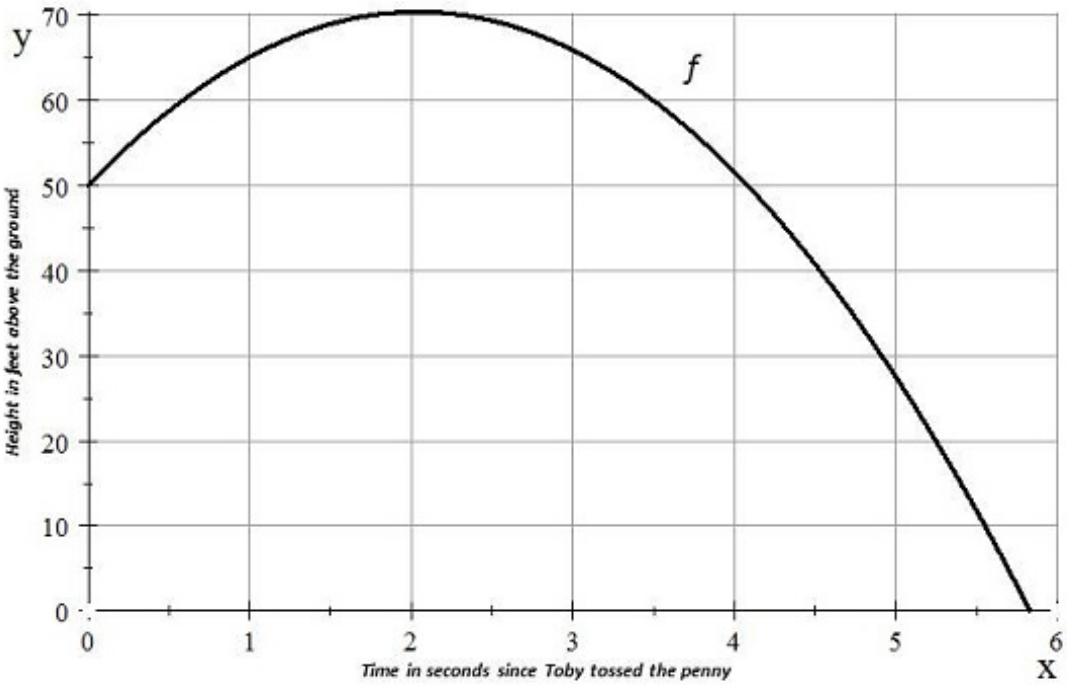
TANGENT LINES AND SECANT LINES

Toby is standing on top of a five storey building. He leans over the edge of the building and tosses a penny straight up into the air, then steps back and watches it fall to the ground. The graph below shows the height in feet of the penny above the ground as a function of the time in seconds since Toby tossed the penny.



Problem 1. Does the graph of f show the *actual* path that the penny took as it fell to the ground? Explain your answer.

Problem 2. Locate the ordered pair $(3, 65.9)$ on the figure above. What is the meaning of this point in the context of this problem?

Problem 3. On the graph shown above, draw what you think the *tangent line* to the graph of f should be at the point $(3, 65.9)$. Why did you draw the line that you did?

Problem 4. Use the grid provided to estimate the slope of your tangent line. Explain how you found the slope.

Problem 5. What units would the slope of your tangent line have? What do you think the meaning of this slope would be in the context of this problem?

Problem 6. What is the average rate of speed for the penny on the time interval $1 \leq x \leq 3$? How did you compute this speed?

Problem 7. What is the average rate of speed for the penny on the time interval $3 \leq x \leq 5$? How did you compute this speed?

Problem 8. The table below gives various times during the penny's trip. For each time value, compute Δx as time increases *from* $x = a$ seconds *to* $x = 3$ seconds. Then, using the graph, estimate Δy, the corresponding change in the height of the penny above the ground on this time interval. Use these values to estimate the average speed of the penny on the time interval $a \leq x \leq 3$.

Average Speed of Penny on the Time Interval $a \leq x \leq 3$ seconds

Value of x	Value of $y = f(x)$	Value of Δx	Value of Δy	Average Speed
1.5				
2.0				
2.5				
2.75				

Problem 9. The table below gives various times during the penny's trip. For each time value, compute Δx as time increases *from* $x = 3$ seconds *to* $x = a$ seconds. Then, using the graph, estimate Δy, the corresponding change in the height of the penny above the ground on this time interval. Use these values to estimate the average speed of the penny on the time interval $3 \leq x \leq a$.

Average Speed of Penny on the Time Interval $3 \leq x \leq a$ seconds

Value of x	Value of $y = f(x)$	Value of Δx	Value of Δy	Average Speed
4.5				
4.0				
3.5				
3.25				

Problem 10. In the tables above, as Δx gets smaller, how to the average speeds of the penny compare to the slope of the tangent line you drew?