1. [13 points] Given below is a table of values for a function $h(x)$ and its derivative $h'(x)$. The functions $h(x)$, $h'(x)$, $h''(x)$, and $h'''(x)$ are all defined and continuous on $(-\infty, \infty)$.

x	-6	-4	-2	0	2	4	6
$h(x)$	2	-0.5	-2	-3	1	4	3
$h'(x)$	0	-4	-1	0	3	0	-2

Assume that between consecutive values of x given in the table above, $h(x)$ is either **always increasing** or **always decreasing**.

In **a.**–**c.**, find the numerical value **exactly**, or write NEI if there is not enough information provided to do so. *You do not need to show work on this page, but limited partial credit may be awarded for work shown.*

a. [2 points] Find the average rate of change of $h(x)$ from $x = -6$ to $x = -2$.

Answer: $\dfrac{-2-2}{-2-(-6)} = -1$

b. [2 points] If the average value of $h'''(x)$ on the interval $[-6, 0]$ is 2, find $5 \cdot \displaystyle\int_{-6}^{0} \left(1 + h'''(x)\right)\, dx$.

Solution: $\dfrac{1}{6}\displaystyle\int_{-6}^{0} h'''(x)\, dx = 2$, so $\displaystyle\int_{-6}^{0} h'''(x)\, dx = 12$. Then $5 \cdot \displaystyle\int_{-6}^{0} \left(1 + h'''(x)\right)\, dx = 5 \cdot 6 + 5 \cdot 12$

Answer: 90

c. [3 points] Find $\displaystyle\int_{-4}^{-2} \left(2h'(x) + x\right)\, dx$.

Solution: $= 2\displaystyle\int_{-4}^{-2} h'(x)\, dx + \int_{-4}^{-2} x\, dx = 2(h(-2) - h(4)) + \dfrac{x^2}{2}\Big|_{-2}^{-4} = 2(-2-(-0.5)) + \dfrac{4}{2} - \dfrac{16}{2}$

Answer: -9

d. [2 points] Find an equation for the tangent line to the graph of $h(x)$ at $x = 6$.

Answer: $y - 3 = -2(x - 6)$ **or** $y = -2x + 15$

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$h(x)$	2	-0.5	-2	-3	1	4	3
$h'(x)$	0	-4	-1	0	3	0	-2

Assume that between consecutive values of x given in the table above, $h(x)$ is either **always increasing** or **always decreasing**.

e. [2 points] Use a left Riemann sum with three equal subdivisions to estimate $\int_{-6}^{6} h(x)\,dx$. Write out all the terms in your sum, which you do not need to simplify.

Solution:
$4 \cdot h(-6) + 4 \cdot h(-2) + 4 \cdot h(2)$
$= 4 \cdot 2 \quad + 4 \cdot (-2) \quad + 4 \cdot (1)$

f. [2 points] Fill in each blank below with one of the following:

$\boxed{\leq}$, $\boxed{\geq}$, $\boxed{=}$ or $\boxed{\text{NEI}}$

where NEI means there is not enough information to decide. You need not justify your answers.

i. $\int_{-6}^{0} h(x)\,dx$ $\underline{\quad \leq \quad}$ $2h(-6) + 2h(-4) + 2h(-2)$.

ii. $\int_{0}^{6} h(x)\,dx$ $\underline{\quad \text{NEI} \quad}$ $2h(0) + 2h(2) + 2h(4)$.