Chapter 2: Multiplying and Dividing Fractions

CHAPTER 2 MULTIPLYING AND DIVIDING FRACTIONS

2.1 Basics of Fractions

2.1 Margin Exercises

1. **(a)** The figure has equal parts.

Three parts are shaded: –

One part is unshaded: –

(b) The figure has equal parts.

One part is shaded: –

Five parts are unshaded: –

2. **(a)** An area equal to of the – parts is shaded.

–

(b) An area equal to of the – parts is shaded.

–

3. **(a)** _ ¥ Numerator
¥ Denominator

(b) _ ¥ Numerator
¥ Denominator

(c) – ¥ Numerator
¥ Denominator

(d) _ ¥ Numerator
¥ Denominator

(b) Improper fractions: numerator *greater than or equal to* denominator.

Á Á

2.1 Section Exercises

1. – ¥ Numerator
¥ Denominator

2. – ¥ Numerator
¥ Denominator

3. – ¥ Numerator
¥ Denominator

4. – ¥ Numerator
¥ Denominator

5. The fraction – represents _ of the _ equal parts into which a whole is divided.

6. The fraction represents _ of the __ equal parts into which a whole is divided.

7. The fraction represents _ of the __ equal parts into which a whole is divided.

8. The fraction — represents __ of the __ equal parts into which a whole is divided.

9. The figure has equal parts.

Three parts are shaded: –

One part is unshaded: –

10. The figure has equal parts.
Five parts are shaded: –

Three parts are unshaded: –

11. The figure has equal parts.
One part is shaded: –

Two parts are unshaded: –

12. An area equal to of the – parts is shaded: –

One part is unshaded: –

13. Each of the two figures is divided into parts and are shaded: –

Three are unshaded: –

14. An area equal to of the – parts is shaded:

One part is unshaded: –

4. **(a)** Proper fractions: numerator *smaller* than denominator.

–Á –Á –

15. Five of the bills have a lifespan of years or greater: –
Four of the bills have a lifespan of years or less: –
Two of the bills have a lifespan of years: –

16. Four of the coins are pennies: –

Three of the coins are nickels: –

Two of the coins are dimes: –

17. There are students, and are hearing impaired.

– ¥ hearing impaired students (numerator)
¥ total students (denominator)

18. There are shopping carts of which are in the parking lot (c ~ are *not* in the parking lot, but are in the store).

Fraction of carts in store:

19. There are rooms. are for nonsmokers, and

c ~ are for smokers.

20. There are employees. c ~ are part-time.

—

21. Proper fractions: numerator *smaller* than denominator.

–Á –Á —

Improper fractions: numerator *greater than or equal to* denominator.

–Á –Á —

22. Proper fractions: numerator *smaller* than denominator.

–Á –Á –

Improper fractions: numerator *greater than or equal to* denominator.

— — –

23. Proper fractions: numerator *smaller* than denominator.

24. Proper fractions: numerator *smaller* than denominator.

none

Improper fractions: numerator *greater than or equal to* denominator.

—Á —Á —Á —Á —Á —

25. Answers will vary. One possibility is

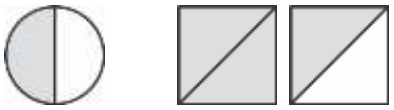
– ¥ Numerator
¥ Denominator

The denominator shows the number of equal parts in the whole and the numerator shows how many of the parts are being considered.

26. An example is – as a proper fraction and – as an improper fraction.

A proper fraction has a numerator *smaller* than the denominator.

An improper fraction has a numerator that is *greater than or equal to* the denominator.



– –

Proper fraction Improper fraction

2.2 Mixed Numbers

2.2 Margin Exercises

1. **(a)** The figure shows whole object with equal parts, all shaded, and a second whole with parts shaded, so parts are shaded in all.

– ~ –

(b) Since each of these diagrams is divided into pieces, the denominator will be _. The number of pieces shaded is _.

–

– ~ –
Á Á

2. **(a)** •_ ~ Multiply and .

b ~ Add .

Á Á

Improper fractions: numerator *greater than or equal to* denominator.

Á Á

~

–

(b) • ~ Multiply and .

Þ ~ Add .

~

(c) • ~ Multiply and .

b ~ Add .

_ ~ —

(d) • ~ Multiply and .

b ~ Add .

_ ~ —

3. **(a)** Divide _ by _.

¥ Whole number part

¥ Remainder

~

_

(b) Divide by .

¥ Whole number part

¥ Remainder

_ ~ _

(c) Divide by .

¥ Whole number part

¥ Remainder

~

2. is a proper fraction since the numerator is *smaller than* the denominator. The statement is *true.*

_

3. • ~ Multiply and .

b ~ Add .

~

The mixed number -can be changed to the improper fraction —, not —. The statement is *false.*

4. The statement "Some mixed number cannot be changed to an improper fraction" is *false* since any mixed number *can* be changed to an improper fraction.

_

5. • ~ Multiply and .

b ~ Add .

~

The mixed number -can be changed to the improper fraction —, not —. The statement is *false.*

6. • ~ Multiply and .

b ~ Add .

~

The statement is *true.*

7. • ~ Multiply and .

b ~ Add .

—

(d) Divide by .

¥ Whole number part

¥ Remainder

~

2.2 Section Exercises

1. is an improper fraction since the numerator is *greater than or equal to* the denominator. The statement is *true*.

~

8. • ~ Multiply and .

b ~ Add .

~

9. – • ~ Multiply and .

b ~ Add .

~

10. – • ~ Multiply and .

b ~ Add .

~

11. • ~ Multiply and .
b ~ Add .

– ~ —

12. Multiply and .
• ~ Add .
b ~

— ~ —

13. • ~ Multiply and .
b ~ Add .

~

14. • ~ Multiply and .

b ~ Add .

– ~ —

15. • ~ Multiply and .
b ~ Add .

– ~ —

16. Multiply and .
• ~ Add .
b ~

—
– ~

17. • ~ Multiply and .

21. • ~ Multiply and .
b ~ Add .

— ~ —

–

22. • ~ Multiply and .
b ~ Add .

~

23. – • ~ Multiply and .
b ~ Add .

~

24. Multiply and .
• ~ Add .
b ~

— ~ ——

25. Multiply and .
• ~ Add .
b ~

~

26. Multiply and .
• ~ Add .
b ~

~

27. • ~ Multiply and .

b ~ Add .

— ——

b ~ Add .

– ~ —

18. • ~ Multiply and .

b ~ Add .

– ~ —

Multiply and .

19. – • ~

b ~ Add .

~

20. • ~ Multiply and .

b ~ Add .

– ~ —

~

28. Multiply and .

• ~ Add .

b ~

~

29. • ~ Multiply and .

b ~ Add .

~

30. Multiply and .

• ~ Add .

b ~

~

31. The improper fraction – can be changed to the mixed number –, not –. The statement is *false*.

32. The statement "An improper fraction cannot always be written as a whole number or a mixed number" is *false* since a mixed number always has a value equal to or greater than a whole number.

33. The statement "Some improper fractions can be written as a whole number with no fraction part" is *true*. For example, – ~ .

34. The statement "The improper fraction — can be written as the whole number " is *true*.

35.

¥ Whole number part

¥ Remainder

– ~ –

36.

¥ Whole number part

¥ Remainder

— ~ –

37.

¥ Whole number part

¥ Remainder

– ~ –

38.

¥ Whole number part

¥ Remainder

– ~ –

39.

40.

¥ Whole number part

¥ Remainder

— ~

41.

¥ Whole number part

¥ Remainder

~

42.

—

¥ Whole number part

¥ Remainder

— ~ –

43.

—

¥ Whole number part

¥ Remainder

~

44.

¥ Whole number part

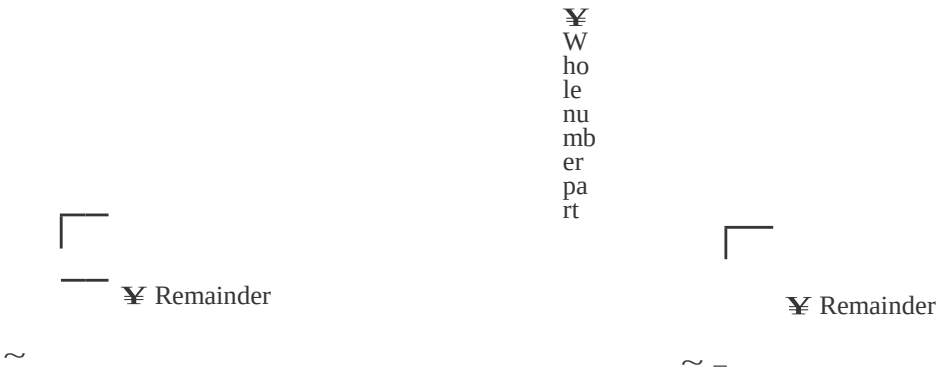
¥ Remainder

number part

¥

Whole

45.



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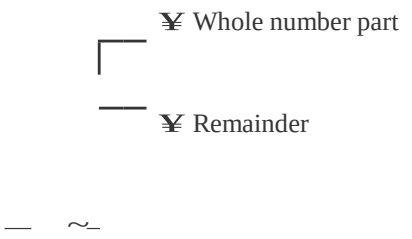

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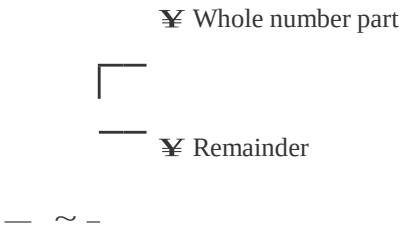

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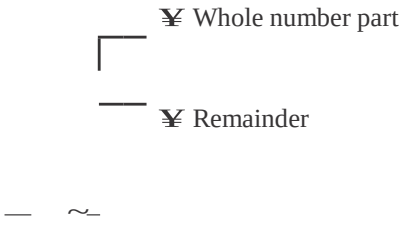

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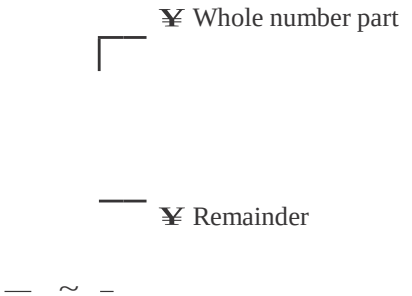

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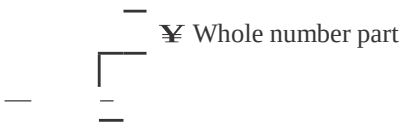

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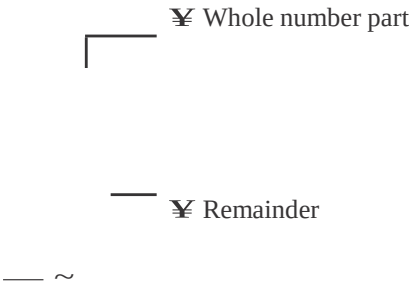

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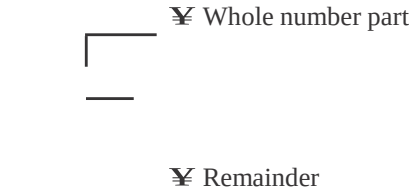

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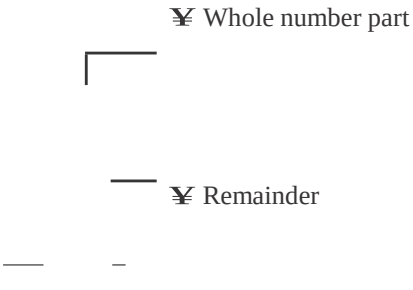

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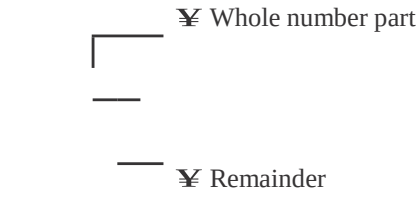
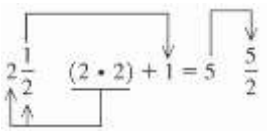
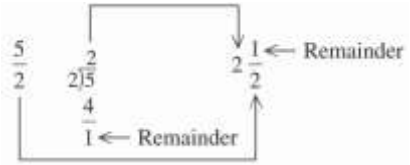


~ ___ —

55. Multiply the denominator by the whole number and add the numerator. The result becomes the new numerator, which is placed over the original denominator.



56. Divide the numerator by the denominator. The quotient is the whole number of the mixed number and the remainder is the numerator of the fraction part. The denominator is unchanged.



57. • ~

b ~

– ~ —

58. • ~

b ~

– ~ —

59. • ~

b ~

– ~ ——

60. • ~

b ~

– ~ —

61. • ~

b ~

– ~ ——

62. • ~

b ~

– ~ ——

—

63.

—

¥ Whole number part

—

64.

¥ Whole number part

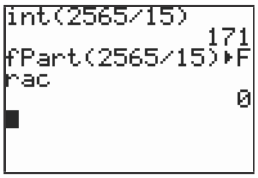
—

—

¥ Remainder

— ~

65. The commands used will vary. The following is from a TI-83 Plus:



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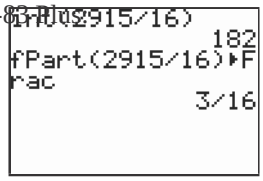
~

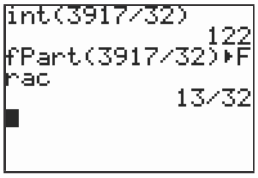
66. The commands used will vary. The following is from a TI-83 Plus:



~

67. The commands used will vary. The following is from a TI-83 Plus:

¥ Remainder



Note: You can use the following procedure on any calculator. Divide by to get À . Subtract . Multiply by to get . The mixed number is .

68. The commands used will vary. The following is from a TI-83 Plus:

```
int(5632/64)
                88
fPart(5632/64)▸F
rac
                 0
```

—— ~

69. The following fractions are proper fractions.

Á Á Á

70. **(a)** The proper fractions in Exercise 69 are the ones where the numerator is less than the denominator.

(b) – ; 

– ; 

– ; 

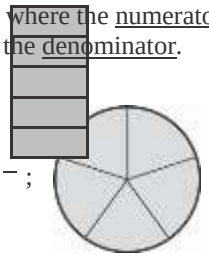
— ; 

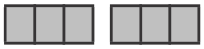
(c) The proper fractions in Exercise 69 are all less than .

71. The following fractions are improper fractions.

–Á —Á –

72. **(a)** The improper fractions in Exercise 71 are the ones where the numerator is equal to or greater than the denominator.

(b) – ; 

— ; 

– ; 

(c) The improper fractions in Exercise 71 are all equal to or greater than .

73. The following fractions can be written as whole or mixed numbers.

–

¥ Whole number part

¥ Remainder

– ~ –

–

¥ Whole number part

¥ Remainder

– ~

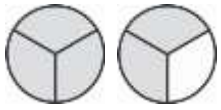
¥ Whole number part

¥ Remainder

— ~ –

74. **(a)** The fractions that can be written as whole or mixed numbers in Exercise 73 are improper fractions, and their value is always greater than or equal to .

–

(b) ~ – ; 

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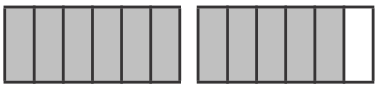
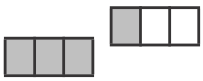




2.3 Factors

2.3 Margin Exercises

1. **(a)** Factorizations of :

• ~ • ~

• ~

The factors of are , , _, , _, and .

(b) Factorizations of :

• ~ • ~ • ~

The factors of are , , , , and .

(c) Factorizations of :

• ~ • ~ • ~ • ~
• ~

The factors of are , , , , , , , , and

.

(d) Factorizations of :

• ~ • ~ • ~ • ~
• ~

The factors of are , , , , , , , , , and .

2. , , , , , , ,

, , , , and are prime because they are divisible only by themselves and .

3. , , , , , , , , , , , , , ,

, , , , and each have no factor other than

themselves or ; , , , , , , and each have a factor of ; , , and have a factor of . So , , , , , , , , , and are composite.

4. **(a)** e ~

e ~ *prime*
~ •_•

(b) e ~
e ~ *prime*
~ •_•

(c) e ~

e ~ *prime*
~ • •

(d) e ~
e ~
e ~ *prime*
~ • • •

This division is done from the "top-down."

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

Either method is correct and yields the prime factorization as follows:

~ • • •_ ~ •

(b)

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ • • • ~ •

(c)

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ • • • ~ • •

(d)

Divide by .

5. **(a)** This division is done from the "bottom-up."

6. **(a)**

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ . . . . ~ .

(b)

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ . . ~ .

(c)

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ . . . ~ . .

(d)

(e)

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ ~

. . . . . .

7. **(a)**

Ã Â

Ã Â

~ . . ~ .

(b)

Ã Â

~ .

(c)

Ã Â

Ã Â

~ . .

2.3 Section Exercises

1. Factorizations of :

. ~ . ~

The factors of are , , , and . The statement is *false* (missing).

2. Factorizations of :

. ~ . ~ . ~

The factors of are , , , , , and . The

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

$\sim \cdot \cdot \cdot \cdot \sim \cdot \cdot$

statement is *true*.

3. Factorizations of :

$\cdot \sim \cdot \sim$

The factors of are , , , and . The statement is *true*.

4. Factorizations of :

$\cdot \sim \cdot \sim \cdot \sim$

The factors of are , , , , , and . The statement is *false* (missing and).

5. Factorizations of :

• ~ • ~ • ~ • ~
• ~

The factors of are , , , , , , , , , and .

6. Factorizations of :

• ~ • ~ • ~ • ~

The factors of are , , , , , , , and .

7. Factorizations of :

• ~ • ~ • ~ • ~

The factors of are , , , , , , , and __.

8. Factorizations of :

• ~ • ~ • ~ • ~
• ~ • ~

The factors of are , , , , , , , , , , , and __.

9. Factorizations of :

• ~ • ~ • ~ • ~
• ~

The factors of are , , , , , , , , and .

10. Factorizations of :

• ~ • ~ • ~

The factors of are , , , , , and .

11. Factorizations of :

• ~ • ~ • ~ • ~

The factors of are , , , , , , , and .

12. Factorizations of :

• ~ • ~ • ~ • ~

• ~ • ~

The factors of are , , , , , , 1 , , , , , and .

13. Factorizations of :

• ~ • ~ • ~ • ~

The factors of are , , , , , , and .

14. Factorizations of :

• ~ • ~ • ~ • ~
• ~ • ~

15. Factorizations of :

• ~ • ~

The factors of are , , , and .

16. Factorizations of :

• ~ • ~

The factors of are , , , and .

17. is divisible by and , so is composite.

18. is divisible by , so is composite.

19. is only divisible by itself and , so it is prime.

20. is divisible by , so is composite.

21. is divisible by and , so is composite.

22. is only divisible by itself and , so it is prime.

23. is only divisible by itself and , so it is prime.

24. is only divisible by itself and , so it is prime.

25. is divisible by , so is composite.

26. is divisible by and , so is composite.

27. is only divisible by itself and , so it is prime.

28. is divisible by and , so is composite.

29.

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ • • • ~ •

The correct choice is **(b)**.

30.

Ã Â
□

Ã Â
□

Ã Â
□ □

The factors of are , , , , , , , , , , , and .

$\sim \cdot \cdot \cdot \sim \cdot$

The correct choice is **(c)**.

31.

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

The correct choice is **(a)**.

32.

Divide by .

Divide by .

Divide by .

Quotient is 1.

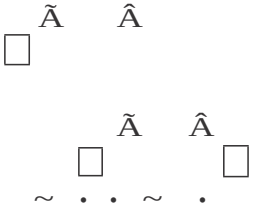
33.

Divide by .

Divide by .

Quotient is 1.

34. We can also use a factor tree.



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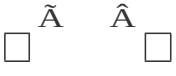
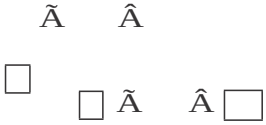


36.

Divide by .

Divide by .

37.



38.

Divide by .

Divide by .

Divide by .

Quotient is 1.

39.

Divide by .

Divide by .

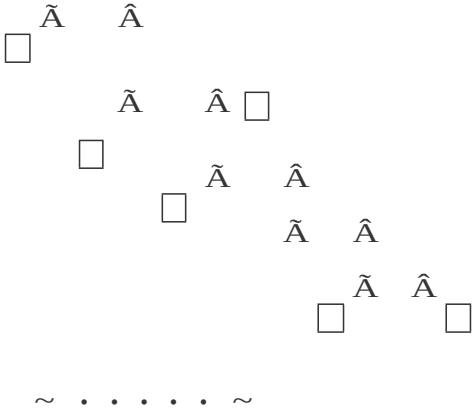
Divide by .

Divide by .

Divide by .

Quotient is 1.

40.



41.

Divide by .

Div

ide

Divide by .

Quotient is 1.

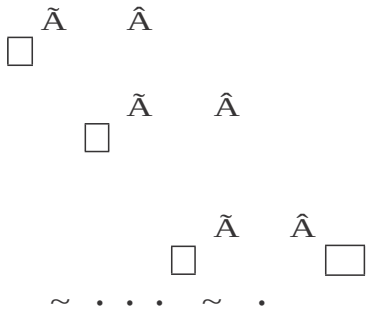
by . Divide

by .

Divide by .

Quotient is 1.

42.



43.

Divide by .

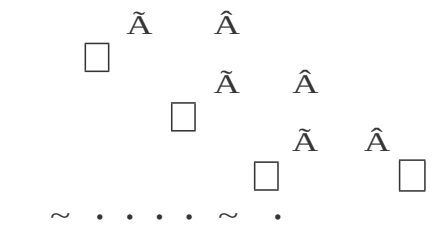
Divide by .

Divide by .

Divide by .

Quotient is 1.

44.



45.

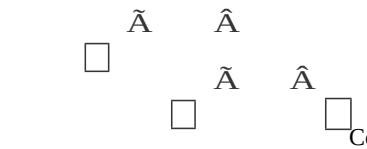
Divide by .

Divide by .

Divide by .

Quotient is 1.

46.



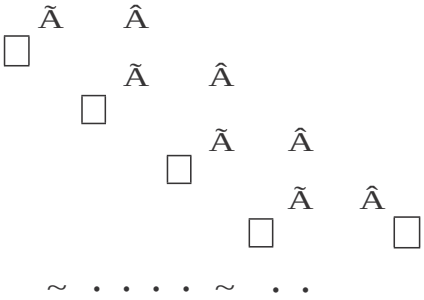
Divide by .

Divide by .

Divide by .

Quotient is 1.

48.



49.

Divide by .

Divide by .

Divide by .

Divide by .

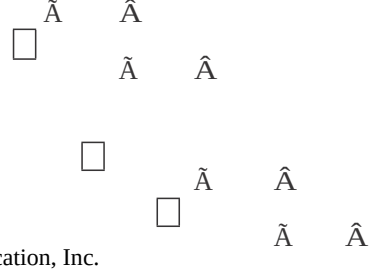
Divide by .

Divide by .

Divide by .

Quotient is 1.

50.



~ • • • ~ •

47.

Divide by .

Divide by .

□ Ã Â

□ Ã Â

□ □

~ • • • • • • ~ • •

51.

Divide by .

Divide by .

Divide by .

Divide by .

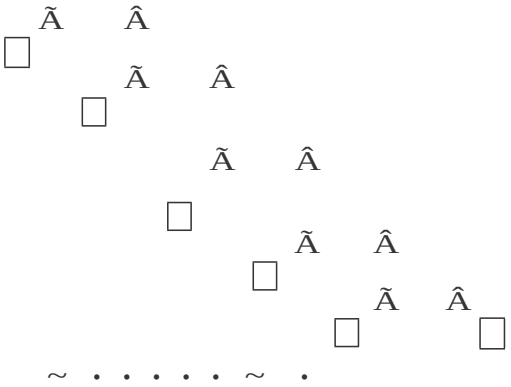
Divide by .

Divide by .

Quotient is 1.

~ • • • • • ~ • •

52.



~ • • • • • ~ •

53. Answers will vary. A sample answer follows. A prime number is a whole number that has exactly two *different* factors, itself and . Examples include , , , , and À A composite number has a factor(s) other than itself or . Examples include , , , , and . The numbers and are neither prime nor composite.

54. No even number other than is prime because all even numbers have as a factor. Many odd numbers are multiples of prime numbers and are not prime. For example, , , , and are all multiples of .

55. All the possible factors of are , , , , , , , and . This list includes both prime numbers and composite numbers. The prime factors of include only prime numbers. The prime factorization of is

~ • • • ~ • À

56. Yes, you can divide by s before you divide by .

57.

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ • • • ~ • •

58.

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ • • • • • • • ~ •

59.

No, the order of division does not matter. As long as you use only prime numbers, your answers will be correct. However, it does seem easier to always start with and then use progressively greater prime numbers. The prime factorization of is

Divide de by .
by .

D Divide by .

i Divide by .

v Divide by .

i Divide by .

d

e

b

Quotient is 1.

y

.

D

i

v

i

d

e

b

y

.

D

i

v

i

~ . . . ~ . .

~ . . . . . ~ . .

60.
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□ □
~ . . . . . ~ .

61.

Divide by .

Divide by À

Divide by À

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ . . . . . ~ . . .

62.

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

63.
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□ □
~ . . . . . ~ . . .

64.
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□
Ã Â
□ □
~ . . . . . ~ . .

65. The prime numbers less than are , , , , , , , , , , , , , , and .

66. A prime number is a whole number that is evenly divisible by itself and only.

67. No. Every other even number is divisible by in addition to being divisible by itself and .

68. No. A multiple of a prime number can never be prime because it will always be divisible by the prime number.

69.

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Divide by .

Quotient is 1.

~ . . . . .

~ . . . . . ~ .

70. ~ . . . . . ~ . . .

2.4 Writing a Fraction in Lowest Terms

2.4 Margin Exercises

1. **(a)** , ;
~ . ~ .

Yes, is a common factor of and .

(b) , ;
~ . ~ .

Yes, is a common factor of and .

(c) , ;
~ • , but is not a factor of .

No.

(d) , ;
~ . ~ .

Yes, is a common factor of and .

2. **(a)**

and have no common factor other than .
Yes, it is in lowest terms.

(b)

and have a common factor of .
No, it is not in lowest terms.

(c)

and have a common factor of .

No, it is not in lowest terms.

(d)

and have no common factor other than .
Yes, it is in lowest terms.

3. **(a)** ~ ~

(b) — ~

~ ~ ~

(c) ~ ~ ~

(d) — ~ ~ ~

5. **(a)** — and

— ~ ~ ~

— ~ ~ ~

The fractions are *equivalent* ~

(b) — and —

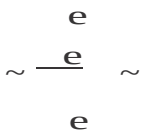
— ~ ~ ~

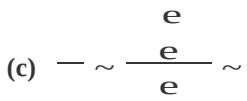
~

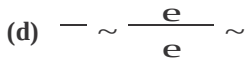
— ~ ~ ~

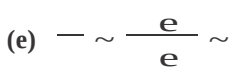
The fractions are *not equivalent* £

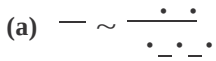
(c) — and

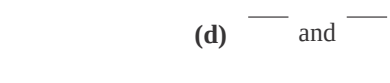
(b) 

(c) 

(d) 

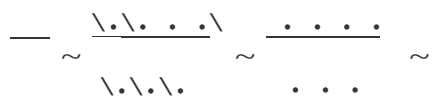
(e) 

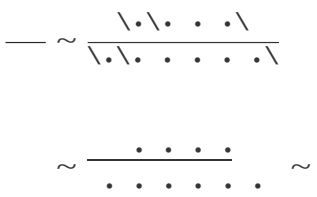
4. **(a)** 

(d) 

The fractions are *equivalent* (~).

(d) and





The fractions are *not equivalent* ² £ —³

2.4 Section Exercises

1. A number can be divided by if the number is an even number.

2. A number can be divided by if the number ends in _ or _.

3. Any number can be divided by if the number ends in 0.

4. If the sum of a number's digits is divisible by _, the number is divisible by .

5. 9 9 9 9

6. 9 9 9 9

7. 9 9 X X

8. 9 9 X X

9. 9 X 9 9

10. X X 9 X

11. 9 9 X X

12. 9 9 9 9

14. — is in lowest terms, so the fractions and are not equivalent. *false*

15. — is in lowest terms, so the fractions and are not equivalent. *false*

16. — ~ — ~ , *true*

24.

25.

26.

27.

28.

29.

30.

31.

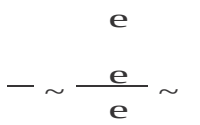
32.

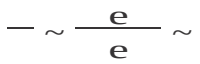
33.

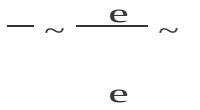
34.

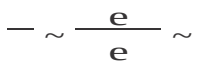
36.

37.

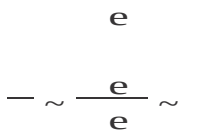
17. 

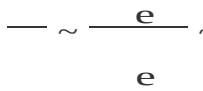
18. 

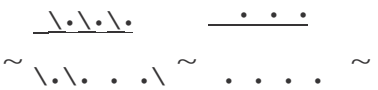
19. 

20. 

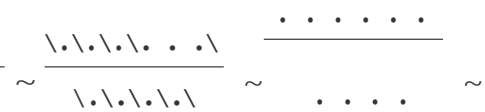
21. 

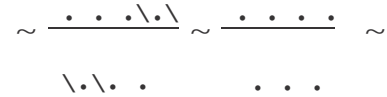
22. 

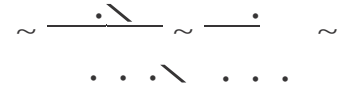
23. 

38. 

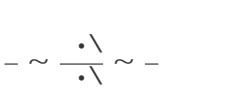
39. 

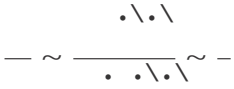
40. 

41. 

42. 

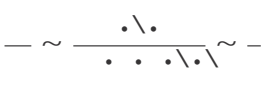
43. and





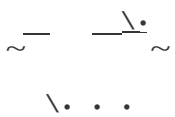
The fractions are *equivalent*

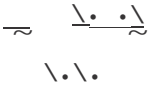
44. and



The fractions are *equivalent*

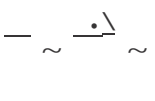
45. and





The fractions are *not equivalent*

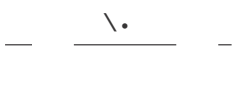
46. and



48. and

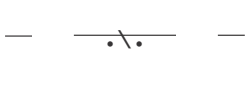
The fractions are *not equivalent*

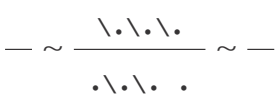
49. and



The fractions are *equivalent*

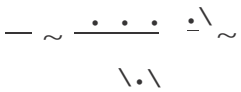
50. and

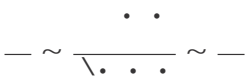




The fractions are *equivalent*

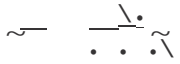
51. and



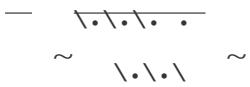


The fractions are *not equivalent* ² – £ —³À

47. — and

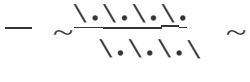


The fractions are *not equivalent* ² – £ —³À



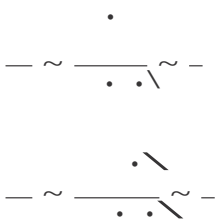
The fractions are *not equivalent* £ À

52. — and —



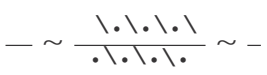
The fractions are *equivalent* ~ À

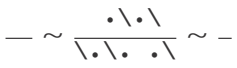
53. — and



The fractions are *equivalent* ² – ~ – ³Ì

54. — and

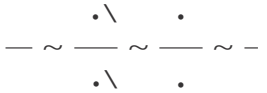


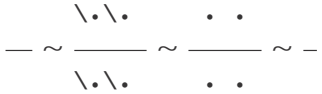


The fractions are *equivalent* ² – ~ – ³Ì

55. A fraction is in lowest terms when the numerator and the denominator have no common factors other than . Some examples are –, –, and – Ì

56. Two fractions are equivalent when they represent the same portion of a whole. For example, the fractions — and are equivalent.





The fractions are *equivalent* 2 – ~ – 3Ì

Summary Exercises *Fraction Basics*

1. The figure has equal parts.
Five parts are shaded: –

One part is unshaded: –

2. The figure has equal parts.
One part is shaded: –

–

Two parts are unshaded:

3. The figure has equal parts.
Five parts are shaded: –

Three parts are unshaded: –

4. –
¥ Numerator
¥ Denominator

5. –
¥ Numerator
¥ Denominator

6. Proper fractions: numerator *smaller* than denominator.

–, —,

Improper fractions: numerator *greater than or equal to* denominator.

–, —, –

7. There are winners in total
(b b b b b ³. Seven of the winners were from Switzerland.

8. Since b ~ of the winners *were* from either France or South Africa, c ~ *were not.*

–

~

9. b ~ of the winners were from either Japan

57. —— ~ \.\.\.\.\.\. ~
\.\.\.\.\.\. . .

58. —— ~ \.\.\. ~
. . . .\.\

59. —— ~ .\.\ ~ – ~
\.\

60. —— ~ . .\.\ ~ – ~
\.\

or the United States. ~

10. Since of the winners *were* from Canada,

c ~ *were not.* ~

11.

¥ Whole number part

¥ Remainder

~

12.

¥ Whole number part

¥ Remainder

— ~ –

13.

¥ Whole number part

¥ Remainder

~

14.

¥ Whole number part

¥ Remainder

– ~ –

15.

¥ Whole number part

¥ Remainder

—

~

16.

¥ Whole number part

18.

¥ Whole number part

¥ Remainder

~

19. • ~ Multiply and .

b ~ Add .

– ~ —

20. • ~ Multiply and .

b ~ Add .

– ~ —

21. • ~ Multiply and .

b ~ Add .

~

22. • ~ Multiply and .

b ~ Add .

~

23. • ~ Multiply and .

b ~ Add .

~

24. — • ~ Multiply and .

b ~ Add .

— ~ —

¥ Remainder

~

17.

¥ Whole number part

¥ Remainder

~

25. • ~ Multiply and .

b ~ Add .

~

26. – • ~ Multiply and .

b ~ Add .

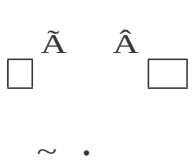
– ~

27.

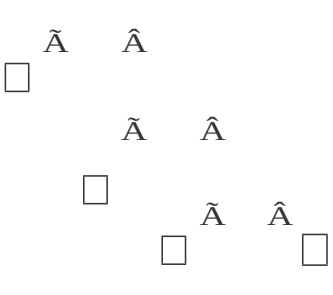
Ã Â

~ •

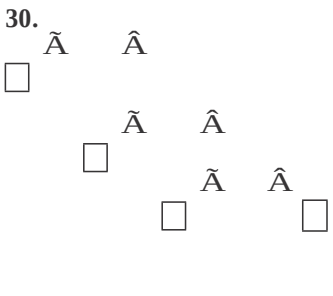
28.



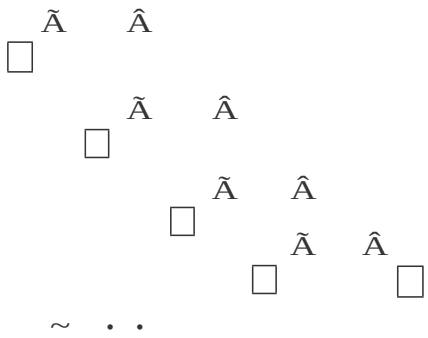
29.



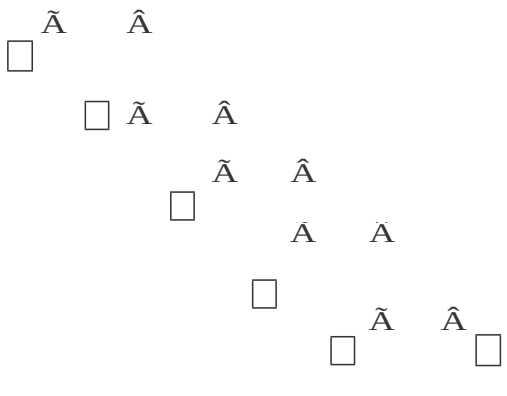
30.



31.



32.



33. $\sim \frac{e}{e} \sim$

38. $\sim \frac{e}{e} \sim$

39. $\sim \frac{e}{e} \sim$

40. $\sim \frac{e}{e} \sim$

41. $\sim \frac{e}{e} \sim$

42. $\sim \frac{e}{e} \sim$

43. $\sim \frac{e}{e} \sim$

44. $\sim \frac{e}{e} \sim$

45. $\sim \frac{\cdot\backslash\cdot\backslash}{\backslash\cdot\backslash\cdot} \sim$

46. $\sim \frac{\backslash\cdot\backslash\cdot\backslash\cdot\backslash}{\cdot\backslash\cdot\backslash\cdot\backslash} \sim$

47. $\sim \frac{\backslash\cdot\backslash\cdot}{\backslash\cdot\backslash} \sim \sim$

48. $\sim \frac{\backslash\cdot\backslash\cdot\backslash\cdot\backslash\cdot}{\backslash\cdot\backslash\cdot\backslash\cdot} \sim$

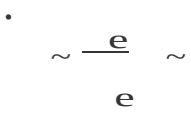
2.5 Multiplying Fractions

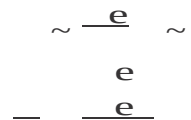
2.5 Margin Exercises

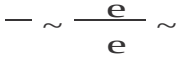
1. – of – as read from the figure is the darker shaded part of the second figure. One of eight equal parts is shaded, or –

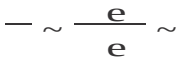
2. **(a)** $\frac{\cdot}{\cdot} \sim$

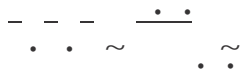
(b) $\frac{\backslash\cdot}{\backslash} \sim$

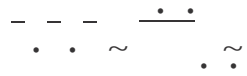
34. 

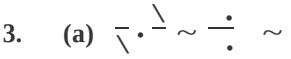
35. 

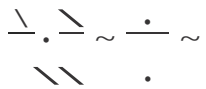
36. 

37. 

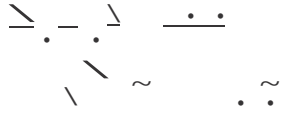
(c) 

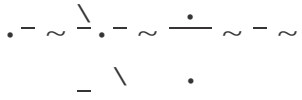
(d) 

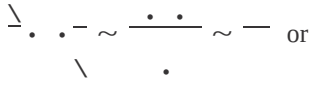
3. **(a)** 

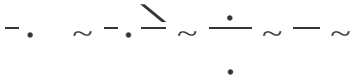
(b) 

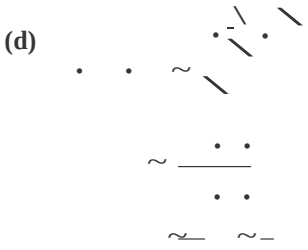
(c) 

(d) 

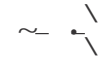
4. **(a)** 

(b)  or

(c) 

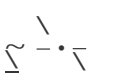
(d) 

5. **(a)** Area ~ length • width



~ yd

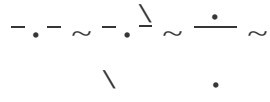
(b) Area ~ length • width

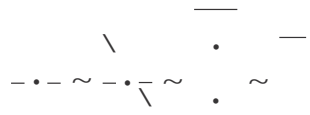


2. To write a fraction in lowest terms, you must divide both the numerator and denominator by a common factor.

3. A shortcut when multiplying fractions is to divide both a numerator and a denominator by the same number.

4. Using the shortcut when multiplying fractions should result in an answer that is in lowest terms.

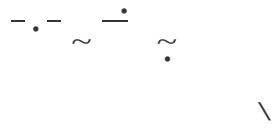
5. 

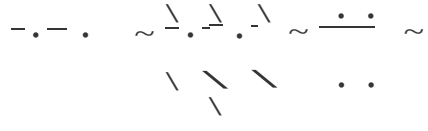
6. 

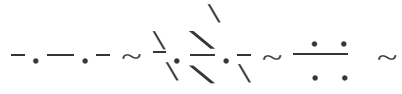
7. 

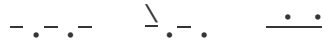
8. 

9. 

10. 

11. 

12. 

13. 

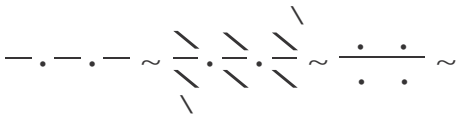
(c) Area $\sim$ length $\cdot$ width

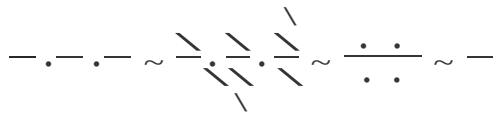
2.5 Section Exercises

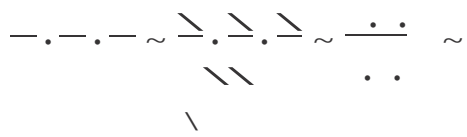
1. To multiply two or more fractions, you multiply the numerators and you multiply the denominators.

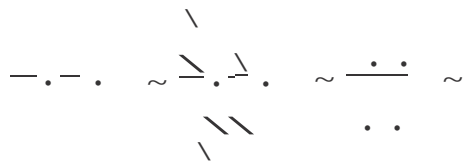
14. 

15. 

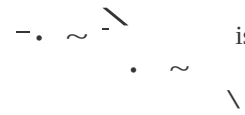
16. 

17. 

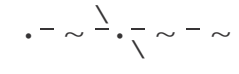
18. 

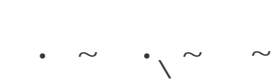
19. 

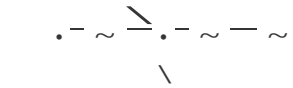
20. The statement "When multiplying a fraction by a whole number, the whole number should be rewritten as the number over ." is *true*.

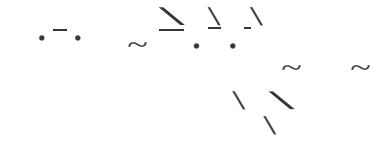
21.  is *false*.

The correct method is as follows:

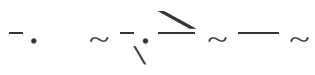
22. 

23. 

24. 

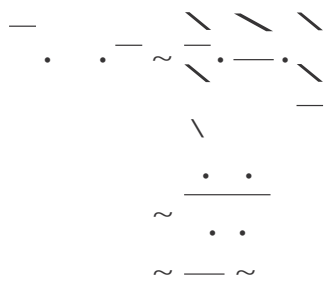
25. 

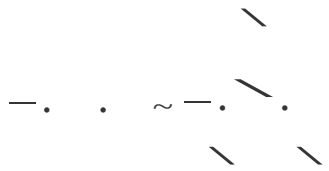
26.

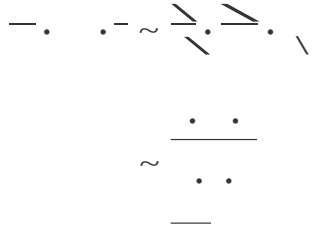
30. 

31.

32. 

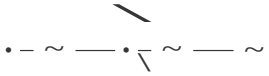
33. 

34. 

35. 

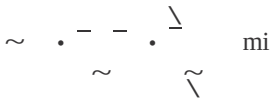
36. 

27. 

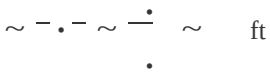
28. 

29. 

37. Area ~ length • width

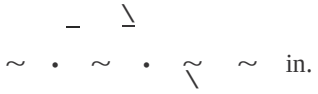


38. Area ~ length • width

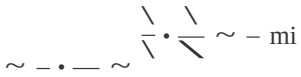


39. Area ~ length • width

40. Area ~ length • width

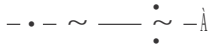


41. Area ~ length • width

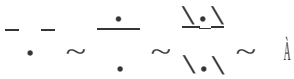


42. Area ~ length • width

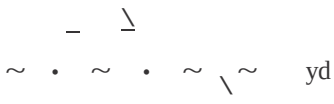
43. Multiply the numerators and multiply the denominators. An example is



44. You must divide a numerator and a denominator by the same number. If you do all possible divisions, your answer will be in lowest terms. One example is

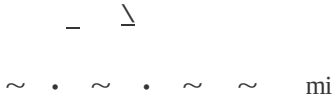


45. Area ~ length • width



46. Area ~ width • height

47. Area ~ length • width



50. **Rocking Horse Ranch** **Silver Spur Ranch**

Area ~ length • width Area ~ length • width

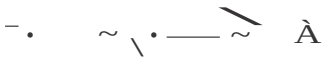
Neither ranch is larger in area. They are both the same size.

51. b b b b b b b ~ ____ supermarkets

The estimate of the total number of supermarkets in these states is .

52. b b b b b b b ~ ____ supermarkets, which is the exact total number of supermarkets in these states.

53. An estimate of the number of supermarkets in medium to large population areas in New York is



The exact value is

Rounding gives us supermarkets.

54. An estimate of the number of supermarkets in New Hampshire which are in shopping centers, is

The exact value is

48. Area ∼ length • width

∼ • ∼ • ∼ ∼ mi

49. **Sunny Side Soccer Park**

Area ∼ length • width

∼ •

∼ mi

Creekside Soc. Park

Area ∼ length • width

∼ •

∼ mi

They are both the same size.

Rounding gives us supermarkets.

55. We need a multiple of with *two* nonzero digits that is close to . A reasonable choice is and an estimate is

• ∼ • ∼ supermarkets

This value is closer to the exact value because using as a rounded guess is closer to than using as a rounded guess.

56. We need a multiple of with *two* nonzero digits that is close to . A reasonable choice is and an estimate is

supermarkets

This value is closer to the exact value because using as a rounded guess is closer to than using as a rounded guess.

2.6 Applications of Multiplication

2.6 Margin Exercises

1. **(a)** *Step 1*

The problem asks us to find the amount of money they can save in a year.

Step 2
Find the amount they can save by multiplying – and , .

Step 3
We can estimate this amount using – and , .

Step 4

Now solve the problem using the original values.

Step 5
They can save $, in a year.

Step 6
The answer is reasonably close to our estimate.

(b) *Step 1*
The problem asks us to find the amount of money she will receive as retirement income.

Step 2
To find her retirement income, multiply – and

Step 4
Now solve the problem using the original values.

Step 5

She will receive $, as retirement income.

Step 6
The answer is reasonably close to our estimate.

2. *Step 1*
The problem asks for the number of prescriptions paid for by a third party.

Step 2

A third party pays for of the total number of prescriptions, .

Step 3

An estimate is

Step 4
The exact value is

Step 5
A third party pays for prescriptions.

Step 6
The answer is reasonably close to our estimate.

3. *Step 1*
The problem asks for the fraction of students who speak Spanish.

Step 2
– of the – of the students who speak a foreign language, speak Spanish.

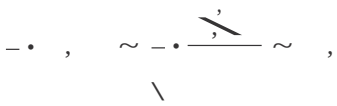
Step 3

An estimate is

Step 4

$, .

Step 3
We can estimate this amount using – and , .



Step 4
The exact value is , which is the same as the estimate since we didn't round.

Step 5

The fraction of students who speak Spanish is .

Step 6

The answer, –, matches our estimate.

4. **(a)** From the circle graph, the fraction is –À

(b) Multiply – by the number of people in the survey, À Since we can estimate the answer using the exact values, our estimated answer will be the same as the exact answer.

– • ~ • —— ~ —— ~

children buy food from vending machines.

(c) From the circle graph, the fraction is —À

(d) Multiply by . Since we can estimate the answer using the exact values, our estimated answer will be the same as the exact answer.

—• ~ • ~ ~

children buy food from a convenience store or street vendor.

2.6 Section Exercises

1. The words that are indicator words for multiplication are *of*, *times*, *twice*, *triple*, *product*, and *twice as much*.

2. The final step when solving an application problem is to check your work.

3. When you multiply length by width you are finding the area of a rectangular surface.

4. When calculating area, the length and the width must be in the same units of measurement. If the measurements are both in miles, the answer will be in square miles and shown as mi À

5. Multiply the length and the width.

– • – ~ ——— –

The area of the digital photo frame is – ft .

8. Multiply by , , À

– • , , ~ • ~ , ,

, , people who shop at flea markets on a daily basis purchase produce.

9. Multiply the length and the width.

• ~ —— ~ •

The area of the top of the table is yd .

10. Multiply the number of bowls by the fraction eaten in the summer months.

• ~ —• —— ~

The average person consumes bowls of cereal in the summer months.

11. Multiply – by À

– • ~ • —— ~

He earned $ on his job.

12. Multiply – by À

• – ~ • – ~

The average household does loads of wash in the winter months.

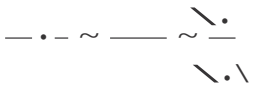
13. Multiply the daily parking fee by the fraction.

• ~ ~

The daily parking fee in Boston is $.

14. Multiply the daily parking fee by the fraction.

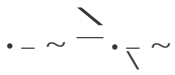
6. Multiply the length and width.



The area of the floor is yd .

7. Multiply the length and the width.

The area of the cookie sheet is ft .



The daily parking fee in San Francisco is $.

15. **(a)** of the runners are women.

runners are women.

(b) The number of runners that are men is

16. **(a)** Multiply the fraction of nonsmoking rooms by the number of rooms.

There are nonsmoking rooms.

(b) The number of smoking rooms is

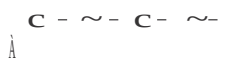
17. The smallest sector of the circle graph is the *4 hours* group, so this response was given by the least number of people. To find how many people gave this response, multiply  by the total number of people, .

people gave this response.

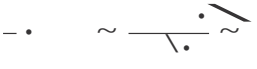
18. The largest sector of the circle graph is the *2 hours or less* group, so this response was given by the greatest number of people. To find how many people gave this response, multiply – by the total number of people, .

people gave this response.

19. The only group that is *not* willing to wait hours or less is the *8 hours* group, and the fraction corresponding to that group is  Thus, the fraction willing to wait hours or less is



The total number of people willing to wait hours or less is



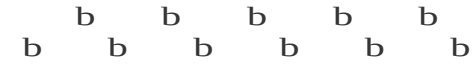
20. The only group that is *not* willing to wait hours or more is the *2 hours or less* group, and the fraction corresponding to that group is Thus,

21. Because everyone is included and fractions are given for *all* groups, the sum of the fractions must be *1*, or *all* of the people.

22. Answers will vary. Some possibilities are

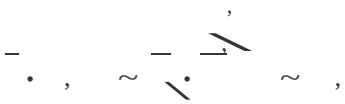
1. You made an addition error.
2. The fractions on the circle graph are incorrect.
3. The fraction errors were caused by rounding.

23. Add the income for all twelve months to find the income for the year.



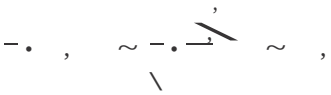
The Owens family had income of $, for the year.

24. Multiply the fraction – by the total income ($,).



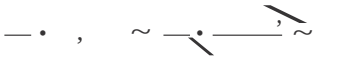
Their taxes were $, .

25. From Exercise 23, the total income is $, . The circle graph shows that of the income is for rent.



The amount of their rent is $, À

26. Multiply the fraction by the total income.



They spent $, on food.

27. Multiply the total income by the fraction saved.

the fraction willing to wait hours or more is

$$\frac{\quad}{\quad}$$

The total number of people willing to wait hours or more is

$$\frac{\quad}{\quad}$$

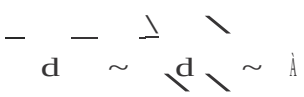
The Owens family saved $ for the year.

28. Multiply the fraction by the total income.

$$\frac{\quad}{\quad}$$

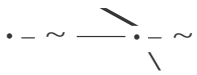
They spent $ on clothing.

29. The error was made when dividing by and writing instead of . The correct solution is



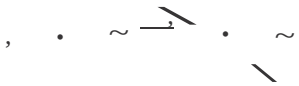
30. Yes, the statements are true. Since whole numbers are or greater, when you multiply, the product will always be greater than either of the numbers multiplied. But, when you multiply two proper fractions, you are finding a fractional part of a fraction, and the product will be smaller than either of the two proper fractions.

31. Multiply the cost in the United States by



The cost of laser eye surgery for one eye in Thailand is $.

32. Multiply the cost in the United States by

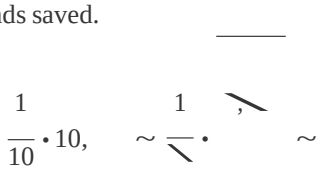


The cost of a knee replacement in Mexico is $.

33. We want of the actual length.

The length of the scale model is feet.

34. First multiply and , to find the number of pounds saved.



To find the weight of the test truck, subtract:

10, pounds.

The test truck weighs pounds.

35. First multiply and , to find the number of

36. Multiply the fraction by the cost ($,).

To find the amount borrowed in the first years, subtract:

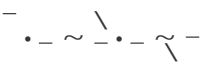
$, $,

$, was borrowed in the first years.

37. Multiply the remaining of the estate by the fraction going to the American Cancer Society.

of the estate goes to the American Cancer Society.

38. Multiply the remaining of their total investments by the fraction invested in bonds.



The couple invested of their total investment in bonds.

2.7 Dividing Fractions

2.7 Margin Exercises

1. **(a)** ; The reciprocal of is because

(b) ; The reciprocal of is because

(c) The reciprocal of is because

(d) The reciprocal of is because

her votes from senior citizens.

To find the votes needed from voters other than the senior citizens, subtract:

votes.

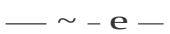
She needs votes from voters other than the senior citizens.

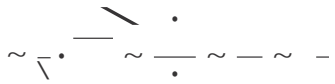
2. (a)

(b)

(c)

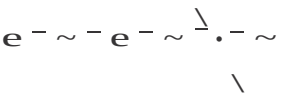
(d)



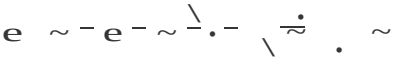


3. **(a)**

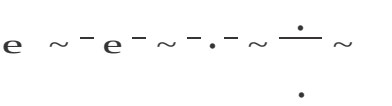
(b)



(c)



(d)



4. **(a)** *Step 1*

The problem asks for the number of --ounce dispensers that can be filled using ounces of eye drops.

Step 2
Divide the total number of ounces of eye drops by the fraction of an ounce each dispenser holds.

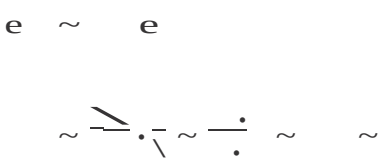
Step 3
An estimate is

Step 4
Solving gives us

Step 5

--ounce dispensers can be filled.

Step 6



Step 5

--quart bottles can be filled.

Step 6
The answer is reasonably close to our estimate.

5. **(a)** *Step 1*
The problem asks for the fraction of the bonus money that each employee will receive.

Step 2
Divide the fraction of the bonus money, -, by the number of employees, .

Step 3

An estimate is

Step 4
Solving gives us

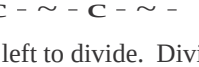
Step 5

Each employee will receive of the bonus money.

Step 6
The answer is reasonably close to our estimate.

(b) *Step 1*
The problem asks for the fraction of the prize money that each employee will receive.

Step 2
Since they donate - of the winnings, they have



of the winnings left to divide. Divide the fraction

The answer is reasonably close to our estimate.

(b) *Step 1*

The problem asks for the number of --quart bottles that can be filled from a -quart cask.

Step 2
Divide the total number of quarts in the cask by the size of the bottles.

Step 3

An estimate is

Step 4
Solving gives us

of the winnings that remain, , by the number of employees, .

Step 3
An estimate is

Step 4
Solving gives us

Step 5

Each employee will receive of the prize money.

Step 6
The answer is reasonably close to our estimate.

2.7 Section Exercises

1. When you invert or flip a fraction, you have the reciprocal of the fraction.

2. To find the reciprocal of a whole number, you must first write the whole number over 1, and then invert it.

3. To divide by a fraction, you must first invert the divisor and then change division to multiplication.

4. After completing a fraction division problem, it is best to write the answer in lowest terms.

5. The reciprocal of – is – because

6. The reciprocal of – is – because

7. The reciprocal of – is – because

8. The reciprocal of — is — because

9. The reciprocal of – is – because

10. The reciprocal of — is — because

11. The reciprocal of is – because

12. The reciprocal of is because

13.

14.

20.

21.

22.

23.

24.

25.

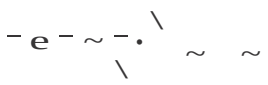
26.

27.

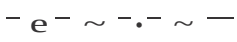
28.

29.

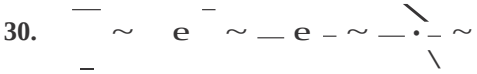
15. 

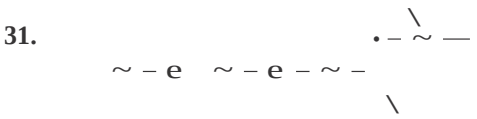
16. 

17. 

18. 

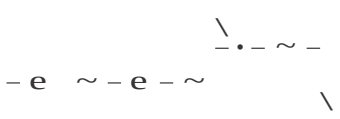
19. 

30. 

31. 

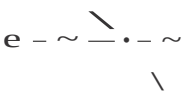
32. 

33. – of a quart divided into parts:



Each horse will get – of a quart.

34. Divide the number of quarts of shampoo by the fraction of a quart each container holds.



Harold can fill containers.

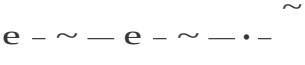
35. Divide the total number of cups by the size of the measuring cup.

They need to fill the measuring cup times.

36. Divide the total number of pounds of jelly beans by the size of the bag.

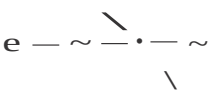
–-pound bags can be filled.

37. Divide the total number of ounces of eye drops by the fraction of an ounce each dispenser holds.



dispensers can be filled.

38. Divide the number of pounds of peanuts by the fraction of pounds of peanuts each person will likely eat.

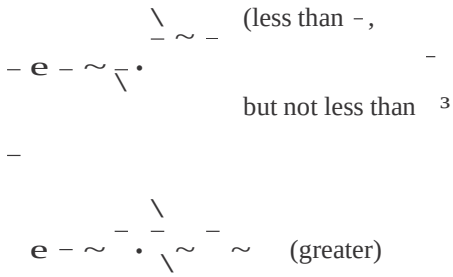


guests can be served with pounds of peanuts.

41. Answers will vary. A sample answer follows:

You can divide two fractions by multiplying the first fraction by the reciprocal of the second fraction (divisor).

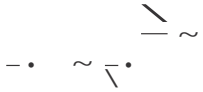
42. Sometimes the answer is less and sometimes it is greater.



(less than –, but not less than 3

(greater)

43. Each loafcake requires – pound of jellybeans, so to make loafcakes, use multiplication.

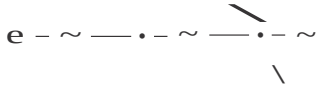


pounds will be needed.

44. We want – of patients—use multiplication.

patients were still taking their drugs.

45. Divide the cans of compound by the fraction of a can needed for each new home.



homes can be plumbed.

46. Divide the gallons of differential fluid by the fraction of a gallon needed for each car serviced.

39. Divide the total weight of a carton by the weight per fastener.

There are –-pound fasteners in each carton.

40. Divide the total acreage by the acreage per lot.

There are –-acre lots in the subdivision.

cars can be serviced.

47. **(a)** In – of the visits, doctors failed to discuss the issues—use multiplication.

The doctors failed to discuss the issues in visits.

(b) The doctors *did* discuss the issues in visits.

48. **(a)** – of the miles have been completed—use multiplication.

He has gone miles.

(b) The number of miles that remain is

c ~ miles.

49. Divide the yards of fabric by the fraction of a yard needed for each dish towel.

towels can be made.

50. Multiply the number of applicants by the fraction of jobs available per applicant.

There are job openings.

51. The indicator words for multiplication are underlined below.

more than	per
double	twice
times	product
less than	difference
equals	twice as much

52. The indicator words for division are underlined below.

fewer	sum of
goes into	divide
per	quotient
equals	double
loss of	divided by

53. To divide two fractions, multiply the first fraction by the reciprocal of the second fraction.

54. The reciprocal of – is – because

55. **(a)** To find the perimeter of any flat equal-sided 3-, 4-, 5-, or 6-sided figure, multiply the length of one side by 3, 4, 5, or 6, respectively.

(b) The stamp has four sides, so multiply — by .

The perimeter of the stamp is inches.

56. Area ~ length • width

The area is — in. . Multiply the length by the width to find the area of any rectangle.

2.8 Multiplying and Dividing Mixed Numbers

2.8 Margin Exercises

1. **(a)**

¥ is more than

¥ Half of is

rounds up to .

(b)

¥ is less than

¥ Half of is

rounds down to .

(c)

¥ is more than

¥ Half of is

rounds up to .

(d)

¥ is more than

¥ Half of is À

The reciprocal of – is – because

• ~ ~ À

rounds up to .

– —

The reciprocal of is – because

• ~ ~ À

(e)

¥ is the same as À

The reciprocal of — is — because

¥ Half of is À

— • — ~ —— ~ À

rounds up to .

–

–

(f)

is less than

Half of is

rounds down to .

2. (a)

Estimate: rounds to . rounds to .

Exact:

(b)

Estimate: rounds to . rounds to .

Exact:

(c)

Estimate: rounds to . rounds to .

Exact:

(d)

Estimate: rounds to . rounds to .

Exact:

(b)

Estimate: rounds to . rounds to .

Exact:

(c)

Estimate: rounds to . rounds to .

Exact:

(d)

Estimate: rounds to . rounds to .

Exact:

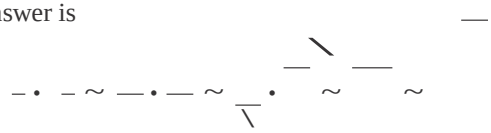
4. Multiply the amount of paint needed for each car by the number of cars.

Estimate: rounds to . rounds to .

Exact:

Exact:

quarts are needed for cars. The answer is



3. (a)

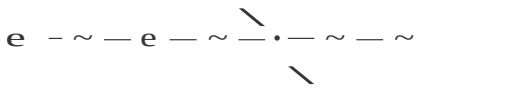
Estimate: rounds to . rounds to .

Exact:

reasonably close to the estimate.

5. (a) Divide the total pounds of brass by the number of pounds needed for one engine.

Estimate: rounds to . rounds to .



propellers can be manufactured from pounds of brass. The answer is reasonably close to the estimate.

(b) Divide the total number of quarts by the number of quarts needed for each oil change.

Estimate: rounds to . – rounds to .

Exact:

oil changes can be made with quarts of oil.

The answer is reasonably close to the estimate.

2.8 Section Exercises

1. The statement "When multiplying two mixed numbers, the reciprocal of the second mixed number must be used." is *false*. A reciprocal is used when *dividing* fractions, not *multiplying* fractions.

2. The statement "If you were dividing a mixed number by the whole number , the reciprocal of would be ." is *false*. The reciprocal of is .

3. The statement "To round mixed numbers before estimating the answer, decide whether the numerator of the fraction part is less than or more than half of the denominator." is *true*.

4. The statement "When rounding mixed numbers to estimate the answer to a problem, the estimated answer can vary quite a bit from the exact answer. However, it can still show whether the exact answer is reasonable." is *true*.

5.

Estimate:

Exact:

6.

Estimate:

Exact:

8.

Estimate:

Exact:

9.

Estimate:

Exact:

10.

Estimate:

Exact:

11.

Estimate:

Exact:

12.

Estimate:

Exact:

13.

Estimate:

Exact:

14.

Estimate:

Exact:

15.

Estimate:

Exact:

Estimate:

Exact:

16.

Estimate:

Exact:

17. *Estimate*:

The best estimate is choice **(d)**.

18. *Estimate*:

The best estimate is choice **(a)**.

19. *Estimate*:

The best estimate is choice **(b)**.

20. *Estimate*:

The best estimate is choice **(c)**.

21.

Estimate:

Exact:

22.

Estimate:

Exact:

23.

Estimate:

26.

Estimate:

Exact:

27.

Estimate:

Exact:

28.

Estimate:

Exact:

29.

Estimate:

Exact:

30.

Estimate:

Exact:

Exact: ⁻ e ~ ⁻ e ⁻ ~ ⁻ • ⁻ ~

24. ⁻ e

Estimate: e ~ ⁻ ~

Exact: ⁻ e ~ — e ⁻ ~ — • ⁻ ~ — ~

25. e

Estimate: e ~

Exact: e – ~ – e – ~ – • – ~ — ~ –

• \ ~ ~

31. – e

Estimate: e ~

Exact: ⁻ e ~ — e ⁻ ~ — • ⁻ ~

32. ⁻ e

Estimate: e ~

Exact: – e ~ — e – ~ — • – ~ — ~ –

33. Multiply each amount by .

(a) Applesauce: cup

Estimate: ~ cups

Exact: ~ ~ ~ cups

(b) Salt: tsp.

Estimate: ~ tsp.

Exact: ~ ~ ~ ~ tsp.

(c) Flour: cups

Estimate: ~ cups

Exact: ~ ~ ~ ~ cups

34. Multiply each amount by .

(a) Flour: cups

Estimate: ~ cups

Exact: ~ ~ ~ ~ cups

(b) Applesauce: cup

Estimate: ~ cups

Exact: ~ ~ ~ ~ cups

(c) Vegetable oil: cup

Estimate: ~ cups

Exact: ~ ~ ~ cup

35. Divide each amount by .

(a) Vanilla extract: tsp.

Estimate: ~ tsp.

Exact: ~ ~ ~ tsp.

36. Divide each amount by .

(a) Flour: cups

Estimate: ~ cup

Exact: ~ ~ ~ cup

(b) Salt: tsp.

Estimate: ~ teaspoon

Exact: ~ ~ ~ teaspoon

(c) Applesauce: cup

Estimate: ~ cup

Exact: ~ ~ ~ cup

37. Divide the number of gallons available by the number of gallons needed for each unit.

Estimate: š units

Exact: ~ ~ ~ ~

units can be painted with gallons of paint.

38. Divide the number of total minutes by the number of minutes per moment.

Estimate: ~ moments

Exact:

~ ~ ~ ~

(b) Applesauce: – cup

Estimate: e ~ – cup

Exact: – e ~ – e – ~ –•– ~ – cup

(c) Flour: cups

Estimate: e ~ cup

Exact: – e ~ – e – ~ –•– ~ – cup

There are moments in an 8-hour work day.

39. Each handle requires –inches of steel tubing.

Use multiplication.

Estimate: • ~ in.

Exact: • – ~ — • — ~ —— ~ – in.

– inches of steel tubing is needed to make jacks.

40. Assume that the –inch length listed in the overall dimensions is the length of the handle. Use multiplication.

Estimate: • ~ , in.

Exact: • ~ • ~ , in.

The amount of wood that is necessary to make handles is , inches.

41. The answer should include:

Step 1
Change mixed numbers to improper fractions.

Step 2
Multiply the fractions.

Step 3
Write the answer in lowest terms, changing to mixed or whole numbers where possible.

42. The additional step is to use the reciprocal of the second fraction (divisor).

43. Multiply the amount of money for each cell phone times the number of cell phones to get the total amount of money from the sale of gold.

Estimate: $ • million ~ $ million

Exact: – • million ~ – • ~ ~

~ million

You would have $ million from the sale of the gold.

44. Divide the number of square yards of carpet by the amount of carpet needed for each apartment unit.

Estimate: e š units

Exact:

e ~ e ~ ~

46. Divide the total amount of roofing material by the amount of roofing material needed for each roof.

Estimate: e š homes

Exact:

e ~ e ~ • ~

homes can be re-roofed with squares of roofing material.

47. **(a)** The maximum height of the standard jack is inches. Use multiplication.

Estimate: • ~ in.

Exact: • ~ • – ~ — ~ in.

The hydraulic lift must raise the car inches.

(b) There are inches in a foot, so the -foot-tall mechanic is d ~ inches tall. So no, the mechanic can not stand under the car without bending.

48. **(a)** The maximum height of the low-profile jack is inches. Use division.

Estimate: e ~ in.

Exact: e ~ • ~ ~ in.

The low-profile lift must raise the car inches.

(b) No, because in. is greater than in.

49. Multiply the swimming speed of the person times the number of times faster that a shark can swim than a person.

Estimate: • ~ miles per hour

Exact: – • – ~ — • — ~ ~

units can be carpeted.

45. Divide the total amount of firewood to be delivered by the amount of firewood that can be delivered per trip.

Estimate: e ~ trips

Exact: e – ~ — e – ~ — ⁄ • – ⁄ ~

trips will be needed to deliver cords of firewood.

The shark can swim – miles per hour.

50. Multiply the boxes of tile per floor times the number of floors (homes) to get the total number of boxes needed.

Estimate: • ~ boxes

Exact: –• ~ — • — ~ —— ~

– boxes of tile are needed.

Chapter 2 Review Exercises

1. There are parts, and is shaded.

2. There are parts, and are shaded.

3. There are parts, and are shaded.

4. Proper fractions have numerator (top) smaller than denominator (bottom).

They are: −Á −Á −À

Improper fractions have numerator (top) larger than or equal to the denominator (bottom).

They are: −Á −À

5. Proper fractions have numerator (top) smaller than denominator (bottom).

They are: —Á

Improper fractions have numerator (top) larger than or equal to the denominator (bottom).

They are: −Á —Á

6. • ~
b ~

– ~ —

7. • ~
b ~

– ~ —

8. ¥ Whole number part

¥ Remainder

~

9.

10. Factorizations of :

• ~ • ~

The factors of are , , , and .

11. Factorizations of :

• ~ • ~ • ~ • ~

The factors of are , , , , , , , and .

12. Factorizations of :

• ~ • ~

The factors of are , , , and .

13. Factorizations of :

• ~ • ~ • ~ • ~
• ~ • ~

The factors of are , , , , , , , , , , , and .

14.

Ã Â
□

Ã Â
□
□

~ • • ~

15.

Ã Â
□

Ã Â
□

□ Ã Â □

~ • • • ~ • •

16.

Ã Â
□

Ã Â
□

Ã Â
□

Ã Â
□

• • • • • • •

17. ~ • ~

18. • ~ • ~

19. • ~ • ~

20. • ~ • ~

21. ~~All~~ parts out of a possible parts are gold.

Whole number part

Remainder

22. 18 of the possible $\frac{b}{e}$ parts are gold.

23. 1 of the possible $\frac{b}{e}$ parts are gold.

24. 1 of the possible $\frac{b}{e}$ parts are gold.

25. $\frac{\quad}{\quad}$

26. $\frac{\quad}{\quad}$

27. $\frac{}{}$ and $\frac{}{\frac{}{}}$

The fractions are equivalent

28. $\frac{}{}$ and $\frac{}{\frac{}{}}$

The fractions are not equivalent

29. $\frac{}{}$ and $\frac{}{\frac{}{}}$

The fractions are equivalent

30. $\frac{}{}$

31.

35.

36.

37.

38.

39.

40.

41.

42.

43.

44.

45. To find the area, multiply the length and the width.

32.

33.

34.

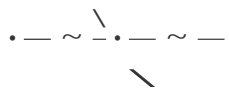
46. To find the area, multiply the length and the width.

The area is ft .

47. Multiply the length and width.

The area is ft .

48. Multiply the length and width.



The area is – ft .

49. –.

Estimate: . ~

Exact: –. – ~ —.– ~ — ~

50. –. –.

Estimate: . . ~

Exact: –. –. – ~ –.—.– ~ —— ~

51. – e

Estimate: e ~ — ~

Exact: – e ~ —.– ~ — ~

52. – e

Estimate: e ~

Exact: – e – ~ e — ~ . ~

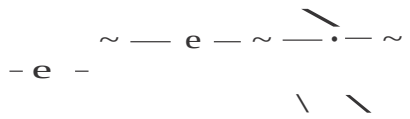
53. Divide the total tons of almonds by the size of the bins.

Estimate: e – ~ . ~ bins

55. Divide the total yardage by the amount needed for each pull cord.

Estimate: e š pull cords

Exact:



pull cords can be made.

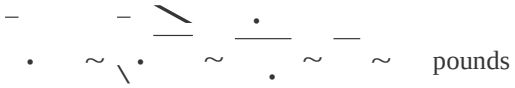
56. Multiply the weight per gallon times the number of aquariums times the gallons per aquarium.

Estimate: . . ~

Exact: –. . ~ —.–.— ~

The weight of the water is —, or – pounds.

57. Ebony sold – of pounds of rice.



Thus, c ~ pounds remain. She gave – of pounds to her parents.

Ebony gave pounds to her parents. The amount she has left is c ~ pounds.

58. Sheila paid – of $ for taxes, social security, and a retirement plan.

She paid $ for taxes, social security, and a retirement plan.

She paid of the remainder,

Exact:

bins will be needed to store the almonds.

54. The other equal partners own

of the business. Divide that amount by .

Each of the other partners owns of the business.

, for basic living expenses.

She has left.

59. must be divided by .

Each school will receive of the amount raised.

60. – of the catch must be divided evenly among fishermen.

Each fisherman receives ton.

61. **[2.5]**

62. **[2.5]**

63. **[2.8]**

64. **[2.8]**

65. **[2.7]**

66. **[2.7]**

67. **[2.5]**

68. **[2.8]**

69. **[2.2]**

¥ Whole number part

71. **[2.2]**

72. **[2.2]**

73. **[2.4]**

74. **[2.4]**

75. **[2.4]**

76. **[2.4]**

77. **[2.4]**

78. **[2.4]**

79. **[2.8]** Multiply – ounces per gallon by the number of gallons.

Estimate: ounces

Exact:

ounces of the product are needed.

80. **[2.8]** Multiply the number of tanks by the number of quarts needed for each tank.

Estimate: qt

¥ Remainder

– ~–

70. [2.2]

¥ Whole number part

¥ Remainder

~

Exact: • ~ • ~ ~ ~

– quarts are needed.

81. [2.8] To find the area, multiply the length and the width. – – – –

— —

• ~ • ~ ~

The area of the stamp is – in. .

82. [2.8] To find the area, multiply the length and the width.

– –

• ~– •– ~— ~ —

The area of the patio table top is – yd .

Chapter 2 Test

1. There are parts, and are shaded.

2. There are parts, and are shaded.

3. Proper fractions have the numerator (top) smaller than the denominator (bottom).

4.

5. ¥ Whole number part

¥ Remainder

6. Factorizations of :

The factors of are , , , , , and

7.

8.

10.

11.

12. Write the prime factorization of both numerator and denominator. Divide the numerator and denominator by any common factors. Multiply the remaining factors in the numerator and denominator.

13. Multiply fractions by multiplying the numerators and multiplying the denominators. Divide two fractions by using the reciprocal of the divisor (the second fraction) and then changing division to multiplication.

14.

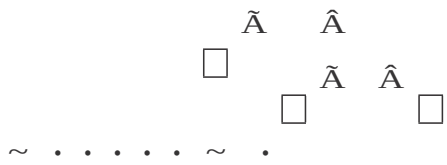
15.

16. Multiply the length and the width.

The area of the grill is yd .

17. First, find the number of seedlings that don't survive.

Next, subtract to find the number that do survive.



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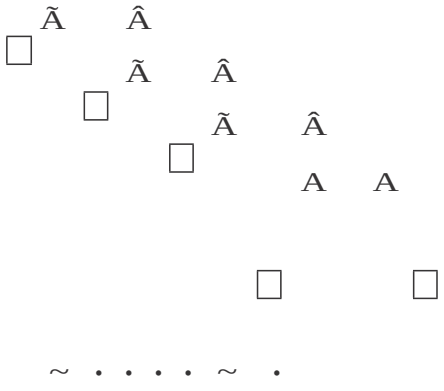


seedlings do survive.

18.

19.

20. Divide the total length by the length of the pieces.

pieces can be cut.

21.

Estimate:

Exact:

22.

Estimate:

Exact:

23.

Estimate:

Exact:

24.

Estimate:

Exact:

25. If grams can be synthesized per day, multiply to find the amount synthesized in days.

Estimate: grams

Exact:

2.

millions:
ten-thousands:

3.

4.

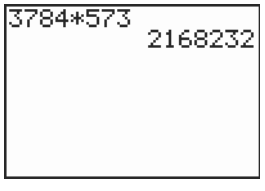
5.

6.

7.

8.

9.



10.

Attach À

grams can be synthesized.

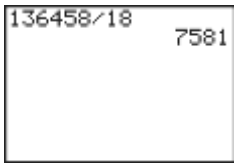
Cumulative Review Exercises (Chapters 1–2)

1.

hundreds:
tens:

11.

12.



13. , e R

,

Check:

d

,

b

,

14. R

,

Check:

d

,

b

,

15. **To the nearest ten:**

Next digit is or less.

Tens place does not change.

All digits to the right of the underlined place change to zero.

To the nearest hundred:

Next digit is or more.

Hundreds place changes (b ~).

All digits to the right of the underlined place change to zero.

To the nearest thousand:

16. **To the nearest ten:** ,

Next digit is or less.

Tens place does not change.

All digits to the right of the underlined place change to zero. ,

To the nearest hundred: ,

Next digit is or more.

Hundreds place changes (b ~).

All digits to the right of the underlined place change to zero. ,

To the nearest thousand: _,

Next digit is or less.

Thousands place does not change.

All digits to the right of the underlined place change to zero. ,

17.

c 2 3	*Exponent*
~ c 2 3	*Multiply.*
~ c ~	*Subtract.*

18.

j c · b	*Square root*
~ c · b	*Multiply.*
~ c b	*Subtract.*
~ b ~	*Add.*

19. Multiply to find the amount used for the half-day and full-day tours; then add to find the total.

d d b

gallons of fuel are needed

20. Subtract to find the difference in cases.

\ , \ \ \

Next digit is or more.

Thousands place changes (b ~).

All digits to the right of the underlined place change to zero.

c ,

,

There were , more cases of pertussis than mumps.

21. Find the number of hairs lost in years and subtract to find the hairs remaining.

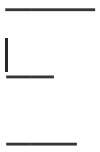
, ,

d d c ,

, , ,

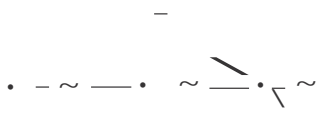
, hairs remain.

22. Divide the total number of hours by the number of workers.



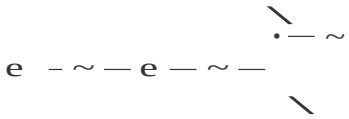
Each health care worker will work hours.

23. Multiply the number of flushes and the amount of water used per flush to find the number of gallons of water used.



gallons of water are used in flushes.

24. Divide the total length by the length of the pieces.



pieces can be cut.

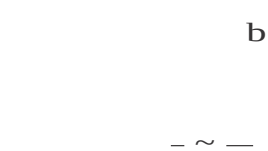
25. – is *proper* because the numerator ² ³ is smaller than the denominator ² ³.

26. – is *improper* because the numerator ² ³ is larger than or the same as the denominator ² ³.

27. – is *proper* because the numerator ² ³ is smaller than the denominator ² ³.

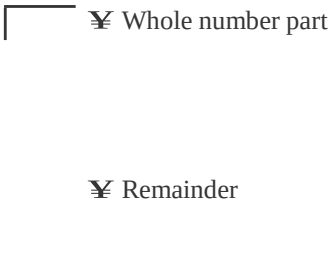
28.

29.



30.

31.



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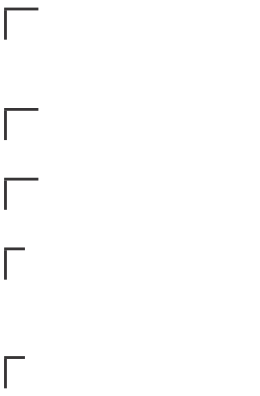

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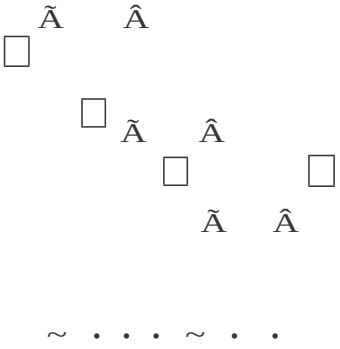

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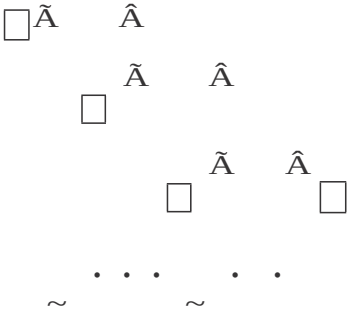

35.

36.

37. ¥ Whole number part

¥ Remainder

38.

39.

40.

41.

42.

43.

44.

45.

46.