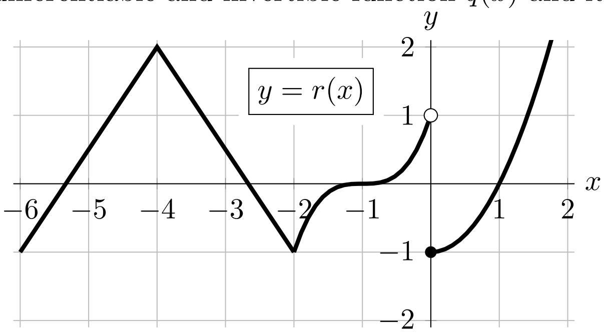
1. [9 points] A portion of a graph of the function $r(x)$, whose domain is $(-\infty, \infty)$ is shown below to the left. The function $r(x)$ is linear on the intervals $[-6, -4]$ and $[-4, -2]$. A table of values for a differentiable and invertible function $q(x)$ and its derivative $q'(x)$ are shown below to the right.



x	-3	-2	-1	0	1	2	3
$q(x)$	14	10	3	2	-5	-6	-15
$q'(x)$	-10	-12	-4	0	-2	-5	-6

Find the **exact** values of the quantities in parts **a.-d.**, whenever possible. Write NEI if there is not enough information to do so, or write DNE if the value does not exist. Your answers should not include the letters q or r but you do not need to simplify your numerical answers. Show your work.

a. [1 point] Find $r'(-4)$.

Solution: The graph of $r(x)$ has a sharp corner at $x = -4$ so $r'(-4)$ does not exist. (The slope from the right is 1.5 while the slope from the left is -1.5.)

Answer: $r'(-4) =$ **DNE**

b. [2 points] Find $(q^{-1})'(-6)$.

Solution: We have

$$(q^{-1})'(x) = \frac{1}{q'(q^{-1}(x))}$$

so

$$(q^{-1})'(-6) = \frac{1}{q'(q^{-1}(-6))} = \frac{1}{q'(2)} = \frac{1}{-5} = -\frac{1}{5}.$$

Answer: $(q^{-1})'(-6) =$ $-1/5$

c. [3 points] Let $J(x) = e^{q(x)}$. Find $J'(1)$.

Solution: Applying the chain rule, we find

$$J'(x) = e^{q(x)}q'(x)$$

so

$$J'(1) = e^{q(1)}q'(1) = e^{-5}(-2) = -2e^{-5}.$$

Answer: $J'(1) =$ $-2e^{-5}$

d. [3 points] Let $D(x) = r(x)q(2x + 4)$. Find $D'(-3)$.

Solution: Applying the product and chain rules, we find

$$D'(x) = r'(x)q(2x + 4) + r(x)q'(2x + 4)(2)$$

so

$$D'(-3) = r'(-3)q(-2) + r(-3)q'(-2)(2) = -\frac{3}{2} \cdot 10 + \frac{1}{2} \cdot (-12) \cdot 2 = -15 - 12 = -27.$$

Answer: $D'(-3) =$ -27