 5$$



# Parabolic Motion Simulator

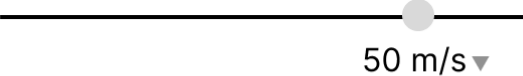
## Parameters

Launch Angle

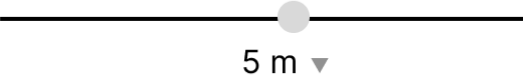


45 deg ▼

Initial Velocity



Release Height



## Calculations

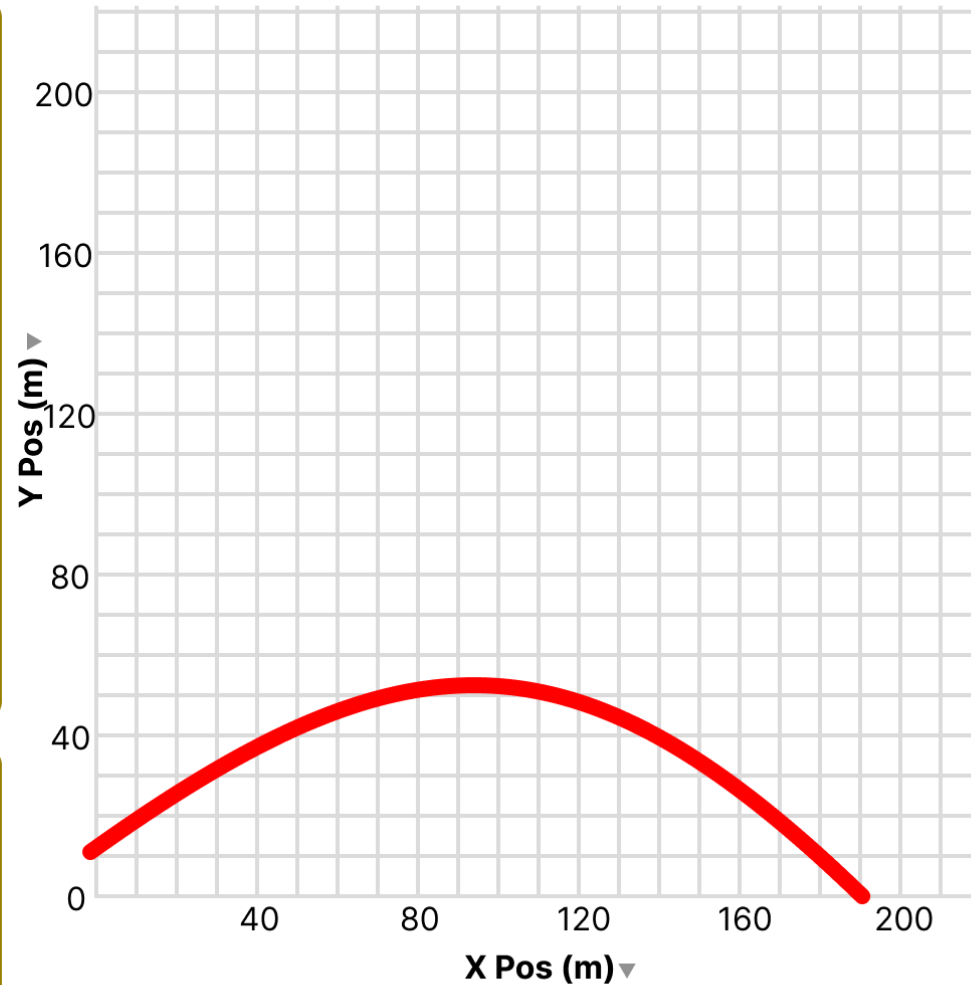
### Calculations Initial Velocity

$$\begin{aligned}v_x &= v_i \cdot \cos(\theta) \\ &= 50 \text{ m/s} \cdot \cos(45 \text{ deg}) \\ &= 35.36 \text{ m/s}\end{aligned}$$

$$\begin{aligned}v_y &= v_i \cdot \sin(\theta) \\ &= 50 \text{ m/s} \cdot \sin(45 \text{ deg}) \\ &= 35.36 \text{ m/s}\end{aligned}$$

### Time in air

$$\begin{aligned}d &= d_i + v_{i,y} \cdot t + 0.5 \cdot a \cdot t^2 \\ 0 &= 5 \text{ m} + 35.36 \text{ m/s} \cdot t + 0.5 \cdot -9.8 \text{ m/s}^2 \cdot t^2 \\ t &= \end{aligned}$$




# The Solution

- A general calculator generator which supports the creation of a wide range of tools.
- Templates will help make the creation process easy while supporting varied functionality.
  - e.g. medical calculator, middle school math, financial planner




# Creating a calculator






- Step 1: Specify the values to collect


**Race** 

Type  


String 

**Possible Values**


White   
African American   
Asian   
Pacific Islander   
Native American   
[+ Add Value](#)

**Height** 


Datum Type  


Numeric 

Must the user provide this value?  

Required 


Units 

m 


1 

Default Value  

1.8 m

Lower Bound 


1 m

Lower Bound 

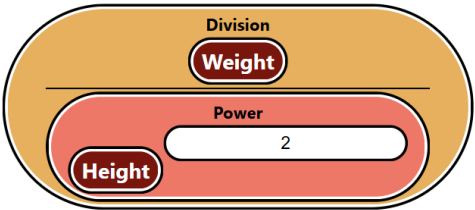
8 m

# Creating a calculator

- Step 2: Specify the output equations

**BMI** 


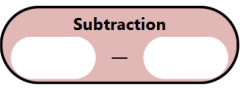
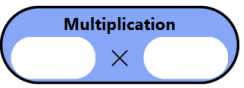

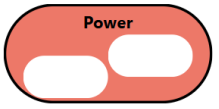
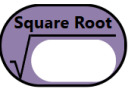
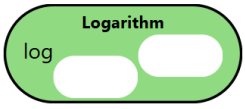
Units

= 

**Values**

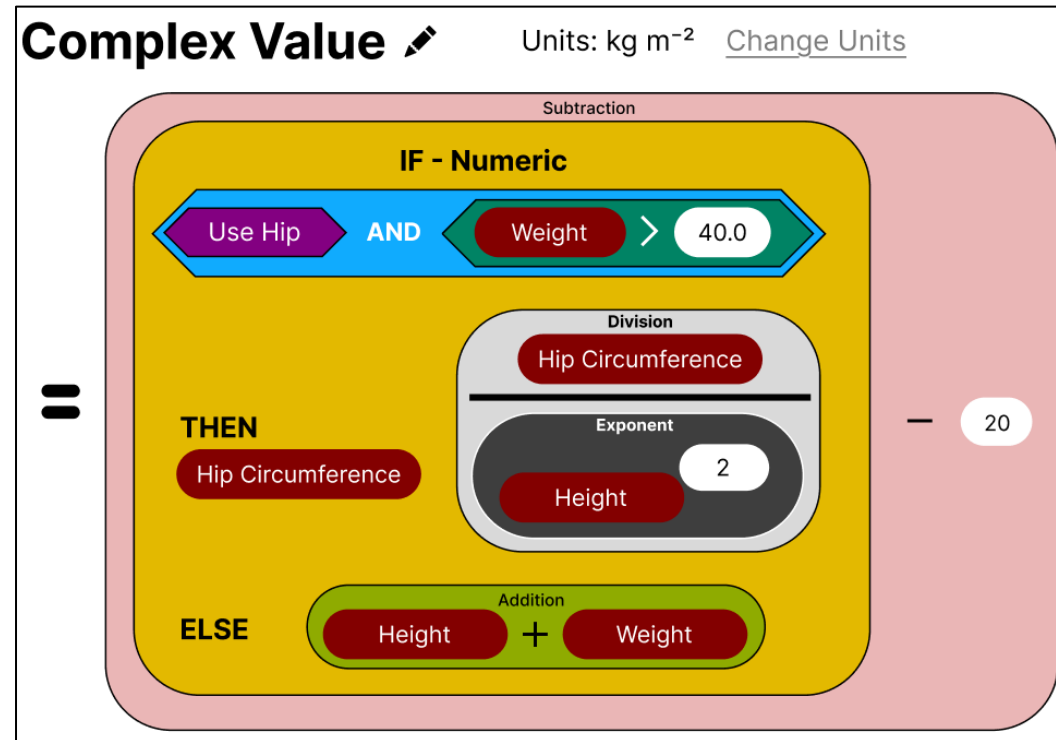
- Height
- Weight
- BMI
- New Equation 2

**Functions** Number Conditional

- Addition 
- Subtraction 
- Multiplication 
- Division 
- Power 
- Square Root 
- Logarithm 

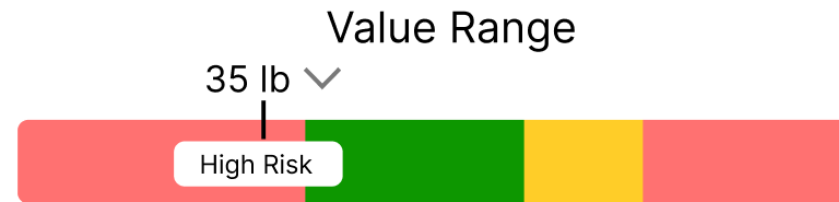
# Creating a calculator

- Step 2: Specify the output equations
- Complex values are supported



# Creating a calculator

- Step 3: Create your layout



## Edit Data Ranges

**IF - Ranges**

Sex = Male

**THEN**

**Range 1**

Display Text: At Risk

Display Color:

Lower Bound: 10.0

Upper Bound: 15.0

**Range 2**

Display Text: Healthy

Display Color:

Lower Bound: 15.0

Upper Bound: 40.0

[+ Add Range](#)

**ELSE**

**Range 1**

Display Text: At Risk

Display Color:

Lower Bound: 10.0

Upper Bound: 15.0

**Range 2**

Display Text: Healthy

Display Color:

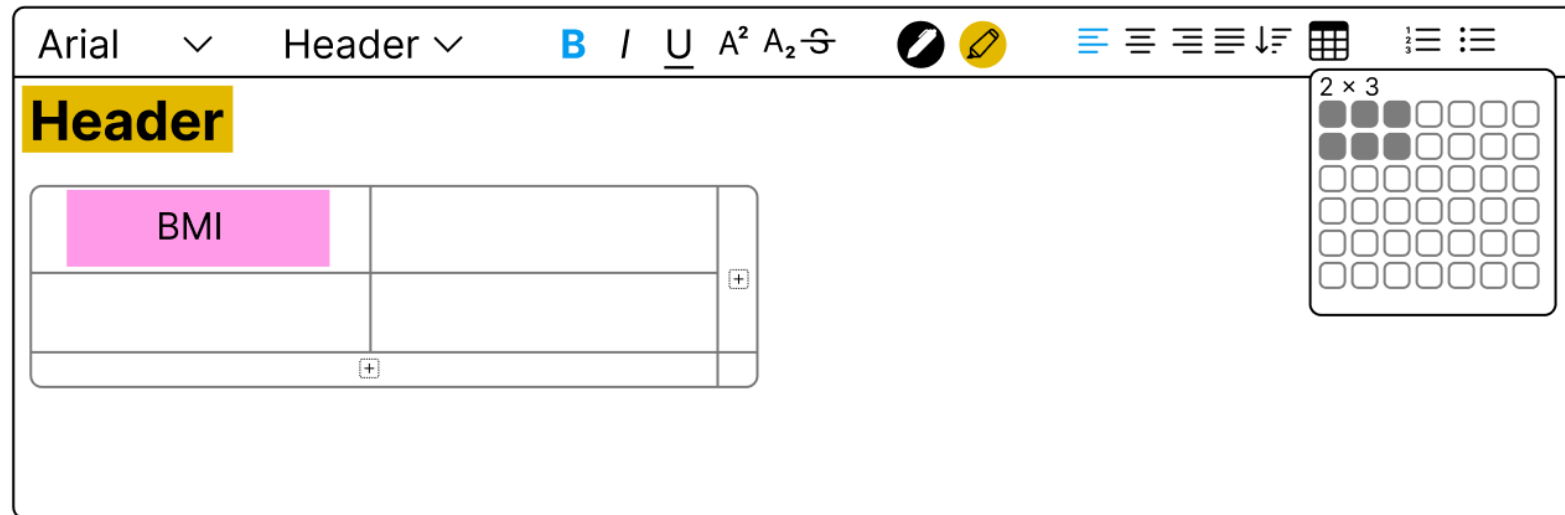
Lower Bound: 15.0

Upper Bound: 40.0

[+ Add Range](#)

# Creating a calculator

- Step 3: Create your layout



# Creating a calculator

- Step 3: Create your layout

The input value

60

ft 6

in ▾

**feet (ft) inches (in)**  
inches (in)  
centimeters (cm)

# Creating a calculator

- Step 3: Create your layout

Multiple selection input 2 open

3 selections

▼

Option A

☒

Option A

☐

Option A

☐

Option A

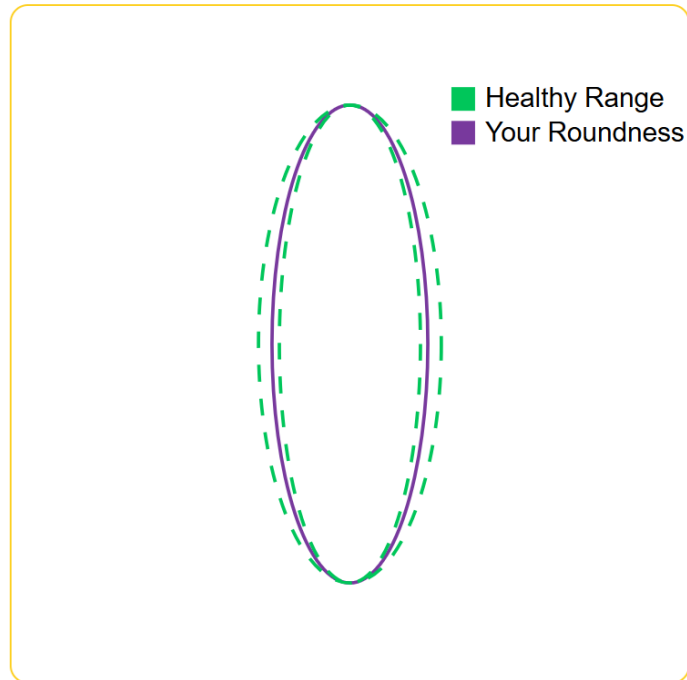
☒

Option A

☒

# Creating a calculator

- Step 3: Create your layout





# Creating a calculator

- Step 3: Create your layout

## Graph

Done

### Bounds

x-Min

-10

x-Max

10

x-Step

1

y-Min

-10

y-Max

10

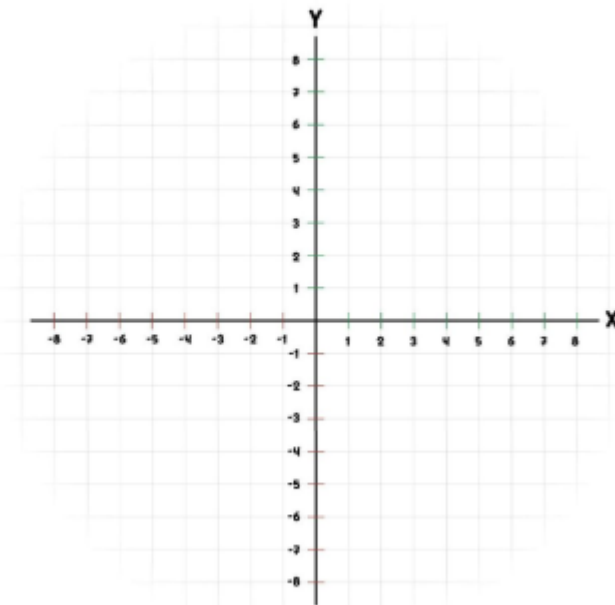
y-Step

1

Allow user to change viewport

















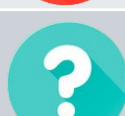

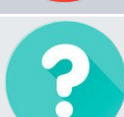

### Equations



# Creating a calculator

- Step 4: Share your calculator
- Can be password protected for private sharing during research
- Collaboration
- Get a link and QR code, no need to host
- Embeddable

# Comparison

Feature	Calculator Generator	Excel	Programming
Advanced Features			
Cost			
Researcher Ease of Use			
Development Time			
End User Ease of Use			
Modifications after Publication			

Live Demo – BMI

# Select a Calculator Template

Basic

Create a basic calculator

Medical

Useful for providing medical inputs and outputs

Financial

Useful for financial planning

Geometry

Useful for demonstrating geometry

## Components

Section

Toggle



Selection

Choose from options



Numeric Input

560.42

cm<sup>2</sup>

The value for this is

35 lb

High Risk

45%

Arial



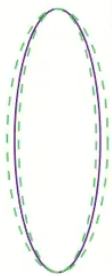
Header



**B**

U

Text Display



Healthy Range  
Your Roundness

To get started, drag and drop a component onto the grid.

Data

Equations

Layout

Run

# BMI Calculator

Numeric Input

5 ft 10.9 in ▾

Numeric Input

70 kg ▾

Ranges

21.6

Normal

cm  
ft in  
in

# Future Work

- Polish up code
- Reach out to researchers, offer to create calculators
- Advanced functionality
  - Server functions integration
  - AI presets
- Custom user components
- Import from Excel