Announcements

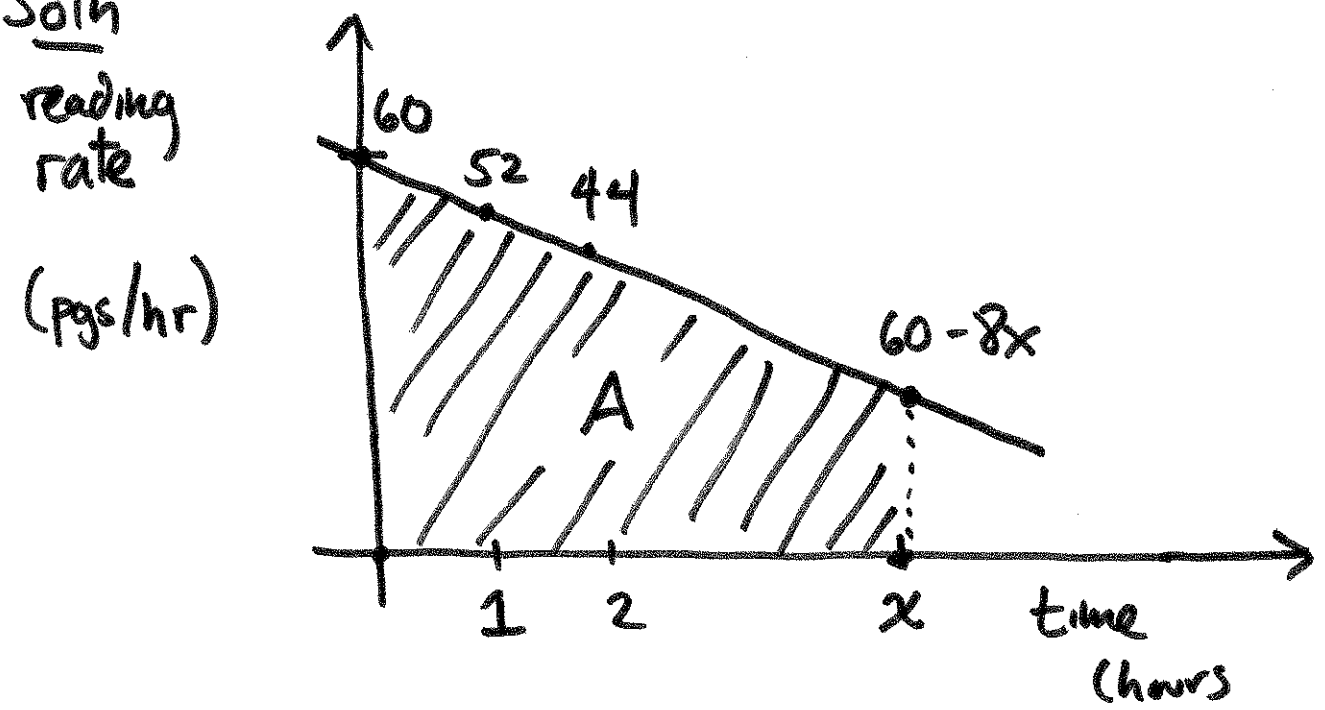
- HW 9 due Today
- Quiz 9 (Ch 5) Friday in class
- Test 2 stats:

	011	013
Avg	75.6	71.98
Med	79	79.25
Std Dev	14.33	19.37

- Test 3 Fri Nov 19
  ⇒ Review sheet on course website

WARMUP: Under optimal conditions, Sue can read 60 pages per ~~hour~~ hour. At time $t=0$, she gets tired and her reading rate slows by 8 pages per hour each hour. How long will it take her to read 160 pages?

Soln



- # pages read at time x = A

$$= \frac{h}{2} \cdot (L_1 + L_2)$$

$$= \frac{x}{2}(60 + 60 - 8x)$$

$$= \frac{x}{2}(120 - 8x)$$

$$= 60x - 4x^2$$

- Solve for x in $60x - 4x^2 = 160$

$$60x = 160 + 4x^2$$

$$0 = 4x^2 - 60x + 160$$

$$0 = 4(x^2 - 15x + 40)$$

$$x^2 - 15x + 40 = 0$$

- Use quad formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{15 \pm \sqrt{225 - 160}}{2}$$

$$= \frac{15 \pm \sqrt{65}}{2}$$

$\frac{15 - \sqrt{65}}{2} \approx$ (3.47 hrs) $\quad \frac{15 + \sqrt{65}}{2} \approx 11.53$ hrs

- After $\boxed{3.47 \text{ hrs}}$, she has read 160 pages.

7.1 An <u>antiderivative</u> of a function $f(x)$ is a function $F(x)$ whose derivative is $f(x)$ (i.e. $F'(x) = f(x)$).

- FTC says that we can solve $\int_a^b f(x)\,dx$ exactly if we can find an antiderivative of f.
- If $f(x) = 4$, then for every constant C, $F(x) = 4x + C$ is an antiderivative of $f(x)$. We say that $4x + C$ is the <u>family of antiderivatives</u> of $f(x)$.

<u>def</u> The <u>indefinite integral</u> $\int f(x)\,dx$ is the family of antiderivatives of $f(x)$.

Ex $\int 4\,dx = 4x + C$

- Note: • An Indefinite integral $\int f(x)\,dx$ is a families of functions.
  - A Definite integral $\int_a^b f(x)\,dx$ is a number.

Integration Rules

- Constant rule: If k is a constant, then $\int k\,dx = kx + C$.

Ex: $\int 5\,dx = 5x + C$.

- Power rule: If $n \neq -1$, then

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$$

Ex: $\int x^4\,dx = \frac{x^5}{5} + C$

Check: $\frac{d}{dx}\left[\frac{x^5}{5} + C\right] = \frac{1}{5}\frac{d}{dx}[x^5] + \frac{d}{dx}[C]$

$= \frac{1}{5}(5x^4) + 0$

$= x^4$

Ex: $\int \frac{1}{x^2}\,dx = \int x^{-2}\,dx$

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

Ex $\int \sqrt{x}\,dx = \int x^{\frac{1}{2}}\,dx$

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

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

Ex: $\int x^{\ln(2)}\,dx = \boxed{\frac{x^{\ln(2)+1}}{\ln(2)+1} + C}$

Sums and Const Multiples

- $\int f(x) \pm g(x)\,dx = \int f(x)dx \pm \int g(x)dx$
- If c is a const, $\int cf(x)dx = c\int f(x)dx$

Ex: $\int 4x^2 + 3x^{4.2}\,dx = 4\int x^2dx + 3\int x^{4.2}dx$

$$= \boxed{4\frac{x^3}{3} + 3\frac{x^{5.2}}{5.2} + C}$$

Rules involving logarithms and exp. functions

- $\int \frac{1}{x}dx = \ln|x| + C$, where

$|x|$ is the abs. value of x.

Ex $\int \frac{x^2+4}{x}dx = \int \frac{x^2}{x} + \frac{4}{x}dx$

$$= \int x + 4\cdot\frac{1}{x}dx$$

$$= \int x\,dx + 4\int \frac{1}{x}\,dx$$

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

- $\int e^x dx = e^x + C$
- $\int e^{kx} dx = \frac{1}{k} e^{kx} + C$, where k is a nonzero constant.