

Assigned: Page 54, Exercise 2, 4, 23, 25, 33

## Exercise 2

Which of the following binary operations are associative?

- subtraction of integers
- division of nonzero rationals
- function composition of polynomials with real coefficients
- multiplication of  $2 \times 2$  matrices with integer entries
- exponentiation of integers

## Exercise 4

Which of the following sets are closed under the given operation?

- $0, 4, 8, 12$  addition mod 16
- $0, 4, 8, 12$  addition mod 15
- $1, 4, 7, 13$  multiplication mod 15
- $1, 4, 5, 7$  multiplication mod 9

## Exercise 23

(Law of Exponents for Abelian Groups)

Let  $a$  and  $b$  be elements of an Abelian group and let  $n$  be any integer. Show that  $(ab)^n = a^n b^n$ .

Is this also true for non-Abelian groups?

## Exercise 25

Prove that a group  $G$  is Abelian iff  $(ab)^{-1} = a^{-1}b^{-1}$ ,  $\forall a, b \in G$ .

## Exercise 33

Suppose the table below is a group table. Fill in the blank entries.

	e	a	b	c	d			e	a	b	c	d
e	e	-	-	-	-			e	-	-	-	-
a	-	b	-	-	e	→		a	-	b	-	e
b	-	c	d	e	-			b	-	c	d	e
c	-	d	-	a	b			c	-	d	-	a
d	-	-	-	-	-			d	-	-	-	-