

Practice for midterm #2.
Mr. Neeman, 10A. September 16.

#1. Solve each of the following inequalities:

(a) $x^2(x - 1) \leq 0$

(b) $x^2 + 3x - 18 > 0$

(c) $\frac{6}{x + 4} \geq 1$

(d) $2x^2 + 12x + 18 > 0$

(e) $\frac{x^2 + 5x + 10}{x - 1} \geq 0$

#2. For each of the following, circle the type of proposition it is, or “NP” if it’s not a proposition.

(a) Asia is a city in Texas.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

(b) Either it will rain tomorrow or it won’t.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

(c) Honk if you like puppies.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

(d) Peter the Great was Russian and Peter the Great wasn’t Russian.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

(e) If it’s cloudy, then it’s raining.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

(f) Bill Monroe is dead.

Tautology	Contradiction	Contingent	NP
-----------	---------------	------------	----

#3. Translate each of the following, using the key given

p : Alice likes painting.

q : Alice likes quilting.

r : Alice likes reading.

(a) If Alice doesn’t like painting, then she likes reading.

(b) Either Alice doesn’t like painting or she doesn’t like quilting.

(c) Alice likes reading if and only if she likes both painting and quilting.

(d) Alice doesn’t like quilting, and she does like reading.

(e) If Alice likes either reading or quilting, then she doesn’t like quilting.

(f) $p \underline{\vee} r$

(g) $p \vee \neg q$

(h) $\neg r \Rightarrow (p \wedge q)$

#4. For each of the following, draw a truth table and use it to say whether the proposition is a tautology, a contradiction, or contingent.

- (a) $p \Leftrightarrow (\neg p \Rightarrow p)$
- (b) $p \vee (p \Rightarrow q)$
- (c) $p \vee (\neg p \wedge \neg q)$
- (d) $(p \wedge q) \Leftrightarrow \neg p$
- (e) $(\neg p \vee \neg q) \Leftrightarrow (p \wedge q)$

#5. Use truth tables to find out, for each of the following pairs, whether the two sentences are logically equivalent or not.

- (a) $p \Rightarrow \neg q$ and $\neg(p \wedge q)$
- (b) $p \vee \neg q$ and $p \Rightarrow q$
- (c) $\neg(p \wedge \neg q)$ and $\neg p \wedge q$

#6. Write down the inverse, converse, and contrapositive for each of the following:

- (a) If the moon is made of cheese, then I don't like pizza.
- (b) If Alice voted for Lincoln, then she is dead.
- (c) $\neg p \Rightarrow (p \vee q)$
- (d) $p \Rightarrow \neg q$

#8. Consider the following function:

$$f : \mathbb{R} \rightarrow \mathbb{R}$$

$$f(x) = x^2 + 3$$

- (a) Find the image of 2.
- (b) Find the image of -5.
- (c) Find any preimages of 0.
- (d) Find any preimages of 3.
- (e) Find any preimages of 12.

#9. Say whether each of the following is a function or not.

(a) $f : \mathbb{R} \rightarrow \mathbb{R}$

$$f(x) = \frac{6}{x+2}$$

(b) $f : \mathbb{R} \rightarrow \mathbb{R}$

$$f(x) = x^2 - 9$$

(c) $f : [6, \infty[\rightarrow \mathbb{R}$

$$f(x) = \sqrt{x-4} + \sqrt{x}$$

#10. Find the maximal domain for each of the following mappings:

(a) $f(x) = 5x - 19$

(b) $f(x) = 2\sqrt{x-8}$

(c) $f(x) = \frac{3x+4}{x^2}$

(d) $f(x) = \sqrt{x-3} - 3\sqrt{10-x}$

(e) $f(x) = \frac{\sqrt{2x-1}}{x+4}$

(f) $f(x) = \sqrt{x+4} + \frac{1}{x-1}$

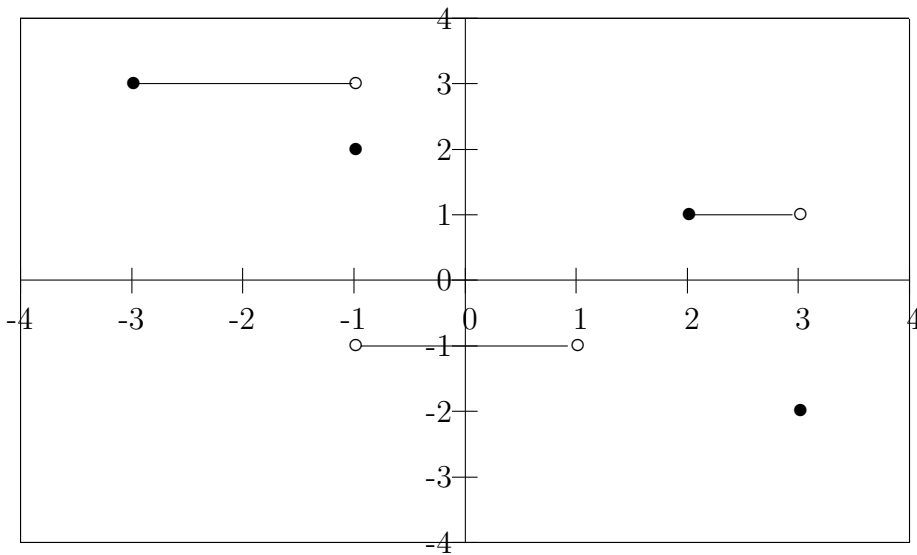
#11. Consider the following function:

$$f : [-3, 3] \rightarrow \mathbb{R}$$

$$f(x) = \begin{cases} -1 & \text{if } -3 \leq x < -2 \\ 0 & \text{if } x = -2 \\ 2 & \text{if } -2 < x \leq 2 \\ 1 & \text{if } 2 < x < 3 \\ -2 & \text{if } x = 3 \end{cases}$$

- Sketch the function's graph.
- Find the image of 1.
- Find the image of -2.
- Find the image of 2.
- Find any preimages of 2
- Find any preimages of -2.
- Find any preimages of 3.

#12. Consider this graph of the function f , with codomain \mathbb{R} .



- Find the function's domain.
- Write down the function's mapping.
- Find the image of -1.
- Find the image of 2.
- Find the image of -2.
- Find any preimages of 1.
- Find any preimages of -2.
- Find any preimages of -3.