1. \[13\text{ points}\]

A portion of the graph of the function \(k(x)\) is shown to the right. Note that:

- \(k(x)\) consists of a quarter circle on \(-1 \leq x < 1\)
- \(k(x)\) is piecewise linear on \(1 < x \leq 4\)
- \(k(x) = -\frac{1}{2}(x-4)^2 + 2\) on the interval \(4 \leq x \leq 6\)
- the area of the shaded region is \(\frac{8}{3}\)

a. \[6\text{ points}\]

On the axes to the right, carefully sketch the graph of \(k'(x)\), the derivative of \(k(x)\), on the interval \(-1 < x < 6\). Be sure that your graph carefully indicates:

- where \(k'(x)\) is undefined
- any vertical asymptotes of \(k'(x)\)
- where \(k'(x)\) is zero, positive, and negative
- where \(k'(x)\) is increasing, decreasing, and constant
- where \(k'(x)\) is linear (with correct slope)

b. \[7\text{ points}\]

Let \(K(x)\) be a continuous antiderivative of \(k(x)\) with \(K(1) = 0\). On the axes to the right, carefully draw a graph of \(K(x)\) on \(-1 \leq x \leq 6\). Be sure that your graph carefully indicates:

- where \(K(x)\) is and is not differentiable
- the values of \(K(x)\) at \(x = -1, 1, 3, 4,\) and \(6\)
- where \(K(x)\) is increasing, decreasing, and constant
- the concavity of \(K(x)\) and any inflection points of \(K(x)\)