Exercise 1 – Practice Problems

1. Express the interval as an inequality in set notation and graph the inequality on the number line.

a) $(-2, 6)$

$\{x \mid x \in \mathbb{R},\ -2 < x < 6\}$

b) $[-3, -2)$

$\{x \mid x \in \mathbb{R},\ -3 \leq x < 2\}$

c) $(1, 4]$

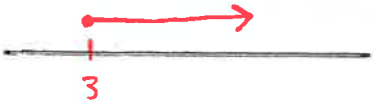
$\{x \mid x \in \mathbb{R},\ 1 < x \leq 4\}$

d) $[-2, 1.5]$

$\{x \mid x \in \mathbb{R},\ -2 \leq x \leq 1.5\}$

e) $[3, \infty)$

$\{x \mid x \in \mathbb{R},\ x \geq 3\}$

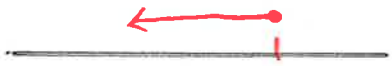


f) $(-\infty, 2)$

$\{x \mid x \in \mathbb{R},\ x < 2\}$

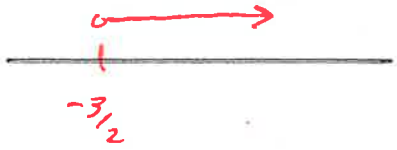
g) $(-\infty, 1]$

$\{x \mid x \in \mathbb{R},\ x \leq 1\}$



h) $\left(-\frac{3}{2}, \infty\right)$

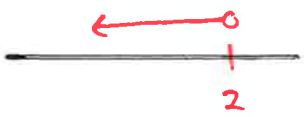
$\{x \mid x \in \mathbb{R},\ x > -3/2\}$



2. Express the inequality in interval notation and graph the interval on a number line.

a) $x < 2$

$(-\infty, 2)$

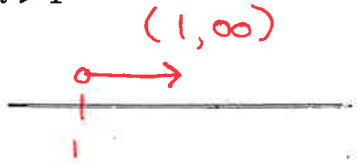


b) $0 < x < 3$

$(0, 3)$

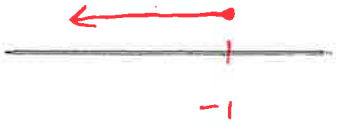
c) $-1 \le x < 2$ $[-1, 2)$

d) $x > 1$ $(1, \infty)$



e) $-1 \le x \le 3$ $[-1, 3]$

f) $x \le -1$ $(-\infty, -1]$



Exercise 2 – Practice Problems

1. Solve the inequality.

a) $3x + 7 > 0$

$x > -\frac{7}{3}$ $\left(-\frac{7}{3}, \infty\right)$

b) $18 - 4x < 0$

$-4x < -18$

$x > \frac{9}{2}$ $\left(\frac{9}{2}, \infty\right)$

c) $17 - 2x \ge 13$

$-2x \ge -4$

$x \le 2$ $(-\infty, 2]$

d) $2x + 1 < 5x - 11$

$12 < 3x$

$4 < x$ $(4, \infty)$

e) $2x - 1 < 19$

$2x < 20$

$x < 10$

$(-\infty, 10)$

f) $x^2 - 7x + 6 > 0$

$(x-1)(x-6) > 0$

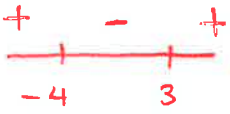
$\{x \mid x \in \mathbb{R},\ x < 1 \text{ or } x > 6\}$

$(-\infty, 1) \cup (6, \infty)$

g) $12 - x - x^2 > 0$

$x^2 + x - 12 < 0$

$(x+4)(x-3) < 0$



$\{x \mid x \in \mathbb{R},\ -4 < x < 3\}$

$(-4, 3)$

h) $x^2 < 3x$

$x^2 - 3x < 0$

$x(x-3) < 0$

$\{x \mid x \in \mathbb{R},\ 0 < x < 3\}$

$(0, 3)$

i) $x^2 - 9 > 0$

$(x+3)(x-3) > 0$

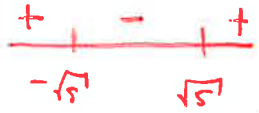
$\{x \mid x \in \mathbb{R},\ x < -3 \text{ or } x > 3\}$

$(-\infty, -3) \cup (3, \infty)$

j) $x^2 \leq 5$

$x^2 - 5 \leq 0$

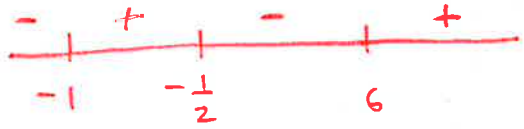
$(x - \sqrt{5})(x + \sqrt{5}) \leq 0$



$\{x \mid x \in \mathbb{R},\ -\sqrt{5} \leq x \leq \sqrt{5}\}$

$[-\sqrt{5}, \sqrt{5}]$

k) $(x+1)(2x+1)(x-6) > 0$

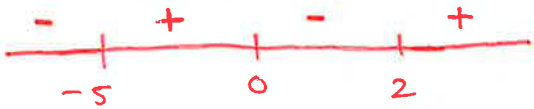


$\{x \mid x \in \mathbb{R},\ -1 < x < -\frac{1}{2} \text{ or } x > 6\}$

$(-1, -\frac{1}{2}) \cup (6, \infty)$

l) $x^3 + 3x^2 - 10x < 0$

$x(x^2 + 3x - 10) < 0 \rightarrow x(x+5)(x-2) < 0$



$\{x \mid x \in \mathbb{R},\ x < -5 \text{ or } 0 < x < 2\}$

$(-\infty, -5) \cup (0, 2)$

m) $x^3 + 3x^2 - 4 < 0$

$f(1) = 0$

$x^2 + 4x + 4$

$x-1 \overline{)\ x^3 + 3x^2 + 0x - 4}$

$x^3 - x^2$

$4x^2 + 0x$

$4x^2 - 4x$

$4x - 4$

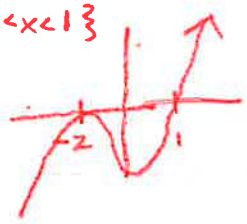
$4x - 4$

0

$(x-1)(x+2)(x+2) < 0$

$\{x \mid x \in \mathbb{R},\ x < -2 \text{ or } -2 < x < 1\}$

$(-\infty, -2) \cup (-2, 1)$



n) $x^3 + 2x^2 - 9x - 18 > 0$

$f(-2) = 0$

$x^2 + 0x - 9$

$x+2 \overline{)\ x^3 + 2x^2 - 9x - 18}$

$x^3 + 2x^2$

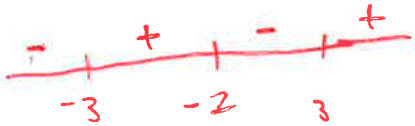
$0x^2 - 9x$

$0x^2 + 0x$

$-9x - 18$

$(x+2)(x^2 - 9) > 0$

$(x+2)(x+3)(x-3) > 0$



$\{x \mid x \in \mathbb{R},\ -3 < x < 2 \text{ or } x > 3\}$

$(-3, -2) \cup (3, \infty)$

o) $x^3 - 8 \geq 0$

quadratic Eq^n

$(x-2)(x^2+2x+4)$

$\sqrt{b^2-4ac}$

$(x-2)$

$\sqrt{\ -\ }$

NO SOLUTION

$\{x \mid x \in \mathbb{R},\ x > 2\}$

$(2, \infty)$

p) $x^9 + x > 0$

$x(x^8+1)$

never 0

$\{x \mid x \in \mathbb{R},\ x > 0\}$

$(0, \infty)$

2. Solve the inequality

a) $\frac{2x+1}{x^2+1} > 0$ ← Forever positive

$2x+1 > 0$ $\quad x > -\frac{1}{2}$

$(-\frac{1}{2}, \infty)$

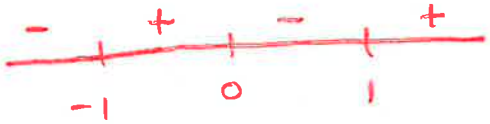
b) $\frac{x+2}{x-3} > 0$

(denominator is an asymptote) but consider sign.

$(-\infty, -2) \cup (3, \infty)$

c) $\frac{x^2+x}{(x-1)^3} < 0$

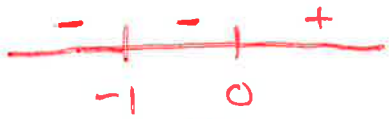
$\frac{x(x+1)}{(x-1)^3}$



$(-\infty, -1) \cup (0, 1)$

d) $\frac{5x}{(x^2-1)^2} < 0$

↑ Forever positive



$(-\infty, -1) \cup (-1, 0)$