

Math 181

Thursday, April 8

Sections 8.1 / 8.2

probability density function, pdf, $f(x)$

Fri - 8.2 Sports Stars

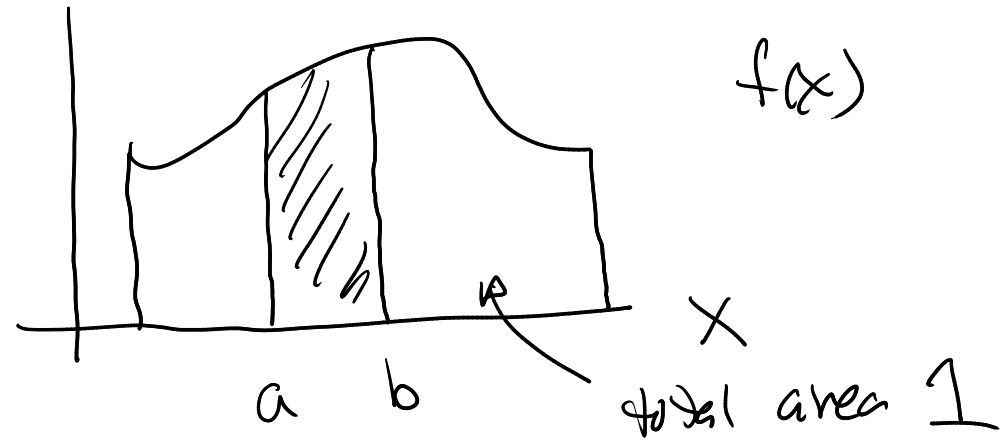
$$P(a \leq X \leq b) = \int_a^b f(x) dx$$

↑
Probability

↑
random variable
(continuous)

Mon - Problems

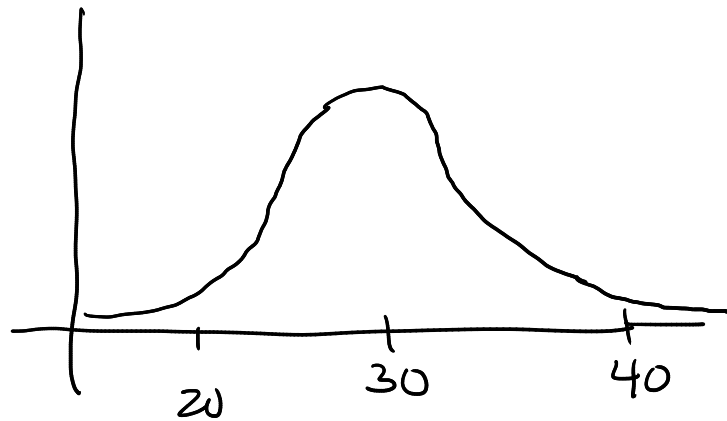
Tue - Exam 3
Chapter 10



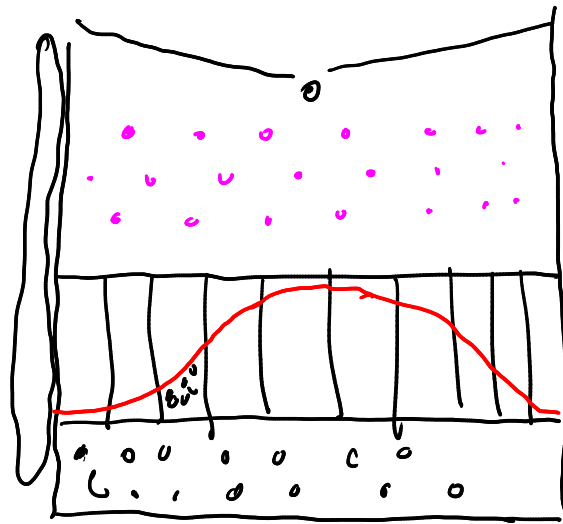
Ex Nesting time for juvenile crow 20 days to 40 days

pdf for $X = \text{nesting time}$ $P(x) = \frac{1}{3\sqrt{2\pi}} e^{-\frac{(x-30)^2}{2 \cdot 3^2}}$, $-\infty < x < \infty$

normal distribution ("bell curve") mean = 30, standard deviation = 3



$$P(28 \leq X \leq 29) = \int_{28}^{29} P(x) dx$$



\star no nice
antiderivative
(Simpson's Rule)
numerically

$$= 0.1169$$

Ex Normal $(0,1)$ distribution
 mean \rightarrow standard deviation

$$P(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}, \quad -\infty < x < \infty$$

Expected value? Discrete case $\sum x P(x)$

Continuous case: $\int x P(x) dx$

$$\int_{-\infty}^{\infty} x \frac{1}{\sqrt{2\pi}} e^{-x^2/2} dx = \frac{1}{\sqrt{2\pi}} \lim_{b \rightarrow \infty} \int_{-b}^b x e^{-x^2/2} dx$$

$u = -\frac{1}{2}x^2$
 $du = -x dx$
 $-du = x dx$

$$= \lim_{b \rightarrow \infty} \int_{x=-b}^{x=b} -e^u du = - \lim_{b \rightarrow \infty} e^u \Big|_{x=-b}^{x=b} = - \lim_{b \rightarrow \infty} e^{-1/2x^2} \Big|_{x=-b}^{x=b}$$

$$= - \lim_{b \rightarrow \infty} e^{-1/2b^2} - e^{-1/2(-b)^2} = - \lim_{b \rightarrow \infty} 0 = -0 = 0$$

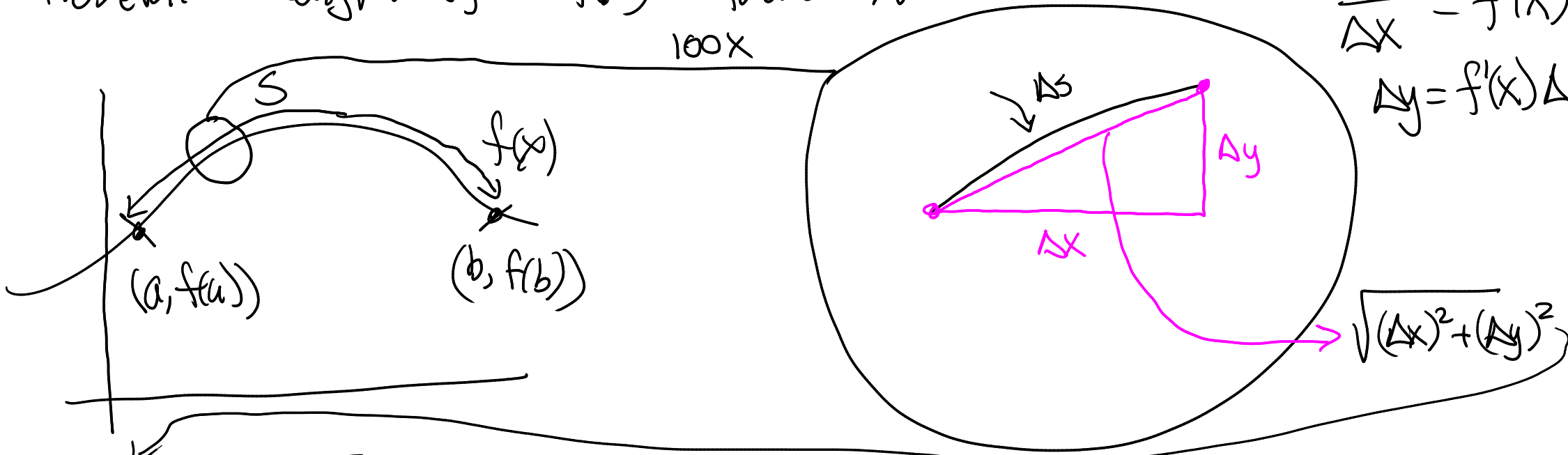


Section 8.2 Arc Length & Surface Area

Problem: Length of $f(x)$ from $x=a$ to $x=b$.

$$\frac{\Delta y}{\Delta x} = f'(x)$$

$$\Delta y = f'(x) \Delta x$$



$$ds \approx \sqrt{(\Delta x)^2 + (f'(x)\Delta x)^2} = \sqrt{\Delta x^2 + (f'(x))^2 \Delta x^2} = \sqrt{(1 + f'(x)^2) \Delta x^2}$$

$$= \sqrt{1 + f'(x)^2} \Delta x. \text{ Arc Length is } S = \int ds = \int_{x=a}^{x=b} \sqrt{1 + f'(x)^2} dx$$

$$\frac{ds}{dx} = \sqrt{1 + f'(x)^2}$$