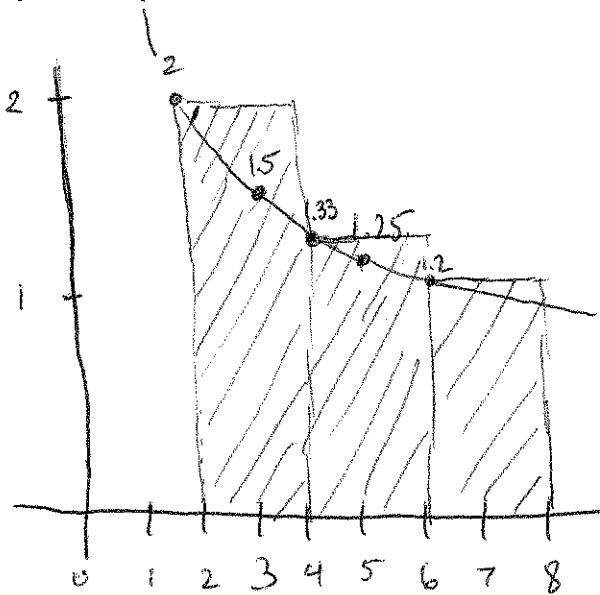


Name: Solutions

Directions: Show all work. No credit for answers without work.

1. [2 points] Use the left hand sum with  $n = 3$  to estimate  $\int_2^8 \frac{x}{x-1} dx$



$$\text{LHS: } 2 \cdot 2 + \frac{4}{3} \cdot 2 + \frac{6}{5} \cdot 2$$

$$\approx \boxed{9.067}$$

2. [2 points] The graph of  $f(x)$  is displayed below. Use the graph to list the following integrals in order from smallest to largest.



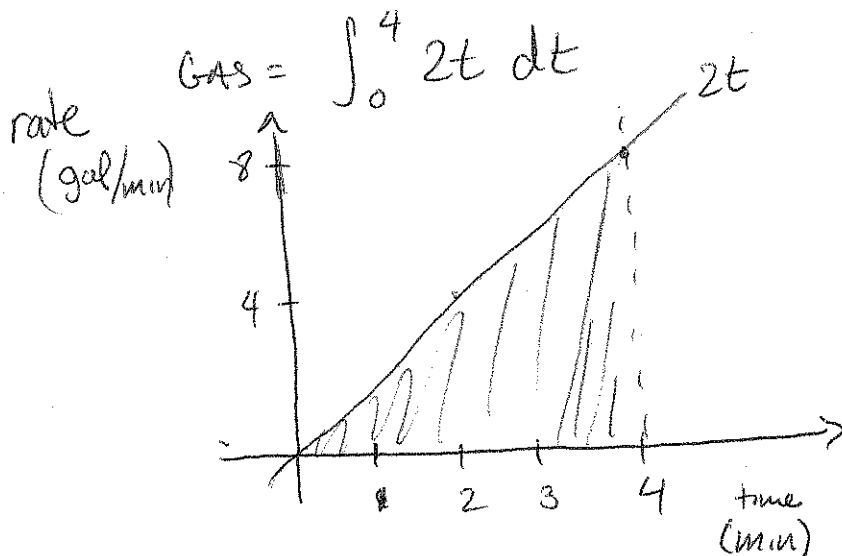
I.  $\int_a^b f(x) dx$     II.  $\int_b^c f(x) dx$     III.  $\int_c^d f(x) dx$     IV.  $\int_a^c f(x) dx$     V.  $\int_a^d f(x) dx$

$$\text{II} < \text{IV} < \text{I} < \text{III} < \text{V}$$

3. [1 point] In terms of the units of  $f(x)$  and  $x$ , what are the units of  $\int_a^b f(x) dx$ ?

$$\text{Units of } \int_a^b f(x) dx = (\text{units of } f(x)) \cdot (\text{units of } x).$$

4. [2 points] A gasoline pump is activated. After  $t$  minutes, the pump dispenses gasoline at a rate of  $2t$  gallons per minute. Find exactly how much gasoline has been pumped after 4 minutes.



$$\text{GAS} = \text{area}$$

$$= \frac{1}{2}bh$$

$$= \frac{1}{2} \cdot 4 \cdot 8$$

$$= \boxed{16 \text{ gal}}$$

5. [3 points] Evaluate the following indefinite integrals.

(a)  $\int 6 dx$

$$\boxed{6x + C}$$

(b)  $\int \frac{4}{x^2} dx = 4 \int x^{-2} dx$

$$= -4x^{-1} + C$$

$$= \boxed{\frac{-4}{x} + C}$$

(c)  $\int e^{3x} dx$

$$= \boxed{\frac{1}{3} e^{3x} + C}$$

(d)  $\int 3x^2 + 5x dx = 3 \int x^2 dx + 5 \int x dx$

$$= \boxed{x^3 + \frac{5}{2}x^2 + C}$$

(e)  $\int \sqrt{x} dx = \int x^{1/2} dx$

$$= \boxed{\frac{2}{3} x^{3/2} + C}$$

(f)  $\int (x+1)^2 dx = \int x^2 + 2x + 1 dx$

$$= \boxed{\frac{x^3}{3} + x^2 + x + C}$$