# Homework Math 140
# Lectures 5 and 6
# Will be quizzed Thursday Feb 21



**Problem 1** *(Textbook page 70, problems 11-32). Complete problem 6 from the previous homework, if you failed to do so last week.*

**Problem 2** *(Textbook, page 91, problem 23-24). Find the (implied) domain of $f(x)$. Extend the definition of $f$ at $x = 2$ to make $f$ continuous at 2.*

1. $f(x) = \frac{x^2-x-2}{x-2}$.
2. $f(x) = \frac{x^3-8}{x^2-4}$.

**Problem 3** *(Textbook, page 92, problem 41-43) Find the numbers $x$ for which $f$ is discontinuous. At which of these numbers is $f$ continuous from the right, from the left, or neither?*

1. $f(x) = \begin{cases} 1+x^2 & \text{if } x \leq 0 \\ 2-x & \text{if } 0 < x \leq 2 \\ (x-2)^2 & \text{if } x > 2 \end{cases}$.
2. $f(x) = \begin{cases} x+1 & \text{if } x \leq 1 \\ \frac{1}{x} & \text{if } 1 < x < 3 \\ \sqrt{x-3} & \text{if } x \geq 3 \end{cases}$.
3. $f(x) = \begin{cases} x+2 & \text{if } x < 0 \\ 2x^2 & \text{if } 0 \leq x \leq 1 \\ 2-x & \text{if } x > 1 \end{cases}$

**Problem 4** *(Textbook, page 92, problem 46) Find the values of $a$ and $b$ that make $f$ continuous everywhere.*

$$f(x) = \begin{cases} \frac{x^2-4}{x-2} & \text{if } x < 2 \\ ax^2 - bx + 3 & \text{if } 2 \leq x < 3 \\ 2x - a + b & x \geq 3 \end{cases}.$$

**Problem 5** *(Textbook, page 92, problem 51-56) Use the Intermediate Value Theorem to show that there is a real number solution of the given equation in the specified interval.*

- $x^4 + x - 3 = 0$ *where* $x \in (1, 2)$.
- $\sqrt[3]{x} = 1 - x$ *where* $x \in (0, 2)$.
- $\cos x = x$, *where* $x \in (0, 1)$.
- $\sin x = x^2 - x$, *where* $x \in (1, 2)$.
- $\cos x = x^3$, *where* $x \in \mathbb{R}$ *(i.e., $x$ is an arbitrary real number).*
- $x^5 - x^2 + 2x + 3$, *where* $x \in \mathbb{R}$.

**Problem 6** *(Textbook, page 93, problem 63-64) For which values of $x$ is $f$ continuous?*

- $f(x) = \begin{cases} 0 & \text{if } x \text{ is rational} \\ 1 & \text{if } x \text{ is irrational} \end{cases}$
- $f(x) = \begin{cases} 0 & \text{if } x \text{ is rational} \\ x & \text{if } x \text{ is irrational} \end{cases}$

**Problem 7** *This problem will not appear on the quiz, and might be slightly harder. For which values of $x$ is $f$ continuous?*

$$f(x) = \begin{cases} \frac{1}{q^2} & \text{if } x \text{ is rational and } x = \frac{p}{q} \\ 0 & \text{if } x \text{ is irrational} \end{cases}$$

*where in the first item $p, q$ are relatively prime integers (i.e., integers without a common divisor).*