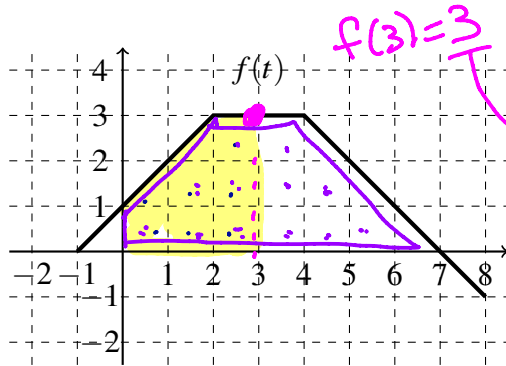


Name: Solutions

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There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. **Show all work for full credit.**

1. [4 points] Define  $G(x) = \int_0^x f(t) dt$  where the graph of  $f(t)$  is drawn below.



a. Determine  $G(3)$ .  $= 7$

b. Determine  $G'(3)$ .  $= 3$

- c. On the interval  $[-1, 8]$ , does  $G(x)$  have a maximum? If so, what is that maximum value? If not, explain why not.

yes.  $G(x)$  has a maximum at  $x = 7$ .

The maximum value is 14.5 (obtained by counting the squares under curve.)

2. [6 points] Use the Fundamental Theorem of Calculus (Part 1) to find each derivative.

a.  $\frac{d}{dx} \left( \int_2^x (t^2 - 5) dt \right) = x^2 - 5$

b.  $\frac{d}{dx} \left( \int_{x^2}^9 \frac{1}{\cos(t)} dt \right) = \frac{d}{dx} \left( - \int_9^{x^2} \frac{1}{\cos(t)} dt \right)$

$$= - \left( \frac{1}{\cos(x^2)} \right) (2x) = -2x \sec(x^2)$$

3. [8 points] Evaluate each definite integral using the Fundamental Theorem of Calculus Part 2. Simplify your numerical answers here.

$$\begin{aligned} \text{a. } \int_1^2 (2x - e^x) dx &= \left[ x^2 - e^x \right]_1^2 = (2^2 - e^2) - (1^2 - e^1) \\ &= 4 - e^2 - 1 + e = \underline{\underline{3 + e - e^2}} \end{aligned}$$

$$\begin{aligned} \text{b. } \int_0^{\pi/2} (1 - \sin(x)) dx &= \left[ x + \cos(x) \right]_0^{\pi/2} = \left( \frac{\pi}{2} + \cos\left(\frac{\pi}{2}\right) \right) - (0 + \cos(0)) \\ &= \frac{\pi}{2} + 0 - 1 = \frac{\pi}{2} - 1 \end{aligned}$$

4. [6 points] The function  $f(t)$  measures the rate of water usage in a household over a 24 hour period where  $f$  is measured in gallons per hour and  $t$  is measured in hours starting at 12:00 am. (So, at 12 midnight,  $t = 0$ ). Write a complete sentence, including units, interpreting each quantity below.

a.  $f(8) = 2$

At 8 am, the household is using water at a rate of 2 gallons per hour.

b.  $\int_8^{10} f(t) dt = 28$

Between 8 am and 10 am, the household used a total of 28 gallons.