Calculus II – Day 3

1. Pollution is removed from a lake on day t at a *rate* of $f(t)$ kilograms per day.

(a) **Group chat:** Given the context stated above, what is the meaning of the following statement?

$$f(12) = 500$$

👍 The most important word here is RATE.

👍 Include units in your answer.

(b) **Group chat:** Given the context stated above, what is the meaning of the following statement?

$$\int_5^{15} f(t)\,dt = 4000$$

👍 What happens when we find the area under the graph when the graph is a rate of change?

👍 Include units in your answer.

2. A car is driving east with velocity (in miles per hour) at time t given by $v(t)$.

(a) **Group chat:** What does $v(2) = -20$ mean? Use words to explain!

(b) Suppose the *position* of the car (east of the start) at time t is given by $s(t)$. Use $s(t)$ to describe what is calculated by

$$\int_{t_1}^{t_2} v(t)\,dt.$$

(c) **Calculus I recall time:** How are $s(t)$ and $v(t)$ related?

👍 Ahhhhhh!

3. Group chat: Why do parts (b) and (c) of #2 indicate that the following is true:

$$\int_a^b F'(t)\,dt = F(b) - F(a)$$

4. Circle the antiderivative(s) of $f(x) = 3x^2$.

$\frac{1}{3}x^3$ $\quad x^3$ $\quad x^3+17$ $\quad x^3+x-17$ $\quad \frac{3}{2}x$ $\quad x^3-2$ $\quad 6x$ $\quad -3x^{-3}$ $\quad x^3+e$

How many are there?

5. Complete the following table.

$f(x)$	What power of x is this?	$\int f(x)\,dx$	$f(x)$	What power of x is this?	$\int f(x)\,dx$
$f(x) = x$	1	$\frac{1}{2}x^2 + C$	$f(x) = \frac{1}{x^5}$		
$f(x) = x^2$	2	$\frac{1}{3}x^3 + C$	$f(x) = x^{2/3}$		
$f(x) = x^3$			$f(x) = x^{-1/2}$		
$f(x) = x^{10}$			$f(x) = \sqrt{x}$		
$f(x) = x^{-3}$			$f(x) = \frac{1}{x}$		

6. Find the following antiderivatives:

$$\int \cos(x)\,dx \qquad \int \sin(x)\,dx \qquad \int e^x\,dx \qquad \int 2^x\,dx \qquad \int e^x + x^2\,dx$$

Remember, you're undoing the derivative.

7. Use the Fundamental Theorem of Calculus to find the *exact* answers:

$$\int_1^2 e^x\,dx \qquad\qquad \int_a^b e^x + x^2\,dx$$

We don't need rectangles anymore!

8. What is the area of exactly one "bump" on the graph of $y = \sin x$?

9. Find the following antiderivatives:

$$\int e^{4x} \cdot 4\,dx \qquad\qquad \int e^{4x}\,dx \qquad\qquad \int (\sin x)^7 \cos x\,dx$$