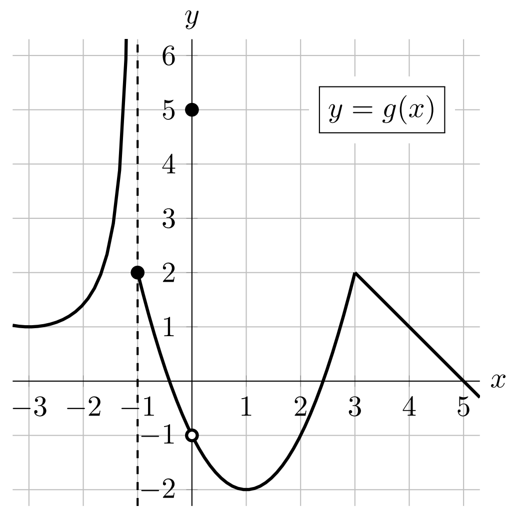
1. [10 points]
A portion of the graph of a function $g(x)$ is shown to the right, along with some values of an invertible, differentiable function $h(x)$ and its derivative $h'(x)$ below. Note that:

- $g(x)$ is linear on $[3, 5]$;
- $g(x)$ has a vertical asymptote at $x = -1$.

x	-2	0	2	4	6
$h(x)$	-1	$-e^{-1}$	0	$\sqrt{2}$	e
$h'(x)$	2	1	π	5	$\sqrt{3}$



a. [2 points] Let $M(x) = x^2h(x)$. Find $M'(-2)$.

Solution: By the Product Rule, $M'(x) = 2xh(x) + x^2h'(x)$, so

$$M'(-2) = -4h(-2) + 4h'(-2) = (-4)(-1) + 4(2) = 12.$$

Answer: $M'(-2) =$ 12

b. [2 points] Let $K(x) = \dfrac{g(x)}{h(x)}$. Find $K'(4)$.

Solution: Using the Quotient Rule,

$$K'(4) = \frac{g'(4)h(4) - g(4)h'(4)}{h(4)^2} = \frac{(-1)(\sqrt{2}) - (1)(5)}{2} = \frac{-\sqrt{2} - 5}{2}.$$

Answer: $K'(4) = \dfrac{-\sqrt{2} - 5}{2}$

c. [2 points] Find $(h^{-1})'(0)$.

Solution: Using the rule for the derivative of an inverse function,

$$(h^{-1})'(0) = \frac{1}{h'\big(h^{-1}(0)\big)} = \frac{1}{h'(2)} = \frac{1}{\pi}.$$

Answer: $(h^{-1})'(0) = \dfrac{1}{\pi}$

d. [2 points] On which of the following intervals does $g(x)$ satisfy the hypotheses of the Mean Value Theorem? Circle all correct answers.

$[-3, -1]$ $[0, 2]$ $\boxed{[1, 3]}$ $[2, 4]$ NONE OF THESE

e. [2 points] On which of the following intervals does $g(x)$ satisfy the conclusion of the Mean Value Theorem? Circle all correct answers.

$\boxed{[-3, -1]}$ $[0, 2]$ $\boxed{[1, 3]}$ $[2, 5]$ NONE OF THESE