



## What To Do

1. Person 1 should hold the ruler vertically at the top end between their thumb and index finger. The ruler should be held away from the body.
2. The person who wishes to test their reflexes (person 2) should put his/her thumb and index finger around the ruler at the bottom end (the 0 mark) but not touch it.
3. Person 1 drops the ruler without warning.
4. Person 2 tries to catch the ruler where it is caught.
5. Repeat at least 3 times and get the average of the three measurements where the ruler was caught.
6. The distance (cm) the ruler falls before being caught (if at all), is a measure of their reflexes. Check the chart to see how fast you reacted.





## What's happening

**Reaction time** is a measure of how quickly an organism responds to some sort of stimulus – a change in the environment that an organism reacts to. The ruler experiment is testing reaction time and voluntary movement.

A **reflex** is an involuntary response that the body uses to protect itself. A reflex is faster than a reaction. Examples include blinking, withdrawal (i.e. when something is hot), or the rubber mallet below your knee at the doctor office (patellar reflex).

The nervous system helps information travel through your body. It consists of your five senses, your brain, your spinal column, and the nerves that connect them all together. As the ruler drops, your eyes send a message to your cerebrum in your brain through your nerves. Your cerebrum sends this information to the cerebellum, which then decides what to do. The cerebellum sends this decision as a message through other nerves to the arm and hand, activating the muscles used to catch the ruler. Of course, all this takes time!

The time it takes from when your eye first notices the ruler to when your arm catches the ruler is an example of reaction time. Even though stimuli travel very quickly along your nervous system as messages, your body doesn't react instantly.





## Reaction Time Calculation

1. Use the equation below to solve for time
2. Plug in the distance the ruler fell (check your units!)
3. Calculate your reaction time
4. Convert your reaction time to milliseconds
5. Plot your result in the chart
6. What are your observations on the results?

$$d = \frac{1}{2} g * t^2$$

t = reaction time (s)    d = distance the ruler fell (m)  
g = acceleration of gravity (9.8m/s<sup>2</sup>)





## REACTION TIMES

Distance (cm)	Time (seconds)
1	0.045
2	0.064
3	0.078
4	0.090
5	0.101
6	0.111
7	0.120
8	0.128
9	0.136
10	0.143
11	0.150
12	0.156
13	0.163
14	0.169
15	0.175
16	0.181
17	0.186
18	0.192
19	0.197
20	0.202

Distance (cm)	Time (seconds)
21	0.207
22	0.212
23	0.217
24	0.221
25	0.226
26	0.230
27	0.235
28	0.239
29	0.243
30	0.247
31	0.252
32	0.256
33	0.260
34	0.263
35	0.267
36	0.271
37	0.275
38	0.278
39	0.282
40	0.286

$$t = \sqrt{\frac{2d}{g}}$$

$t$  = reaction time

$d$  = distance the ruler fell

$g$  = acceleration of gravity (9.8 m/s/s)



## REACTION TIMES (MILLISECONDS)

Distance (cm)	Time (milliseconds)	Distance (cm)	Time (milliseconds)
1	45	21	207
2	64	22	212
3	78	23	217
4	90	24	221
5	101	25	226
6	111	26	230
7	120	27	235
8	128	28	239
9	136	29	243
10	143	30	247
11	150	31	252
12	156	32	256
13	163	33	260
14	169	34	263
15	175	35	267
16	181	36	271
17	186	37	275
18	192	38	278
19	197	39	282
20	202	40	286

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