Author 1 _____

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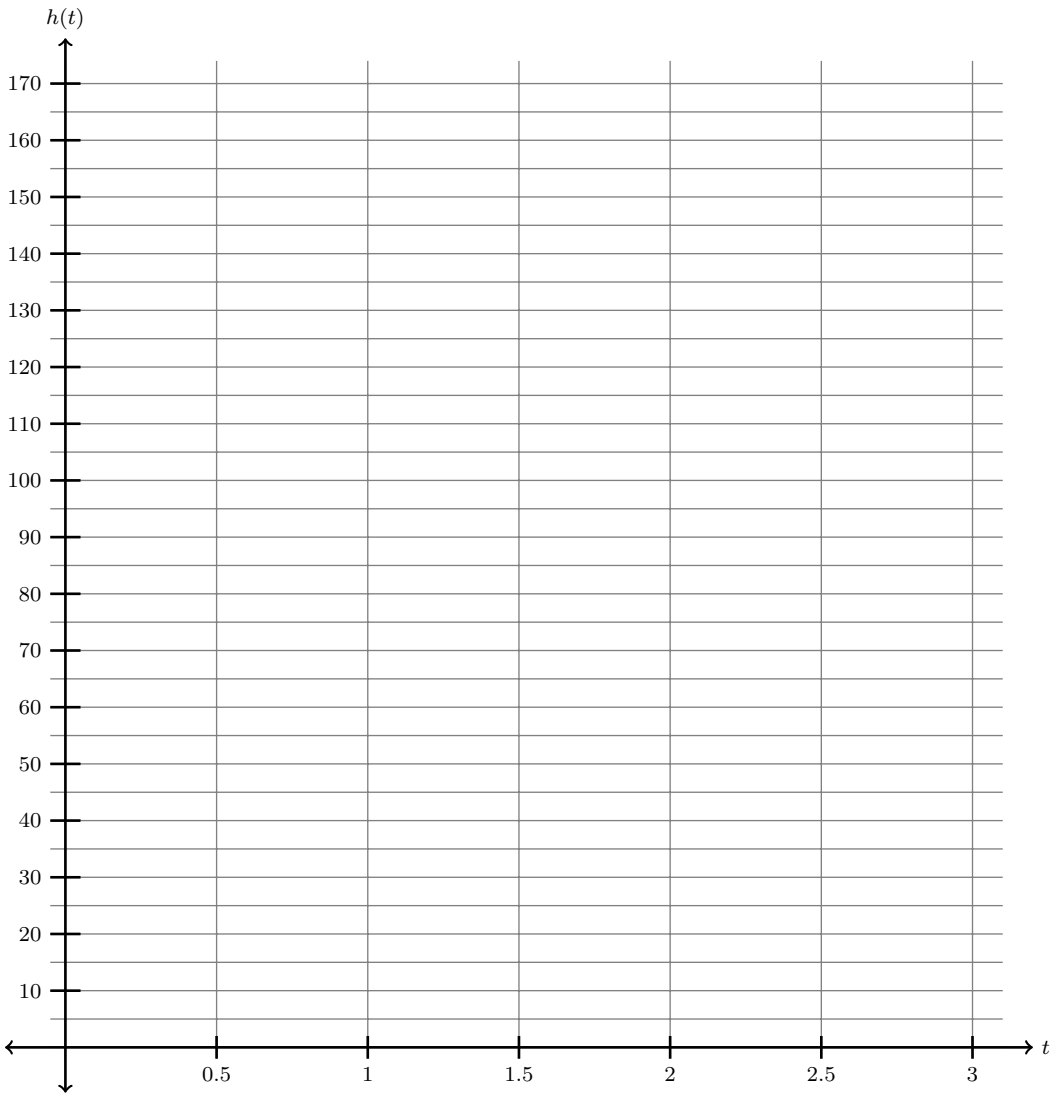
02 – Introduction to Tangents

1. We are going to revisit the ball throwing example from last time. Here's the story again...

My friend and I are slightly bored and decide to figure out how fast I can throw a ball up in the air. We find a baseball and a tall apartment building. The building will help us measure since each level of a typical residential building is 10 feet tall. I throw the ball straight up while my friend takes a video. Reviewing the video, we build the following table, which lists the height $h(t)$ of the ball at a given time t measured in seconds since I threw the ball.

t (in seconds)	0	0.5	0.9	1	1.1	1.5	2	2.5	3
$h(t)$ (in feet)	6	52	83.04	90	96.64	120	142	156	162

(a) Plot the data from the table on the graph below, and sketch the graph of $h(t)$.



(b) **Draw** the *secant line* that passes through $(1, h(1))$ and $(2, h(2))$ on the graph below, and **find the slope of this line**.

The slope of this secant line is

(c) **Draw** the *secant line* that passes through $(1, h(1))$ and $(1.5, h(1.5))$ on the graph below, and **find the slope of this line**.

The slope of this secant line is

(d) **Draw** the *secant line* that passes through $(1, h(1))$ and $(1.1, h(1.1))$ on the graph below, and **find the slope of this line**.

The slope of this secant line is

Below is the table of average velocities you found before.

Time Interval	Avg. Velocity
[0,1]	84
[0.5,1]	76
[0.9,1]	69.6
[0.99,1]	68.16

Time Interval	Avg. Velocity
[1,2]	52
[1,1.5]	60
[1,1.1]	66.4
[1,1.01]	67.84

(e) How are the *slopes* you found above related to the *average velocities*? Try to explain.

(f) Imagine you zoomed in "a lot" on the point $(1, h(1))$. The graph would probably look a bit like a line. **Draw** the line you are imagining; this is called the *tangent line* to the graph at the point $(1, h(1))$. What do you think the slope of this line represents and why?