MTH 161 Calculus

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Virtual office hours: Tue, Thu 4-5pm Zoom link on Blackboard
(Starting next Tuesday) (same link as the lecture)

You can attend office hours of any other MTH 161 professor.

Textbook: Calculus: Early Transcendentals (9^{th} edition) by James Stewart

Grade:

- Webwork HW 15% Every week due on Friday
- Webwork quizzes 10% Every week open for 24 hours on Friday
- Workshop attendance and participation 15% sign up available on Sept 2^{nd} on Blackboard
- 3 Midterm exams 20% each
- Final exam 20%

(Webcam Required during exams!)

lowest MT score will be dropped.
lowest WW-HW will be dropped.
lowest WW-Quiz will be dropped

To access WW, you need to find the link on Blackboard in "Course Materials".

WW - Set 0 is a warm up set. Take it ASAP.

Appendix A. Numbers, Inequalities, and Absolute Values

Integers:

$\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots$

Rational numbers $r = \dfrac{m}{n}$ where m and n are integers and $n \neq 0$

e.g. $\dfrac{1}{2}$ $-\dfrac{3}{7}$ $46 = \dfrac{46}{1}$ $0.17 = \dfrac{17}{100}$

Irrational numbers: numbers that are not rational

$\sqrt{2}$, $\sqrt{3}$, π, e, $\log_{10} 2$

The union of rational numbers and irrational numbers is the set of all real numbers denoted by $\mathbb{R}$

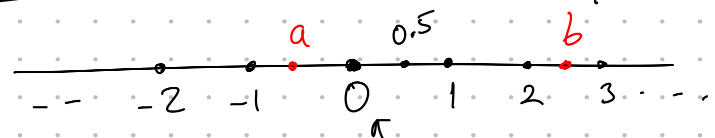
Every number has a decimal representation. If the number is rational then the decimal representation is repeating. For irrationals the decimal representation is not repeating.

rationals
$\frac{1}{2} = 0.50000\ldots = 0.5\overline{0}$ $\frac{2}{3} = 0.6666\ldots = 0.\overline{6}$

$\frac{157}{495} = 0.3171717\ldots = 0.3\overline{17}$

irrationals
$\sqrt{2} = 1.4142135\ldots$ $\pi = 3.1415926\ldots$

The real number line: points $\leftrightarrow$ coordinates $\leftrightarrow$ numbers



$b > a$ or $a < b$ since "a is to the left of b"

Set notation: A set is a collection of elements

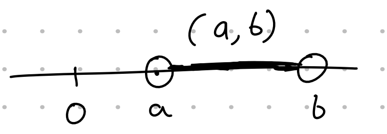
$A = \{1, 2, 3, 4\} = \{x \mid x \text{ is an integer and } 0 < x < 5\}$

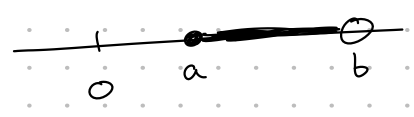
"such that"

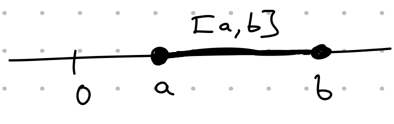
Intervals: (here x is always a real number)

Notation	Meaning
"open" interval $\to (a,b)$	$= \{x \mid a < x < b\}$
"closed" interval $\to [a,b]$	$= \{x \mid a \leq x \leq b\}$

$[a, b) = \{x \mid a \leq x < b\}$







$[a, \infty) = \{x \mid a \leq x\}$

$(-\infty, \infty) = \mathbb{R}$

Rules for inequalities:

1) If $a < b$, then $a + c < b + c$
2) If $a < b$ and $c < d$, then $a + c < b + d$
3) If $a < b$ and $c > 0$, then $ac < bc$
4) If $a < b$ and $c < 0$, then $ac > bc$
5) If $0 < a < b$ then $\frac{1}{a} > \frac{1}{b}$

Example Solve the inequality $1 + x < 7x + 5$

$x < 7x + 4$ by ① with $c = -1$

$x - 7x < \cancel{7x} + 4 \cancel{- 7x}$ by ① with $c = -7x$

$-6x < 4$

$x > -\frac{4}{6} = -\frac{2}{3}$ by ④ with $c = -\frac{1}{6}$

So the solution set is $(-\frac{2}{3}, \infty)$

Example Solve the inequalities $4 \le 3x - 2 < 13$

$$6 \le 3x < 15$$

$$2 \le x < 5$$

x is in $[2,5)$

$x \in [2,5)$

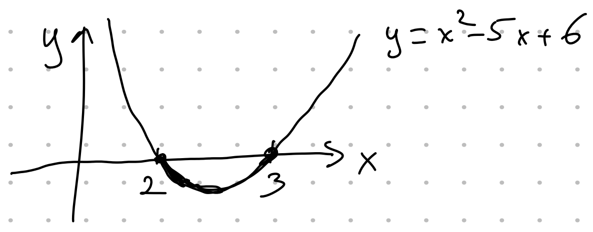
Example Solve the inequality $x^2 - 5x + 6 \le 0$

$$(x-2)(x-3) \le 0$$

$x-2 > 0$ if $x > 2$
$x-2 < 0$ if $x < 2$
$x-3 > 0$ if $x > 3$
$x-3 < 0$ if $x < 3$

Interval	$x-2$	$x-3$	Product $(x-2)(x-3)$
$x < 2$	$-$	$-$	$+$
$2 < x < 3$	$+$	$-$	$-$
$3 < x$	$+$	$+$	$+$

So $x \in [2,3]$



Absolute Value $|a|$ = the distance from a to 0

for a real number a, $|a| = \begin{cases} a & \text{if } a \ge 0 \\ -a & \text{if } a < 0 \end{cases}$ ($-a$ positive)

$|3| = 3 = |-3|$

$|\sqrt{2} - 1| = \sqrt{2} - 1 \qquad |3 - \pi| = \pi - 3$

Recall that the symbol $\sqrt{\ }$ means "the positive square root of".

$\sqrt{a^2} = |a| \qquad \sqrt{a^2} \ne a$ in general

for example $a = -3$: $\sqrt{(-3)^2} = \sqrt{9} = 3 \ne -3$

Properties of Absolute Values

1) $|ab| = |a||b|$ 2) $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$ $(b \ne 0)$

3) $|a^n| = |a|^n$

iff $\Leftrightarrow$ if and only if

Suppose $a > 0$. Then

4) $|x| = a$ iff $x = \pm a$

5) $|x| < a$ iff $-a < x < a$

6) $|x| > a$ iff $x > a$ or $x < -a$

Example Solve $|x-5| < 2$

by ⑤ $-2 < x - 5 < 2$ Then $3 < x < 7$

So $x \in (3,7)$

Geometrically $|x-5|$ is the distance from 5 to x.

So $|x-5| < 2$ means x is at most 2 units apart from 5.

So $x \in (3,7)$