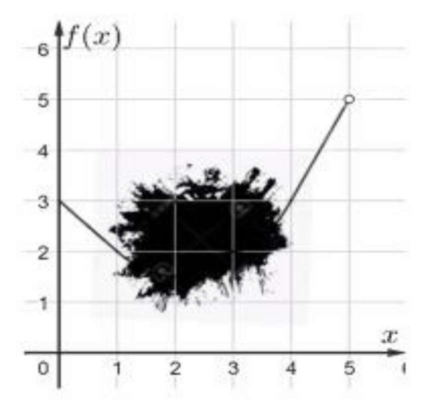
2020 FRQ Practice Problem BC1



BC1: For $0 \le x < 5$, the function f is continuous and differentiable. A portion of the graph of $f(x)$ is obscured by a Tony Record coffee stain. It is known that $\int_0^4 f(x)dx = 8$ and $\int_4^3 f(x)dx = -3$ and $f(x)$ is linear on the intervals $(0,1)$ and $(4,5)$. For $x \ge 5$, $f(x) = \dfrac{4}{(x-a)^2}$, where a is a positive real number.

(**a**) Find $\int_0^4 2xf'(x)dx$.

(**b**) Find $\int_1^2 xf(x^2-1)dx$.

(**c**) Find $\int_0^{\pi/2} \cos(x)f'(\sin(x))dx$.

(**d**) It is known that $\int_3^\infty f(x)dx = 9$, find the value of a.

2020 FRQ Practice Problem BC2

BC2: Consider the function $g(x) = \dfrac{h(x)}{(x+2c)(x-c)}$ where c is a constant with $c < 0$.

(**a**) Find $\displaystyle\int_{4c}^{7c} g(x)\,dx$ where $h(x) = 6c$.

(**b**) Find $\displaystyle\int_{1-2c}^{\infty} g(x)\,dx$ in terms of c where $h(x) = 6c$.

(**c**) Find $\displaystyle\int_{0}^{-3} g(x)\,dx$ where $h(x) = 2x + c$.

2020 FRQ Practice Problem BC3

x	1	2	3	4	6	8
$f(x)$	2	1	?	3	4	3
$f'(x)$	4	2	1	2	-1	10
$g(x)$	1	-4	0	0	8	-2

BC3: The function f is twice differentiable with domain $x \geq -10$. It is known that $f(x) > 0$ for all x values in its domain and has the horizontal asymptote $y = 1$. The function g is twice differentiable for all values of x.

(**a**) If $\int_1^3 f'(x)g(x)dx = 2\int_1^3 f(x)g'(x)dx$, find $\int_1^3 f(x)g'(x)dx$

(**b**) If $\int_2^6 f'\big(g(x)\big)g'(x)dx = -11$, find $f(-4)$.

2020 FRQ Practice Problem BC3

The problem is restated.

x	1	2	3	4	6	8
$f(x)$	2	1	?	3	4	3
$f'(x)$	4	2	1	2	-1	10
$g(x)$	1	-4	0	0	8	-2

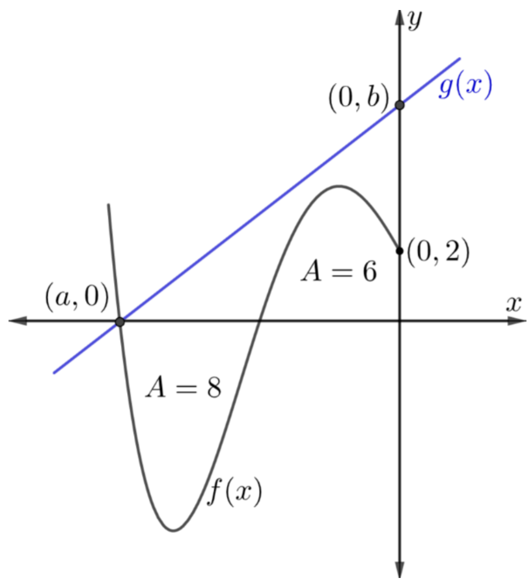
BC3: The function f is twice differentiable with domain $x \geq -10$. It is known that $f(x) > 0$ for all x values in its domain and has the horizontal asymptote $y = 1$. The function g is twice differentiable for all values of x.

(**c**) If $\int_3^\infty \frac{f'(x)}{[f(x)]^2} = 7$, find $f(3)$.

(**d**) Find $\int_1^2 2x^2 f''(x^3)dx$

(**e**) Find $\int_1^2 2x^3 f''(x^2)dx$

2020 FRQ Practice Problem BC4



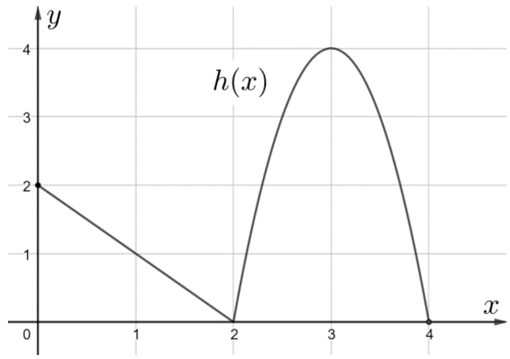
BC4: A portion of the graphs for f and g are shown above where g is linear with x and y intercepts labeled in the figure. The regions bounded by the graph of $f(x)$ and the x axis have areas of 8 and 3 respectively as labeled.

(**a**) Find $\int_a^0 g(x)f'(x)dx$ in terms of a and b.

(**b**) Find $\int_0^{2a} \left[f'\left(\frac{x}{2}\right) - 3\right] dx$ in terms of a.

(**c**) Find $\int_0^{2a} \left[f\left(\frac{x}{2}\right) - 3\right] dx$ in terms of a.

2020 FRQ Practice Problem BC5

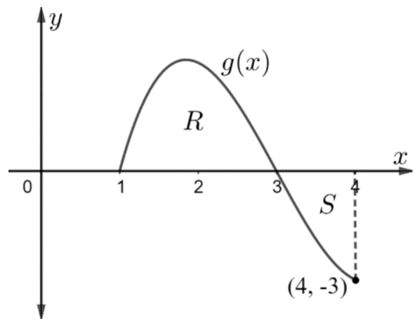


BC5: A portion of the continuous function $h(x)$ is given above on the interval $0 \le x \le 4$.

The function h can also be defined by the equation $h(x) = 3 + \int_2^{2x} f(t)dt$.

(**a**) Find $\int_2^6 xf'(x)\,dx$.

2020 FRQ Practice Problem BC6



BC 6: The functions f and g are continuous and differentiable. A portion of the graph of g is given above.

The areas of the bounded regions R and S are 5 and 2 respectively. The function f is defined by

$f(x) = \dfrac{1}{x^2 + k}$ where k is constant.

(**a**) Find $\int xf(x)dx$ in terms of x and k.

(**b**) Let $k = 9$, find $\int_{\sqrt{3}}^{\infty} f(x)dx$.

(**c**) Let $k = -9$, find $\int (5x + 3)f(x)dx$.

(**d**) Find $\int_1^4 xg'(x)dx$.