■ 1. Given $f(x) = 9 - x^2$ on the interval $[-3,0]$, which of the following would yield an area approximation that's an underestimate.

I. Trapezoidal rule

II. Left endpoint rectangle

III. Right endpoint rectangle

A I only

B III only

C I and II

D I and III

■ 2. Consider $f(x) = \int_{-2}^{x^2} \sqrt{1+t^2}\ dt$. Find $f'(x)$.

A $\sqrt{1+x^4}$

B $\sqrt{1+x^4} - \sqrt{5}$

C $2x\sqrt{1+x^4}$

D $2x(\sqrt{1+x^4} - \sqrt{5})$

■ 3. Given $\int_0^5 f(x)\ dx = 9$ and $\int_2^5 f(x)\ dx = -1$, which statement is true?

A $\int_2^0 f(x)\ dx = -10$

B $\int_0^2 f(x)\ dx = -10$

C $\int_0^2 f(x)\ dx = 8$

D $\int_0^2 f(x)\ dx = -8$

■ 4. Evaluate the following: $\int \frac{x}{\sqrt{x-4}}\,dx$

A $\frac{2}{3}(x-4)^{\frac{3}{2}} - 2(x-4)^{\frac{1}{2}} + C$

B $\left(\frac{3}{2}x - 4\right)^{\frac{3}{2}} + 2(x-4)^{\frac{1}{2}} + C$

C $\frac{x^2\sqrt{x-4}}{2} + C$

D $\frac{2}{3}(x-4)^{\frac{3}{2}} + 8(x-4)^{\frac{1}{2}} + C$

■ 5. Which of the following is an antiderivative of $y = \sin x \cos x$

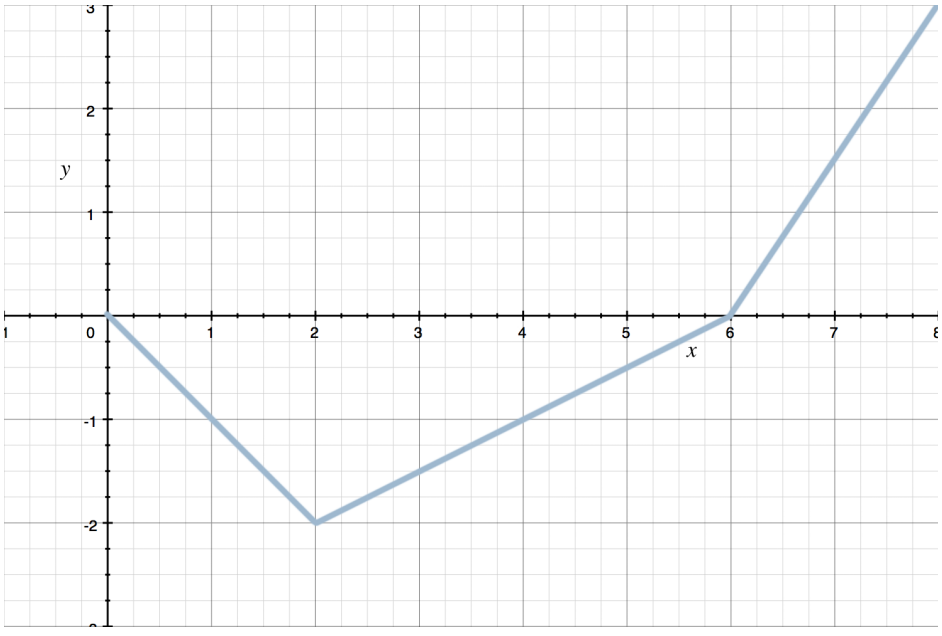
A $\frac{1}{4}\sin^2(2x) + 8$

B $\frac{1}{2}\cos^2 x + 5$

C $\frac{1}{2}\sin^2 x + 6$

D $-\frac{1}{2}\sin^2 x + 4$

■ 6. Given the graph of f and $g(x) = \int_0^x f(t)\,dt$, what is the value of $g''(4)$?



A 0

B $\frac{1}{2}$

C -5

D -1

■ 7. $R(t) = 5 - \sin x$ represents the rate at which sucrose is consumed by a colony of bacteria, measured in mg/day. How much sucrose did the bacteria consume over the first 6 days?

A 29.995 mg

B 1.123 mg

C 5.123 mg

D 10.127 mg

■ 8. If $f(5) = 7$ and $f'(x) = x^{0.3} + e^{0.2x}$, what is the value of $f(1)$?

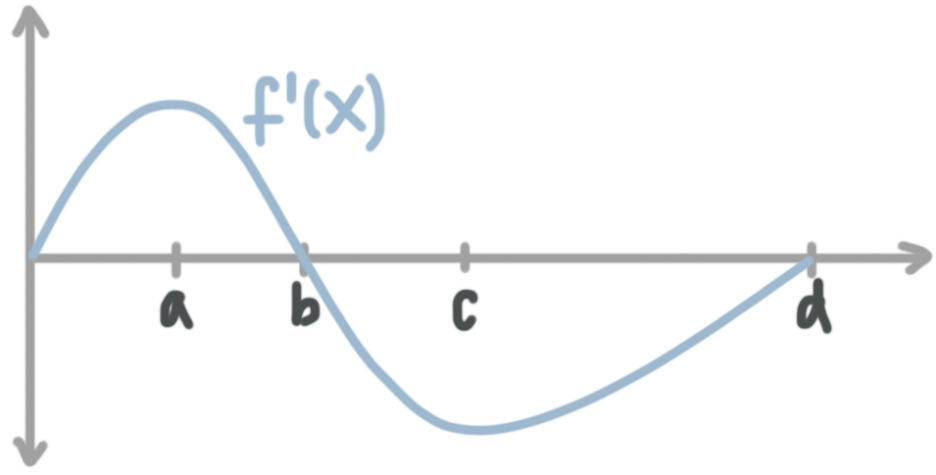
A 2.221

B 12.948

C 19.984

D -5.948

■ 9. Given the graph of $f'(x)$ below, on what interval, if any, is $f(x)$ both increasing and concave down, if $f'(x)$ has horizontal tangents at $x = a$ and $x = c$?



A (a, b)

B $(0, a)$

C (c, d)

D There is no interval where $f(x)$ is increasing and concave down

■ 10. Evaluate $\int_{-1}^{2} x(x^2 - 1)^3 \, dx$

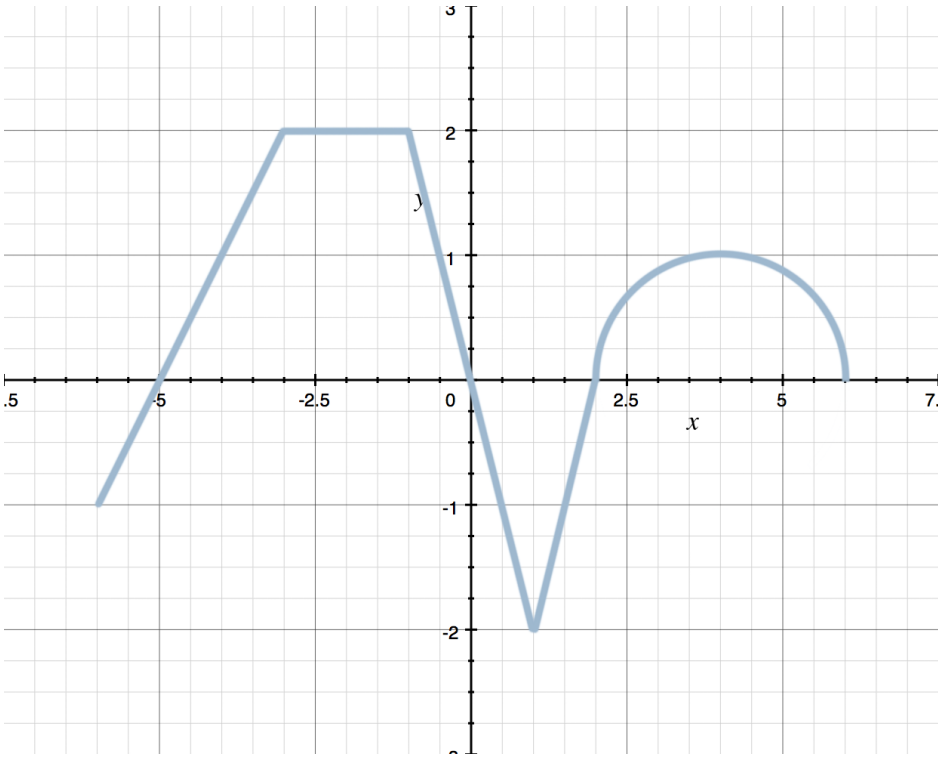
A $\frac{81}{4}$

B $\frac{81}{8}$

C 3

D $\frac{15}{4}$

■ 11. The graph of f, shown below, consists exclusively of line segments and a semi-circle. The function g is defined by $g(x) = \int_{-2}^{x} f(t)\,dt$. Answer each question and justify your answers.



a) Find any relative extrema of $g(x)$ on the interval $(-6,6)$.

b) Does $g(x)$ have an inflection point at $x = 1,\ 2,$ or 4?

c) Evaluate $g'(-4)$ and $g''(-4)$.

d) Determine the absolute maximum of g on the interval $-6 \leq x \leq 6$.

■ 12. The temperature of a cake removed from an oven is modeled by a strictly decreasing function $C(t)$ that is twice differentiable, where t is measured in minutes and $C(t)$ in degrees F. Select values of $C(t)$ are given in the table below. Answer each of the following questions, interpreting the meaning of each answer in the context of the problem.

t	0	2	5	9	12
C(t)	350	310	265	217	187

a) Using the data in the table, approximate $C'(7)$.

b) Using a Riemann sum with right endpoints, approximate the value of $\frac{1}{12}\int_0^{12} C(t)\ dt$.

c) Using the data in the table, evaluate $\int_0^5 C'(t)\ dt$.