# Homework 30

The **due date** for this homework is **Tue 7 May 2013 12:00 AM EDT**.

## Question 1

What is the area between the curve $f(x) = \sin^3 x$ and the $x$-axis from $x = 0$ to $x = \frac{\pi}{3}$ ?

- $\frac{1}{24}$
- $\frac{19}{24}$
- $\frac{23 - 9\sqrt{3}}{24}$
- $\frac{-25 + 15\sqrt{3}}{24}$
- $\frac{5}{24}$
- $\frac{29}{24}$

## Question 2

Compute the area between the curves $f(x) = e^x \sec^2 x$ and $g(x) = e^x \tan^2 x$ for $0 \leq x \leq \pi$.

**Hint:** if you do this correctly, you will not have to worry about the fact that there are singularities in $\sec$ and $\tan$...

- $e^\pi - 1$
- $0$
- $\pi$

- $1 - e^{\pi}$
- $e^{\pi} \sec^2 \pi - e^{\pi} \tan^2 \pi$
- $e^{\pi}$

## Question 3

What is the area between the curve $y = \sin x$ and the $x$-axis for $0 \leq x \leq \pi$ ?

- $\pi$
- $2$
- $-2$
- $-1$
- $1$
- $-\pi$

## Question 4

What is the area between the curve $y = \sin x$ and the $x$-axis for $0 \leq x \leq 2\pi$ ?

- $-4$
- $2$
- $-2$
- $4$
- $1$
- $0$

## Question 5

Find the area of the bounded region enclosed by the curves $y = \sqrt{x}$ and

$y = x^2$.

**Hint:** start by drawing the curves in the plane and identifying the appropriate region.

- $-1$
- $-\frac{1}{3}$
- $3$
- $\frac{1}{3}$
- $1$
- $-3$

# Question 6

Calculate the Gini index (see the lecture for a definition) of a country where the fraction of the total income earned by the lowest $x$ fraction of the populace is given by the function

$$f(x) = \frac{2}{5}\,x^2 + \frac{3}{5}\,x^3$$

- $G(f) = \frac{13}{30}$
- $G(f) = \frac{13}{60}$
- $G(f) = \frac{13}{15}$
- $G(f) = \frac{5}{6}$
- $G(f) = \frac{5}{12}$
- $G(f) = \frac{5}{3}$

# Question 7

Consider a cone of height $h$ with base a circular disc of radius $r$. Let's compute the *surface area* —the area of the "outside" of the cone, not including the bottom. Following how we computed the area of a circular disc (which is, indeed, such a cone with $h = 0$), we can decompose its area into infinitesimal triangles with base $rd\theta$ and height the slant length $L = \sqrt{h^2 + r^2}$. The area element $dA$ is then the area of this infinitesimal triangle. Integrating $dA$ from $\theta = 0$ to $\theta = 2\pi$ gives the *surface area* of the cone. What is its value?

If you find this problem difficult, don't worry! We will revisit it in Lecture 36.

- $\pi r L$
- $\pi r^2 L$
- $\frac{1}{3}\pi r^2 L$
- $\frac{1}{2}\pi r^2 L$
- $2\pi r^2 L$
- $2\pi r L$

In accordance with the Honor Code, I certify that my answers here are my own work.

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