

Multiple Choice Section

1. $\int_{-1}^1 x^{-3} dx =$

- a. 0
- b. 1
- c. -1
- d. 1/2
- e. None of the above

2. Given the graph of $f(t)$ below, order the following quantities from least to greatest.

- a. $f'(1)$
- b. The average value of $f(t)$ over the interval 0 to 5
- c. $\int_2^5 f(t) dt$

3. Given the graph of $f(t)$ in problem 2, determine whether the following statements about the anti-derivative

$$F(x) = \int_1^x f(t) dt \tag{1}$$

are true or false.

- a. T F $F(x)$ is negative for all $0 \leq x < 1$.
- b. T F Over the interval (1,2) $F(x)$ is increasing.
- c. T F $F(x)$ is concave down at $x = 1/2$.

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4. The graph below is of $f(x) = F'(x)$. Use this graph to answer questions about the antiderivative $F(x)$, given $F(0) = -2$.

(a) Find:

- i. $F(1)$
- ii. $F(3)$
- iii. $F(5)$
- iv. $F(6)$

(b) Graph $F(x)$ over the interval 0 to 6. Clearly label all local minima and maxima, global minima and maxima, and the inflection points.

(c) Where is $F(x)$ concave up? Where is $F(x)$ concave down?

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5. Given $g(x) = \int_0^x e^t dt$,

(a) Find an expression for the composite function $h(x) = g(2x^3)$

(b) Find $h'(x)$

(c) At $x = 1$, is $h(x)$ increasing or decreasing? Justify your answer.

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6. Given that $F(x)$ is an antiderivative of $f(x)$, label each of the following quantities on the graph of $f(x)$ and give a one sentence description of what the quantity represents in terms of $f(x)$.

(a) $F'(a)$:

(b) $F(b) - F(a)$:

(c) $\frac{F(b)-F(a)}{b-a}$:

Partial Credit Section

7. Evaluate each of the following integrals EXACTLY. Assume a , b , and k are constants.

(a) $\int_0^1 (ax^3 - bx^2 + k) dx$

(b) $\int \left(\frac{a}{x^4} + \frac{1}{x^{3/2}} \right) dx$

(c) $\int \sqrt{x}(1 - x^2) dx$

(d) $\int_1^4 \frac{e^{\sqrt{t}}}{\sqrt{t}} dt$