

- Midterm 4 April 27 WileyPlus During Class Time
 - Notes allowed
 - Not allowed to use WileyPlus Study Section or other online resources
 - Covers 5.1, 5.2, 5.3, 5.5, 5.6, 6.1, 6.2
HW 11, 12 and 13.
 - Focus mainly on HW problems and sample test problems
 - Categorize the problems, collect problems for each category and try to work on them.
 - Remember how to calculate the definite integral on your calculator.
- Sample Test Problems Due Tuesday midnight.
- We will talk about the Final on Thursday.
- HW 13 Due next Thursday after exam but remember to go over it.
- Complete course evaluation - Responses are anonymous.

- I replace your lowest midterm score with the final exam score.
- The past homework are still open.
let me know if you need me to reopen any HW.

Find the indefinite integrals of the following.

a). $8x^3 + \frac{1}{x}$

Soln.

$$\int 8x^3 + \frac{1}{x} dx$$

$$= \int 8x^3 dx + \int \frac{1}{x} dx$$

$$= 8 \int x^3 dx + \int \frac{1}{x} dx$$

$$= 8 \cdot \frac{x^{3+1}}{3+1} + \ln|x| + C$$

$$= \frac{8x^4}{4} + \ln|x| + C$$

$$= \boxed{2x^4 + \ln|x| + C}$$

$$b) \quad 12e^{0.2t}$$

Soln.

$$\int 12e^{0.2t} dt$$

$$= 12 \int e^{0.2t} dt$$

$$= 12 \cdot \frac{e^{0.2t}}{0.2} + C$$

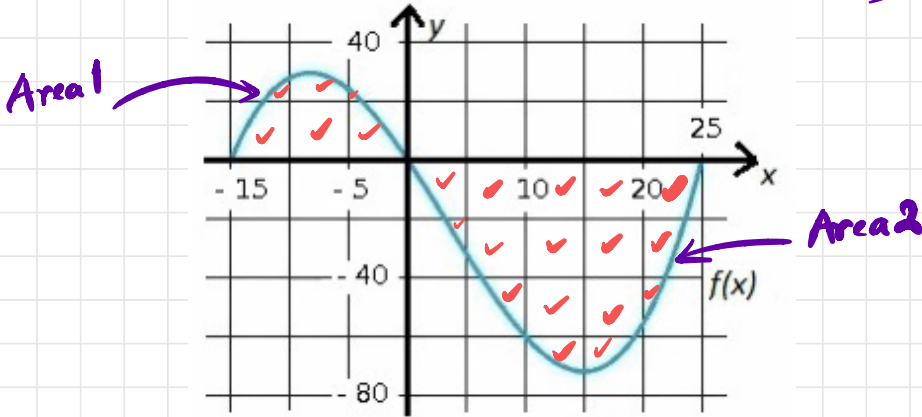
(Formula 4)

$$= \boxed{60e^{0.2t} + C}$$

$$\frac{12}{0.2} = 60$$

HW 12 5.3 #10

+10%



Using the fig., estimate $\int_{-15}^{25} f(x) dx$

Soln. $\int_{-15}^{25} f(x) dx = \text{Area 1} - \text{Area 2}$

$$\begin{aligned} \text{Area of each box} &= 5 \cdot 20 \text{ sq. units} \\ &= 100 \text{ sq. units.} \end{aligned}$$

$$\begin{aligned} \text{Area 1} &= 1 \text{ box} + 1 \text{ box} + 1 \text{ box} \\ &= 3 \text{ boxes} = 3 \cdot 100 \text{ sq. units} = 300 \text{ sq. units} \end{aligned}$$

$$\begin{aligned} \text{Area 2} &= 6 \text{ boxes} + 1 \text{ box} + 1 \text{ box} + 1 \text{ box} + 1 \text{ box} \\ &= 11.25 \text{ boxes} \end{aligned}$$

$$= 11.25 \cdot 100 \text{ sq. units}$$

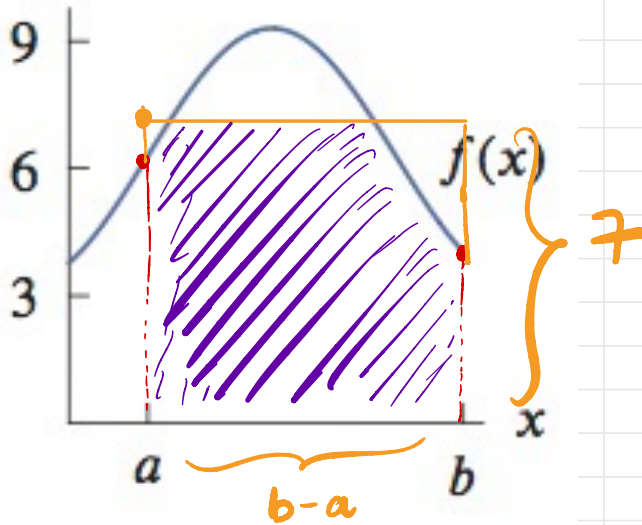
$$= 1125 \text{ sq. units}$$

$$\int_{-15}^{25} f(x) dx = 300 - 1125 \text{ sq. units}$$

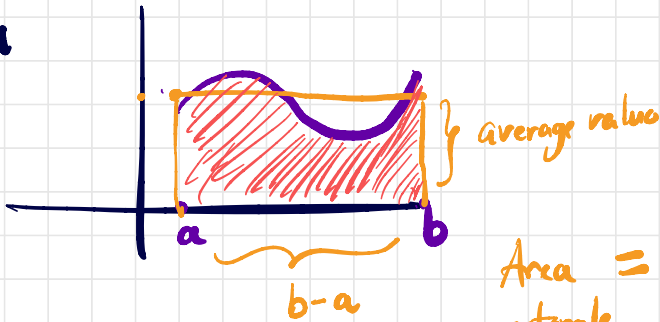
$$= -825 \text{ sq. units}$$

HW 12 5.6 #8

Estimate the average value of $f(x)$ from $x=a$ to $x=b$.



Soln. Recall



Area = Area under graph.

$$\boxed{\text{Average value} = 7}$$

Category 2: Given graph of $f'(x)$ and the values of areas under curve, sketch the graph of $f(x)$.

- Problems:
1. PG 3 from notes for April 20
 2. HW 12 Sec. 5.3 #6
 3. Example 2 Sec 6.2 from BOOK.

Category 3: Given graph of $f'(x)$, the values of areas under curve and value of $f(0)$, find the values for $f(b)$ where $b = \underline{\hspace{2cm}}$
 \uparrow some values.

- Problems:
1. HW 13 Sec 6.1 #32
 2. Sec 6.1 Problem #32 (BOOK).

Section 6.2

Category 1: Check whether a function is an antiderivative of a given function.

Problems: 1. HW 13 Sec 6.2 #7

Which of the following are antiderivatives of $f(x) = e^{x/5}$?

a) $\sqrt{e^{x/5}}$

b) $e^{x/5}$

c) $\sqrt{(1+x)/5}$

d) $e^{x/10}$

e) $\sqrt{e^{x/5}} + 1$

Category 2: Find an antiderivative of the given function.

- Problems:
1. $f(t) = 7t^2$
 2. $f(t) = \frac{1}{t} + t^3$
 3. $f(x) = 7e^{63x}$
 4. Collect more.

Category 3: Find an antiderivative $F(x)$ with $F'(x) = f(x)$
and $F(0) = \underline{\hspace{2cm}}$
 \uparrow some value

- Problems:
1. Sample Test 4c #7
 2. Sec 6.2 # 47-52 (BOOK)
 3. Find antiderivative $F(x)$ with $F'(x) = f(x)$ and $F(0) = 0$ where $f(x) = x^{3/2}$.

Soln. $\int x^{3/2} dx = \frac{x^{3/2+1}}{3/2+1} + C$

$$= \frac{x^{5/2}}{5/2} + C$$
$$= x^{5/2} \cdot \frac{2}{5} + C$$
$$= \frac{2x^{5/2}}{5} + C$$

Let $F(x) = \frac{2x^{5/2}}{5} + C$ be such that $F(0) = 0$.

$$F(0) = \frac{2 \cdot 0^{5/2}}{5} + C$$

$$0 = 0 + C$$

$$\Rightarrow C = 0$$

\therefore required antiderivative is

$$F(x) = \frac{2x^{5/2}}{5}$$

Category 4:

Find indefinite integrals

Problems:

1. $\int 2e^{7t} dt$

2. $\int \frac{1}{x} + x^{3/2} dx$

3. Sample Test 4B # 10.

Formulas:

a) $\int e^{kx} dx$

b) $\int \frac{1}{x} dx$

c) $\int x^n dx$

d) $\int k dx$

e) $\int e^x dx$

HW 12. Sec 5.5 #1

A cup of coffee at 90°C is put into a 20°C room when $t=0$. The coffee's temperature is changing at a rate of $r(t) = -8(0.8^t)^\circ\text{C}$ per minute, with t in minutes. Estimate the coffee's temperature

when $t=10$

Let $R(t)$ denote the temperature

Soln.

Given:

i) $R(0) = 90^\circ\text{C}$

ii) $r(t) = -8(0.8)^t$

Want:

$R(10)$

$R'(t) = r(t)$

By FTC, $\int_0^{10} r(t) dt = R(10) - R(0)$

$\Rightarrow \int_0^{10} -8(0.8)^t dt = R(10) - 90$

$\Rightarrow R(10) = \int_0^{10} -8(0.8)^t dt + 90$

$= -32 + 90$

$= \boxed{58^\circ\text{C}}$

HW 12 5.5 #21

Let $c(n)$ be a city's cost, in millions of dollars, for plowing the roads when n inches of snow have fallen. Let $C(n) = \int_0^n c(t) dt$. Evaluate $C(0)$ and interpret your answer in terms of the cost of plowing snow, given

$$c'(n) < 0 \quad \int_0^{15} c(n) dn = 9.4$$

$$c(15) = 0.4, \quad c(24) = 0.3$$

$$C(15) = 10 \quad C(24) = 16$$

$$C(0) = \boxed{0.6} \text{ means it cost } \$ \boxed{0.6} \text{ millions}$$

if no snow falls.

$$\int_0^{15} c(n) dn = 9.4$$

↓ By FTC

$$\Rightarrow C(15) - C(0) = 9.4$$

$$\Rightarrow 10 - C(0) = 9.4$$

$$\Rightarrow C(0) = 0.6$$

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

$$c \quad e' = e$$

$$\int c(n) dn =$$