02-25-25 MTH 161-004N

1.7 Transformations
 1.7.1 Exercises
 page 140: 1,4, 19, 24, 48, 56

____

2 Linear and Quadratic Functions

2.1 Linear Functions
 2.1.1 Exercises
 page 163: 5, 7, 15, 18, 26, 28, 32, 35, 45

2.2 Absolute Value Functions
 2.2.1 Exercises
 page 183: 1, 2, 15, 17, 22, 29

____

9*1.04=9.36 sections to be on track

____

Memorize

Equation 2.1. The **slope** m of the line containing the points $P(x_0, y_0)$ and $Q(x_1, y_1)$ is:

Δx change in x = run

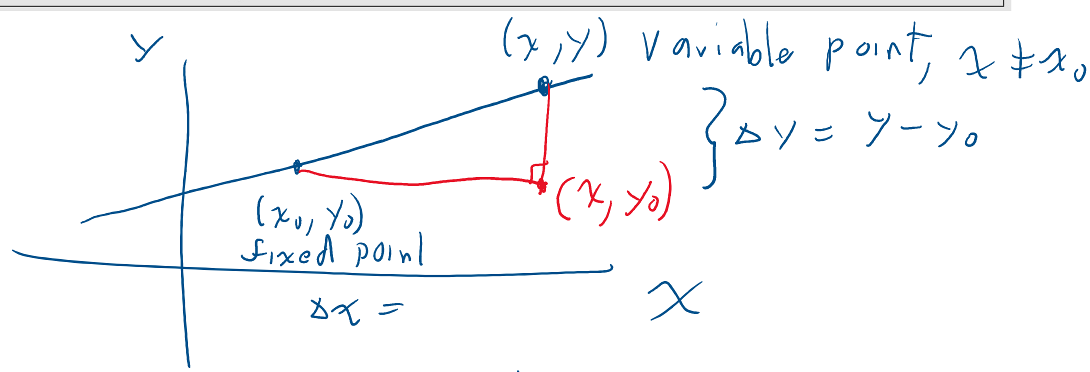
$$m = \frac{y_1 - y_0}{x_1 - x_0},$$

provided $x_1 \neq x_0$. rate of change of a dependent variable

m = Δy with respect to independent variable

Memorize

Equation 2.2. The **point-slope form** of the line with slope m containing the point (x_0, y_0) is the equation $y - y_0 = m(x - x_0)$.



$$m = \frac{\Delta y}{\Delta x} = \frac{y - y_0}{x - x_0}$$

$$m(x-x_0) = \left(\frac{y-y_0}{x-\cancel{x_0}}\right)(x-\cancel{x_0})$$

$$\boxed{y-y_0 = m(x-x_0)}$$ point-slope equation

Memorize

Equation 2.3. The **slope-intercept form** of the line with slope m and y-intercept $(0, b)$ is the equation $y = mx + b$.

Derive the slope-intercept form from the point-slope form. Express b in terms of the given constants

$$y - y_0 = m(x - x_0)$$
$$y = m(x - x_0) + y_0$$
$$y = mx - mx_0 + y_0$$
$$y = mx + (-mx_0 + y_0)$$

Let $b = -mx_0 + y_0$

Memorize

Definition 2.1. A **linear function** is a function of the form

$$f(x) = mx + b,$$

where m and b are real numbers with $m \neq 0$. The domain of a linear function is $(-\infty, \infty)$.

Definition 2.2. A **constant function** is a function of the form

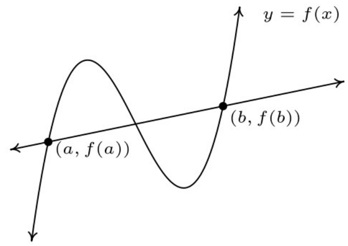
$$f(x) = b,$$

where b is real number. The domain of a constant function is $(-\infty, \infty)$.

Memorize

Definition 2.3. Let f be a function defined on the interval $[a, b]$. The **average rate of change** of f over $[a, b]$ is defined as:

$$\frac{\Delta f}{\Delta x} = \frac{f(b) - f(a)}{b - a}$$

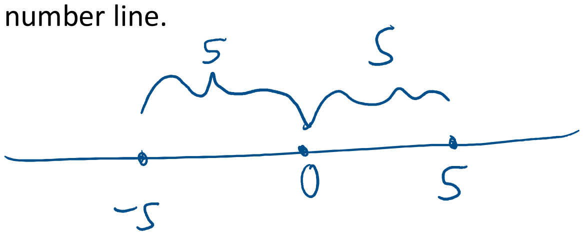


The graph of $y = f(x)$ and its secant line through $(a, f(a))$ and $(b, f(b))$

2.2

Absolute value: geometric definition

The distance from point x to the origin on the real number line.



$|5| = 5$

$|-5| = 5$

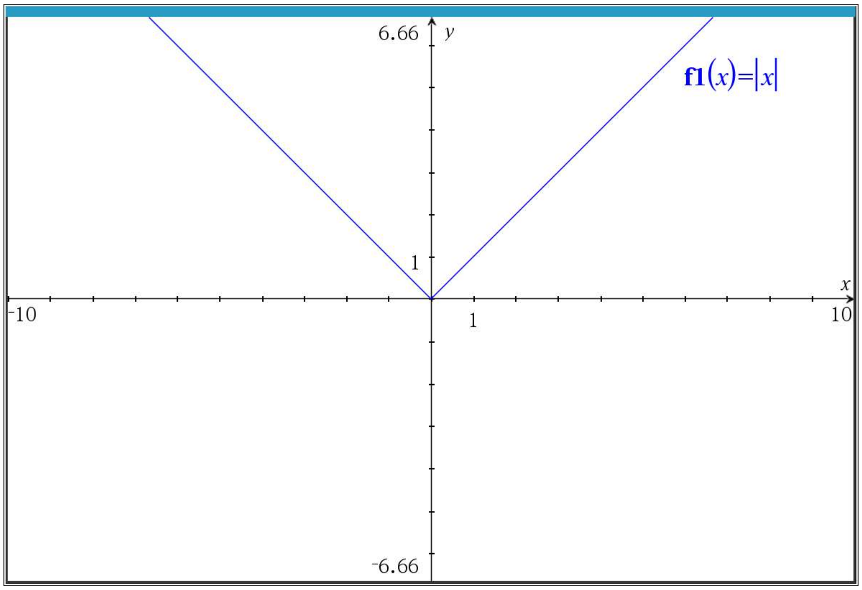
Definition 2.4. The **absolute value** of a real number x, denoted $|x|$, is given by

$$|x| = \begin{cases} -x, & \text{if } x < 0 \\ x, & \text{if } x \geq 0 \end{cases}$$

$-5 < 0 \Rightarrow |-5| = -(-5) = 5$

$5 \geq 0 \Rightarrow |5| = 5$

$Y_1 = (-x)(x < 0) + x(x \geq 0)$



Memorize

Theorem 2.1. Properties of Absolute Value: Let a, b and x be real numbers and let n be an integer.[a] Then

- **Product Rule:** $|ab| = |a||b|$
- **Power Rule:** $|a^n| = |a|^n$ whenever a^n is defined
- **Quotient Rule:** $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$, provided $b \neq 0$

Equality Properties:

- $|x| = 0$ if and only if $x = 0$.
- For $c > 0$, $|x| = c$ if and only if $x = c$ or $-x = c$. $(x = \pm c)$
- For $c < 0$, $|x| = c$ has no solution.

[a]See page 2 if you don't remember what an integer is.

Proof of product rule

Prove $|ab| = |a||b|$

case 1, $a \geq 0$, $b \geq 0$

$ab \geq 0 \Rightarrow |ab| = \boxed{ab}$

$|a| = a$

$|b| = b$

$|b| = b$

$|a||b| = \boxed{ab}$

case 2, $a \geq 0$, $b < 0$

$ab \leq 0 \Rightarrow |ab| = \boxed{-ab}$

$|a| = a$, $|b| = -b$

$|a||b| = \boxed{-ab}$

case 3 $a < 0$, $b \geq 0$

case 4 $a < 0$, $b < 0$

2.2

2.2.1 Exercises

In Exercises 1 - 15, solve the equation.

2. $|3x - 1| = 10$

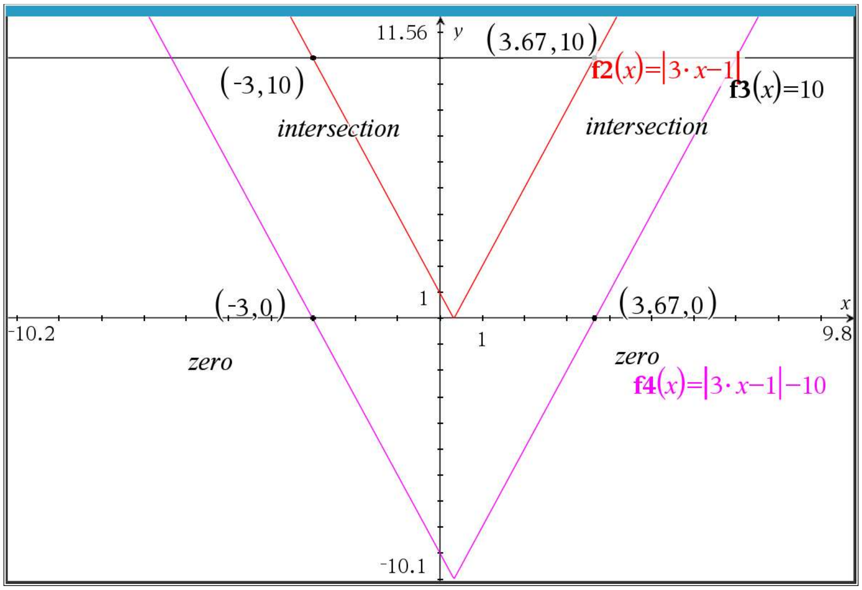
$3x - 1 = 10$ or $3x - 1 = -10$

$3x = 11$ $\quad$ $3x = -9$

$\boxed{x = \frac{11}{3}}$ or $\quad$ $x = \frac{-9}{3}$

$\boxed{x = -3}$

11/3=3.6667



11.56
y
(3.67,10)
f2(x)=|3·x−1|
(-3,10)
f3(x)=10
intersection
intersection
1
(-3,0)
(3.67,0)
x
-10.2
1
9.8
zero
zero
f4(x)=|3·x−1|−10
-10.1