# Math 31B: Week 3 Section

TA: Ben Szczesny Last updated: 2018/01/24

## Information

## Discussion Questions

**Question 1.** Use L'Hopital's rule to evaluate the following limits or state that it does not apply

(a) $\lim_{x\to 9} \dfrac{x^{1/2} - x + 6}{x^{3/2} - 27}$

(b) $\lim_{x\to 0} \dfrac{\cos(2x) - 1}{\sin(5x)}$

(c) $\lim_{x\to 0} \dfrac{\sin(4x)}{x^2 + 3x + 1}$

(d) $\lim_{x\to 1} \dfrac{e^x - e}{2x - 2}$

**Question 2.** Compute without calculator:

(a) $\arcsin(\sin \frac{\pi}{3})$

(b) $\arcsin(\sin \frac{4\pi}{3})$

(c) $\arctan(\tan \frac{3\pi}{4})$

(d) $\cos(\arctan(x))$

**Question 3.** Show that $e = \lim_{x\to 0}(1 + x)^{1/x}$.

**Question 4.** Find the derivatives of the following functions:

(a) $\arcsin(e^x)$

(b) $\arccos(\ln(x))$

(c) $\sec^{-1}(t + 1)$

(d) $\tan^{-1}\left(\dfrac{1 + t}{1 - t}\right)$.

**Question 5.** Evaluate the following integrals:

(a) $\displaystyle\int \frac{dt}{\sqrt{1 - 16t^2}}$

(b) $\displaystyle\int \frac{dx}{x\sqrt{x^4 - 1}}$

(c) $\displaystyle\int \frac{\ln(cos^{-1}(x))dx}{(\cos^{-1}(x))\sqrt{1 - x^2}}$ .

## Homework Questions

Section 7.7
6, 10, 12, 16, 18, 26, 38, 44, 48, 50, 53, 54, 60, 62.
Section 7.8
30, 32, 34, 38, 48, 54, 56, 58, 62, 72, 112.

# Extra Questions

**Question 6.** Show that $0^\infty$ is not an indeterminate form by showing that for any positive functions $f$ and $g$ such that $\lim_{x\to 0} f(x) = 0$ and $\lim_{x\to 0} g(x) = \infty$, then

$$\lim_{x\to 0} f(x)^{g(x)} = 0.$$

In contrast, show that $1^\infty$ is an indeterminate form by finding an example of positive functions $f, g$ such that $\lim_{x\to 0} f(x) = 1$,$\lim_{x\to 0} g(x) = \infty$ and $\lim_{x\to 0} f(x)^{g(x)} = 1$. And then find another pair of functions $f, g$ with corresponding limits as $x \to \infty$ but $\lim_{x\to 0} f(x)^{g(x)} \neq 1$.

**Question 7.** Evaluate the following integrals:

(a) $\displaystyle\int 2^x e^{4x} dx$

(b) $\displaystyle\int \frac{e^x dx}{\sqrt{1-16e^{2x}}}$

(c) $\displaystyle\int \cos(x) 5^{-2\sin(x)} dx$

(d) $\displaystyle\int \frac{dx}{x\sqrt{25x^2-1}}$.