MAR 29 2022 MATH 5A

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Policies

-Office Hours: Monday 8am - 9am and Wednesday 2pm - 3pm. The followings are the ics file and the direct link, respectively.

https://uci.zoom.us/meeting/tJYtdu6grD0uE9LNKBcsvvMwYwDltiv6s0eu/ics

https://uci.zoom.us/j/92017826496

-Appointment: If you have any question, feel free to email me, I will try to respond as soon as possible or hold an extra appointment for you.

-WebAssign Homework:

-If you encounter any technical issue, please contact Cengage tech support!

-Quizzes: There will be no quiz.

-In person quiz at 8:30am in BS3 1200
-In total six quizzes, the lowest one will be dropped!
-No makeup quiz!

-Schedule of my discussion session:

-20 minutes lecture
-15 minutes worksheet
-5 minutes going over worksheet

1.1 Function

Definition. *A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$, in a set E. The set D is called the **domain** of the function. The **range** of the function f is the set of all values $f(x)$ as x varies throughout the domain.*

Example. *Find the domain of the functions $f(x) = \sqrt{x+1}$ and $f(x) = \frac{\sqrt{x+1}}{x-1}$.*

Solution. For $f(x) = \sqrt{x+1}$, we need to make sure that the value inside square root must be non-negative, that is,

$$x + 1 \geq 0 \Rightarrow x \geq -1.$$

So the domain will be

$$\text{Domain} = \{x \colon x \geq -1\} = [-1, \infty).$$

For $f(x) = \frac{\sqrt{x+1}}{x-1}$, first, it is a fraction, so the denominator cannot be zero. We have

$$x - 1 \neq 0 \Rightarrow x \neq 1.$$

Then, we need to make sure the numerator is defined, by the previous function, we require

$$x + 1 \geq 0 \Rightarrow x \geq -1.$$

You need to satisfy these two constraints, so the domain will be the intersection, that is,

$$\text{Domain} = \{x \colon x \geq -1\} \cap \{x \neq 1\} = [-1, 1) \cup (1, \infty).$$

□

1.2 A Catalog of Essential Functions

Polynomials. A function P is a polynomial if it is of the form

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0,$$

where n is a non-negative integer and $a_0, a_1, \cdots, a_{n-1}, a_n$ are real numbers.

Example.

- *Constant function* $f(x) = c$ *is a polynomial of degree* 0.
- *Linear function* $f(x) = ax + b$ *is a polynomial of degree* 1.
- *Quadratic function* $f(x) = ax^2 + bx + c$ *is a polynomial of degree* 2.

Trigonometric Functions.

Example.

- $\sin(x)$.
- $\cos(x)$.
- $\tan(x)$.

1.3 New Functions from Old Functions

Example (Vertical and Horizontal Shifts)**.** *Suppose* $c > 0$.

- $y = f(x) + c$, *shifts the graph of* $y = f(x)$ *a distance* c *units upward.*
- $y = f(x) - c$, *shifts the graph of* $y = f(x)$ *a distance* c *units downward.*
- $y = f(x + c)$, *shifts the graph of* $y = f(x)$ *a distance* c *units to the left.*
- $y = f(x - c)$, *shifts the graph of* $y = f(x)$ *a distance* c *units to the right.*

Example (Vertical and Horizontal Stretching and Reflecting)**.** *Suppose* $c > 0$.

- $y = cf(x)$, *stretch the graph of* $y = f(x)$ *vertically by a factor of* c.
- $y = f(x)/c$, *shrink the graph of* $y = f(x)$ *vertically by a factor of* c.
- $y = f(cx)$, *shrink the graph of* $y = f(x)$ *horizontally by a factor of* c.
- $y = f(x/c)$, *stretch the graph of* $y = f(x)$ *horizontally by a factor of* c.
- $y = -f(x)$, *reflect the graph of* $y = f(x)$ *about the* x*-axis.*
- $y = f(-x)$, *reflect the graph of* $y = f(x)$ *about the* y*-axis.*