3. [5 points] Let

$$K(u) = \arctan(u^2 + 3u).$$

Use the limit definition of the derivative to write an explicit expression for $K'(2)$. *Your answer should not involve the letter K. Do not attempt to evaluate or simplify the limit.* Write your final answer in the answer box provided below.

Solution:

$$K'(2) = \lim_{h\to 0} \frac{K(2+h) - K(2)}{h} = \lim_{h\to 0} \frac{\arctan\left((2+h)^2 + 3(2+h)\right) - \arctan(2^2 + 3\cdot 2)}{h}$$
$$= \lim_{h\to 0} \frac{\arctan\left(h^2 + 7h + 10\right) - \arctan(10)}{h}.$$

Answer: $K'(2) = \lim_{h\to 0} \frac{\arctan\left((2+h)^2 + 3(2+h)\right) - \arctan(2^2 + 3\cdot 2)}{h}$

4. [6 points] Suppose $b(x)$ is a differentiable function whose tangent line at the point $x = 4$ is given by the linear function $T(x)$. To the right is a table consisting of some values of $b(x)$ and $b'(x)$.

x	-3	-2	0	4
$b(x)$	5	1	-3	-6
$b'(x)$	-4	?	?	-1
$T(x)$	1	0	-2	-6

a. [2 points] Find the values of $T(x)$ at $x = -3, -2, 0,$ and 4, and write them into the table.

Solution: We use the fact that $T(x) = b(4) + b'(4)(x-4) = -6 - (x-4) = -2 - x$.

b. [2 points] Use the table to estimate $b'(-1)$.

Solution: $b'(-1) \approx \frac{b(0) - b(-2)}{0 - (-2)} = \frac{-3-1}{2} = \frac{-4}{2} = -2.$

Answer: -2

c. [2 points] Find an equation for the line tangent to the graph of $y = b(x)$ at the point $(-3, 5)$.

Solution: This line has equation

$$y = b(-3) + b'(-3)(x - (-3)) = 5 - 4(x+3) = -4x - 7.$$

Answer: $y = 5 - 4(x+3)$