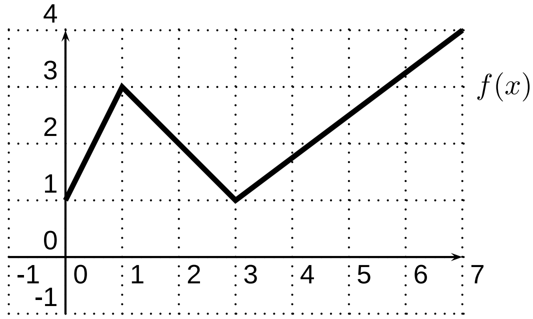
2. [12 points]
Use the graph of the function f and the table of values for the function g to answer the questions below.



x	1	2	3	4	5	6
g(x)	0	4	0	-18	-56	-120
g'(x)	6	1	-10	-27	-50	-79
g"(x)	-2	-8	-14	-20	-26	-32

a. [6 points] Let $h(x) = \frac{g(x)}{f(2x+3)}$. Find $h'(1)$ or explain why it does not exist.

Solution: Using the quotient rule and the chain rule, we get

$$\begin{aligned} h'(x) &= \frac{g'(x)f(2x+3) - g(x)f'(2x+3)\cdot 2}{(f(2x+3))^2} \\ h'(1) &= \frac{g'(1)f(5) - g(1)f'(5)\cdot 2}{(f(5))^2} \\ &= \frac{6\cdot 2.5 - 0\cdot 0.75\cdot 2}{(2.5)^2} \\ &= \frac{6}{2.5} = \frac{12}{5} = 2.4 \end{aligned}$$

b. [6 points] Let $k(x) = g(g(x))$. Determine whether k is increasing or decreasing at $x = 2$.

Solution: Using the chain rule, we get

$$\begin{aligned} k'(x) &= g'(g(x))\cdot g'(x) \\ k'(2) &= g'(g(2))\cdot g'(2) \\ &= g'(4)\cdot g'(2) \\ &= (-27)\cdot 1 = -27 \end{aligned}$$

Since $k'(2) < 0$, we know that $k(x)$ is decreasing at $x = 2$.