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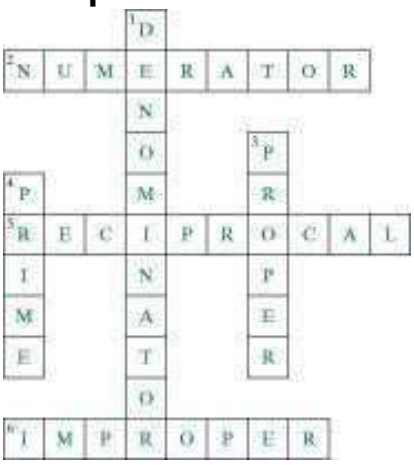
# Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

## Chapter Opener Puzzle




## Section 2.1 Introduction to Fractions and Mixed Numbers

### Section 2.1 Practice Exercises

Answers will vary.

**(a)** A **fraction** is a part of a whole unit. The **numerator** of a fraction denotes the number of pieces of the whole being considered. The **denominator** of a fraction denotes the number of equal pieces into which a whole unit is divided. A fraction is a **proper fraction** if the numerator is less than the denominator.
An **improper fraction** is a fraction in which the numerator is greater than or equal to the denominator.
A **mixed number** is a sum of a whole number and a fractional part of a whole.

Numerator: 2; denominator: 3

Numerator: 8; denominator: 9

Numerator: 12; denominator: 11

Numerator 1; denominator: 2

$6 \div 1; 6$

$9 \div 1; 9$

$2 \div 2; 1$

$8 \div 8; 1$

$0 \div 3; 0$

$0 \div 7; 0$

$2 \div 0$; undefined

$11 \div 0$; undefined

$\frac{3}{4}$

$\frac{1}{2}$

$\frac{5}{9}$

$\frac{3}{5}$

$\frac{1}{6}$

$\frac{4}{7}$

$\frac{3}{8}$

$\frac{2}{3}$

$\frac{3}{4}$

$\frac{1}{4}$

$\frac{1}{8}$

$\frac{2}{8}$ or $\frac{1}{4}$

**27.** $\frac{41}{103}$

**28.** $\frac{43}{103}$

**29.** $\frac{10}{21}$

$\frac{10}{63}$

Proper

Proper

Improper

Improper

Improper

Improper

Proper

Proper

$\frac{5}{2}$

$\frac{4}{3}$

$\frac{12}{4}$

**42.** $\frac{27}{9}$

**43.** $\frac{7}{4}; 1\frac{3}{4}$

**44.** $4; 3\frac{4}{5}$

**45.** $8; 1\frac{1}{8}$

$\frac{51}{2}; 2\frac{2}{2}$

**47.** $1\frac{3}{4} = \frac{4!1+3}{4} = \frac{7}{4}$

**48.** $\frac{1}{6}3 = \frac{6!3+1}{3} = \frac{19}{3}$

**49.** $\frac{2}{4}9 = \frac{4!9+2}{9} = \frac{38}{9}$

$\frac{3}{5}1 = \frac{3!5+1}{5} = \frac{16}{5}$

$\frac{3}{7}3 = \frac{3!7+3}{7} = \frac{24}{7}$

**52.** $8\frac{2}{3} = \frac{8!3+2}{3} = \frac{26}{3}$

**53.** $7\frac{1}{4} = \frac{7!4+1}{4} = \frac{29}{4}$

$10\frac{3}{5} = \frac{10 \cdot 5 + 3}{5} = \frac{53}{5}$

$11\frac{5}{12} = \frac{11 \cdot 12 + 5}{12} = \frac{137}{12}$

$1\frac{1}{12} = \frac{12 \cdot 6 + 1}{12} = \frac{73}{12}$

**56.** $12\frac{6}{3} = \frac{6}{3} = 6$

**57.** $21\frac{8}{8} = \frac{8}{8} = 8$

**58.** $15\frac{1}{2} = \frac{15 \cdot 2 + 1}{2} = \frac{31}{2}$

$2\frac{3}{8} = \frac{2 \cdot 8 + 3}{8} = \frac{19}{8}$

eighths

$2\frac{3}{5} = \frac{2 \cdot 5 + 3}{5} = \frac{13}{5}$

13 fifths

$3\frac{1}{4} = \frac{4 \cdot 3 + 1}{4} = \frac{13}{4}$

**61.** $1\frac{4}{4} = \frac{4}{4}$

7 fourths

$25\frac{3}{2} = \frac{25 \cdot 2 + 3}{2} = \frac{17}{2}$

**62.** $5\frac{3}{3} = \frac{3}{3}$

17 thirds

**63.** $8\overline{)37}$ $4\frac{5}{8}$

$\underline{-32}$

5

**64.** $7\overline{)13}$ $1\frac{6}{7}$

$\underline{-7}$

6

**65.** $5\overline{)39}$ $7\frac{4}{5}$

$\underline{-35}$

4

**67.** $10\overline{)27}$ $2\frac{7}{10}$

$\underline{-20}$

7

$18\overline{)43}$ $\frac{7}{18}$

$\underline{-36}$

7

$9\overline{)52}$ $\frac{7}{9}$

$\underline{-45}$

7

$12\overline{)67}$ $5\frac{7}{12}$

$\underline{-60}$

7

$11\overline{)133}$ $\frac{1}{11}$

$\underline{-11}$

23

$\underline{-22}$

1

$10\overline{)51}$ $5\frac{1}{10}$

$\underline{-50}$

1

3

$\overline{)23}$

$\underline{-18}$

5

**73.**

$\overline{)9}$ $4\frac{4}{16}$

3

**66.**

4

1

**74.**

1
1
5
!7
4
5—
!
4
2

**75.**

3

4
4
3
0
9
!
2
8
2
9
!
2
8

1 ___

3 _
5
6

1 _
6
3
7

4
4
1
7

**76.** $4\overline{)921}$ $230\frac{1}{4}$

230
4 | 921
!8
12
!12
1
1

**77.** $5\overline{)5281}$ $1056\frac{1}{5}$

1056
5 | 5281
!5
28
!25
31
!30
1

**78.** $8\overline{)7213}$ $901\frac{5}{8}$

901
8 | 7213
!72
13
!8
5

**79.** $11\overline{)8913}$ $810\frac{3}{11}$

810
11 | 8913
!88
11
!11
3
!0
3

**80.** $23\overline{)4257}$ $185\frac{2}{23}$

185
23 | 4257
!23
195
!184
117
!115

**81.** $15\overline{)187}$ $12\frac{7}{15}$

12
15 | 187
!15
37
!30
7

**82.** $34\overline{)695}$ $20\frac{15}{34}$

20
34 | 695
!68
15
!0
15

**83.** Divide the distance between 0 and 1 into 4 equal parts.


**84.** Divide the distance between 0 and 1 into 2 equal parts.


**85.** Divide the distance between 0 and 1 into 3 equal parts.


**86.** Divide the distance between 0 and 1 into 5 equal parts.


**87.** Divide the distance between 0 and 1 into 3 equal parts.


**88.** Divide the distance between 0 and 1 into 6 equal parts.

$\frac{}{2}$

$\frac{7}{6} = 1\frac{1}{6}$

Divide the distance between 1 and 2 into 6 equal parts.


$\frac{7}{5} = 1\frac{2}{5}$

Divide the distance between 1 and 2 into 5 equal parts.


$\frac{5}{3} = 1\frac{2}{3}$

Divide the distance between 1 and 2 into 3 equal parts.


$\frac{3}{2} = 1\frac{1}{2}$

Divide the distance between 1 and 2 into 2 equal parts.


False; whole numbers cannot be written as proper fractions.

True

True

True

## Section 2.2 Prime Numbers and Factorization

### Section 2.2 Practice Exercises

Answers will vary.

**(a)** A **factor** of a number $n$ is a nonzero whole number that divides evenly into $n$.

A **factorization** of a number $n$ is a product of factors that equals $n$. A **prime number** is a whole number greater than 1 that has only two factors (itself and 1).

A **composite number** is a whole number greater than 1 that is not prime.

The **prime factorization** of a number is the factorization in which every factor is a prime number.

$\frac{4}{12}; \frac{}{12}$

5 1

$\frac{5}{-4}; \frac{3}{4}$

$\frac{6}{}$

;

5 ; improper
7

12 ; proper
6

6 ; improper
4

9. 5 23 4 3
2 2

!20 5
3

6 2 = 6!7+2 = 44
777

For example: 2 · 4 and 1 · 8

For example: $2 \cdot 10$ and $4 \cdot 5$

For example: $4 \cdot 6$ and $2 \cdot 2 \cdot 2 \cdot 3$

For example: $1 \cdot 14$ and $2 \cdot 7$

**15.**

| Product | 42 | 30 | 15 | 81 |
|---|---|---|---|---|
| Factor | 7 | 30 | 15 | 27 |
| Factor | 6 | 1 | 1 | 3 |
| Sum | 13 | 31 | 16 | 30 |

**16.**

| Product | 42 | 45 | 72 | 24 |
|---|---|---|---|---|
| Factor | 7 | 15 | 18 | 8 |
| Factor | 6 | 3 | 4 | 3 |
| Sum | 1 | 12 | 14 | 5 |

A whole number is divisible by 2 if it is an even number.

A whole number is divisible by 10 if its ones-place digit is 0.

A whole number is divisible by 3 if the sum of its digits is divisible by 3.

A whole number is divisible by 5 if its ones-place digit is 5 or 0.

45

No; 45 is not even.
Yes; 4 + 5 = 9 is divisible by 3.
Yes; the ones-place digit is 5.
No; the ones-place digit is not 0.

100

Yes; 100 is even.
No; 1 + 0 + 0 = 1 is not divisible by 3.
Yes; the ones-place digit is 0.
Yes; the ones-place digit is 0.

137

No; 137 is not even.
No; 1 + 3 + 7 = 11 is not divisible by 3.
No; the ones-place digit is not 0 or 5.
No; the ones-place digit is not 0.

241

No; 241 is not even.
No; 2 + 4 + 1 = 7 is not divisible by 3.
No; the ones-place digit is not 0 or 5.
No; the ones-place digit is not 0.

108

Yes; 108 is even.
Yes; 1 + 0 + 8 = 9 is divisible by 3.
No; the ones-place digit is not 0 or 5.
No; the ones-place digit is not 0.

1040

Yes; 1040 is even.
No; 1 + 0 + 4 + 0 = 5 is not divisible by 3.
Yes; the ones-place digit is 0.
Yes; the ones-place digit is 0.

3140

Yes; 3140 is even.
No; 3 + 1 + 4 + 0 = 8 is not divisible by 3.
Yes; the ones-place digit is 0.
Yes; the ones-place digit is 0.

2115

No; 2115 is not even.
Yes; 2 + 1 + 1 + 5 = 9 is divisible by 3.
Yes; the ones-place digit is 5.
No; the ones-place digit is not 0.

```
      3
28 | 84
    !84
     0
```

Yes, 84 is divisible by 28.

```
      5
22 | 110
    !110
      0
```

Yes, 110 is divisible by 22.

Prime

Prime

**33.** Composite $2 \cdot 5 = 10$

**34.** Composite $3 \cdot 7 = 21$

**35.** Composite $3 \cdot 17 = 51$

**36.** Composite $3 \cdot 19 = 57$

Prime

Prime

Neither

Neither

**41.** Composite $11 \cdot 11 = 121$

**42.** Composite $3 \cdot 23 = 69$

Prime

Prime

**45.** Composite $3 \cdot 13 = 39$

**46.** Composite $7 \cdot 7 = 49$

There are two whole numbers that are neither prime nor composite, 0 and 1.

False; the square of any prime number is divisible by that prime number.

False; 9 is not prime.

False; 2 is not composite.

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79

No, 9 is not a prime number.

No, 8 is not a prime number.

Yes

Yes

**57.** $5 \overline{)35}$, $7$, $2\ 70$ $2 \cdot 5 \cdot 7 = 70$

**58.** $5 \overline{)55}$, $11$, $3 \overline{)165}$, $3 \overline{)495}$ $3!3!5!11 = 3^2!5!11 = 495$

**59.** $5 \overline{)65}$, $13$, $2 \overline{)130}$, $2 \overline{)260}$ $2!2!5!13 = 2^2!5!13 = 260$

**60.** $5 \overline{)35}$, $7$, $175$ $5!5!7 = 5^2!7 = 175$

**61.** $7 \overline{)49}$, $7$, $3 \overline{)147}$ $3!7!7 = 3!7^2 = 147$

**62.** $3 \overline{)51}$, $17$, $2 \overline{)102}$ $2 \cdot 3 \cdot 17 = 51$

**63.** $3 \overline{)69}$, $23$, $2 \overline{)138}$ $2 \cdot 3 \cdot 23 = 138$

**64.** $7 \overline{)77}$, $11$, $3 \overline{)231}$ $3 \cdot 7 \cdot 11 = 231$

**65.** $7 \overline{)77}$, $11$, $2 \overline{)154}$, $2 \overline{)308}$, $2 \overline{)616}$ $2!2!2!7!11 = 2^3!7!11 = 616$

**66.** $7 \overline{)912}$, $13$, $2 \overline{)182}$, $364$ $2!2!7!13 = 2^2$ 41 is prime.

47 is prime.

!7!13=364

1, 2, 3, 4, 6, 12

1, 2, 3, 6, 9, 18

1, 2, 4, 8, 16, 32

1, 5, 11, 55

1, 3, 9, 27, 81

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

1, 2, 3, 4, 6, 8, 12, 16, 24, 48

1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

No; 30 is not divisible by 4. No;

46 is not divisible by 4.

Yes; 16 is divisible by 4.

Yes; 64 is divisible by 4.

Yes; 32 is divisible by 8.

Yes; 520 is divisible by 8.

No; 126 is not divisible by 8.

No; 58 is not divisible by 8.

Yes; 3 + 9 + 6 = 18 is divisible by 9.

Yes; 4 + 1 + 4 = 9 is divisible by 9.

No; 8 + 4 + 5 + 3 = 20 is not divisible by 9.

No; 1 + 5 + 8 + 7 = 21 is not divisible by 9.

Yes; 522 is even and 5 + 2 + 2 = 9 is

Yes; 546 is even and 5 + 4 + 6 = 15 is divisible by 3.

No; 5917 is not even.

No; 6 + 3 + 9 + 4 = 22 is not divisible by 3.

## Section 2.3 Simplifying Fractions to Lowest Terms

### Section 2.3 Practice Exercises

Answers will vary.

**(a)** A fraction is said to be in **lowest terms** if the numerator and denominator share no common factor other than 1.

The largest number that divides evenly into the numerator and denominator is call their **greatest common factor**.

**3.** $5\overline{)145}$ $5\cdot 29=145$

$3\overline{)57}$ $2\overline{)114}$ $2\cdot 3\cdot 19=114$

**5.** $2\overline{)46}$ $2\overline{)92}$ $2!2!23= 2^{2}!23=92$

**6.** $3\overline{)51}$ $3\overline{)153}$ $3!3!17 = 3^{2}!17 =153$

**7.** $5\overline{)85}$ $5\cdot 17=85$

**8.** $3\overline{)15}$ $\overline{)30}$ $\overline{)60}$ $\overline{)120}$ $2!2!2!3!5 = 2^{3}!3!5 =120$

**9.** 5 | 65 ; 3 | 195 ; 13

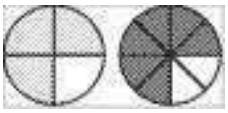
3·5·13=195

**10.** 3 | 15 ; 3 | 45 ; 2 | 90 ; 2 | 180 ; 5

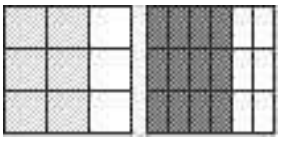
2 2

2!2!3!3!5 = 2 !3 !5 = 180

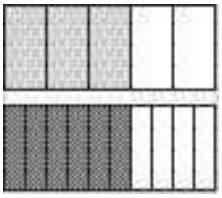
**11.**



**12.**



**13.**



**14.**

False; 5 × 5 ≠ 4 × 4

Two fractions are equivalent if they both represent the same part of a whole.

2!5 ! 3!3

10"9

$\frac{2}{3} \; \frac{3}{5}$

1!9 ! 4!2

9 " 8

$\frac{1}{4} \; \frac{2}{9}$

1!6 ! 2!3

6 = 6

$\frac{1}{1} \; \frac{3}{6}$

=

6!8 ! 16!3

48=48

$\frac{6}{16} \; \frac{3}{8}$

=

12!4 !16!3

48=48

$\frac{12}{6} \; \frac{3}{4}$

=

4!15!5 !

12

60=60

$\frac{4}{5} \; \frac{12}{15}$

=

8!27 ! 9!20

216 " 180

$\frac{8}{9} \; \frac{20}{27}$

!

5!18 ! 6!12

90"72

$\frac{5}{6} \; \frac{12}{18}$

!

$\frac{12}{24} = \frac{2!2!3}{2!2!2!3} \neq \frac{1}{2}$

$\frac{153!55}{18} = \frac{}{2!3!3} = 6$

**27.** $\frac{2!3}{18} = \frac{1}{2!3!3} = \frac{1}{3}$

$\frac{3!7}{24} = \frac{7}{2!2!2! 3} = \frac{7}{8}$

$\frac{36}{2!2!3!3} = \frac{9}{2!2!55}$

$\frac{497!77}{42} = \frac{}{2!3!7} \neq 6$

$\frac{15}{12} = \frac{3 \cdot 5}{2 \cdot 2 \cdot 3} = \frac{5}{4}$

$\frac{130}{150} = \frac{2 \cdot 5 \cdot 13}{2 \cdot 3 \cdot 5 \cdot 5} = \frac{13}{15}$

$30 = 2 \cdot 3 \cdot 5 = 6$
$2 \cdot 5 \cdot 5 \cdot 5$

$\frac{70}{2 \cdot 2 \cdot 3 \cdot 5} = \frac{2 \cdot 5 \cdot 7}{12} = \frac{7}{120} \frac{2}{}$

$20 = 2 \cdot 2 \cdot 5 = 4$
$2 \cdot 5 \cdot 5 \cdot 5$

$385 = 5 \cdot 7 \cdot 11 = 77$
$195 \quad 3 \cdot 5 \cdot 13 \quad 39$

$\frac{8}{16} = \frac{8 \cdot 1}{2 \cdot 8 \cdot 2}$

$39 = 3 \cdot 13 = 3$
$130 \quad 2 \cdot 5 \cdot 13 \quad 10$

$\frac{14}{14} = 1$

$85 = \frac{2 \cdot 17}{5 \cdot 17} = \frac{2}{5}$

$\frac{8}{8} = 1$

$\frac{69}{2 \cdot 2 \cdot 23} = \frac{3 \cdot 23}{4} = 3$

$\frac{50}{25} = \frac{2 \cdot 25}{25} = 2$

$\frac{6 \cdot 2}{10+4} = \frac{4}{14} = \frac{2 \cdot 2}{2 \cdot 7} = \frac{2}{7}$

$\frac{24}{66} = \frac{4 \cdot 6}{6 \cdot 6} = 4$

**54.** $\frac{9 \cdot 1}{15+3} = \frac{8}{18} = \frac{2 \cdot 2 \cdot 2}{2 \cdot 3 \cdot 3} = \frac{4}{9}$

$\frac{9}{9} = 1$

$\frac{5 \cdot 5}{7 \cdot 2} = \frac{0}{5} = 0$

**55.**

$\frac{2}{2} = 1$

$\frac{11 \cdot 11}{11 \cdot 11} = \frac{0}{0}$

$105 = 3 \cdot 5 \cdot 7 = 3$
$140 \quad 2 \cdot 2 \cdot 5 \cdot 7 \quad 4$

**56.** $4 + 7 = 11 = 0$

**42.** $\frac{84}{126} = \frac{2 \cdot 2 \cdot 3 \cdot 7}{2 \cdot 3 \cdot 3 \cdot 7} = \frac{2}{3}$

**57.** $\frac{7 \cdot 2}{5 \cdot 5} = \frac{5}{0}$ = undefined

$33 \quad 3 \cdot 11$

$\frac{4 + 7}{11 \cdot 11} = \frac{11}{0}$

**58.** = undefined

**43.** $\frac{}{11} = \frac{}{11} = 3$

**44.** $\frac{}{} = \frac{}{} = \frac{}{}$

**59.** $\frac{8}{8} \div \frac{2}{10} = \frac{6}{6} \cdot \frac{2}{2} = \frac{3}{3} = \frac{}{} = \frac{}{} = \frac{}{}$

15+3
18 6"3

!133 **60.** = =

= 13

5

77=7!11=7

110 10 ! 10

85 = 5!17 =5

153 3!3! 9

15!3 12 6"2 2

120 12 2!2!3 3

**61.** = = =

16 2!2!2!2 4

720 =72= 8!9 = 9

800 80 8 !10 10

$\frac{3000}{1800} = \frac{30}{18} = \frac{2!3!5}{2!3!3} = \frac{5}{3}$

$\frac{2000}{1500} = \frac{20}{15} = \frac{2!2!5}{3!5} = \frac{4}{3}$

$\frac{42,\blacksquare\blacksquare\blacksquare}{22,\blacksquare\blacksquare\blacksquare} = \frac{42}{22} = \frac{2!21}{2\ 2!11} = \frac{21}{11}$

$\frac{50,\blacksquare\blacksquare\blacksquare}{65,\blacksquare\blacksquare\blacksquare} = \frac{50}{65} = \frac{2!5!5}{5\ 5!13} = \frac{10}{13}$

**67.** $\frac{5100}{30,000} = \frac{51}{300} = \frac{3!17}{3!100} = \frac{17}{100}$

**68.** $\frac{9800}{28,000} = \frac{98}{280} = \frac{2!7!7}{2!\ 2!2!5!\ 7} = \frac{7}{20}$

Heads: $= \frac{2!2!55}{48} = \frac{}{2!2!2!2!3} = \frac{}{12}$ Tails: $48 - 20 = 28$

$= \frac{2!2!7}{2!\ 2!2!2!3} = \frac{7}{12}$

$= \frac{2!5!7}{105} = \frac{2}{3!5!7} = \frac{2}{3}$

$\frac{6}{26} = \frac{2!3}{2!13} = \frac{3}{13}$

**71. (a)** $26 - 6 = 20$

$= \frac{2!2!5}{2!13} = \frac{10}{13}$

**(a)** $\frac{12}{88} = \frac{2!2!3}{2!\ 2!2!11} = \frac{3}{22}$

$\frac{362!2!3!39}{88} = \frac{}{2!2!2!11} = \frac{}{22}$

$\frac{25}{} \quad \frac{5!5}{} \quad \frac{5}{}$

**73. (a)** Jonathan: $= \frac{}{} = 35\ 5!7\ 7$

Jared: $\frac{24}{28} = \frac{2!2!2\ !\ 3}{2!2!7} = \frac{6}{7}$

Jared sold the greater fractional part because $\frac{6}{7} > \frac{5}{7}$.

$\frac{15}{} \quad \frac{3!5}{} \quad \frac{5}{}$

**(a)** Lynette: $24 = 2 ! 2 ! 2 ! 3 = 8$

Lisa: $\frac{14}{16} = \frac{2 ! 7}{2 !2!2!\ 2} = \frac{7}{8}$

**(b)** Lisa has completed more of her course because $\frac{7}{8} > \frac{5}{8}$.

**75. (a)** Raymond:

$= \frac{2!2!2!3!5}{2!2!2!3!3!11} = \frac{10}{11}$

Travis: $\frac{540}{660} = \frac{2!2!3!3!3!5}{2!2!3!5!11} = \frac{9}{11}$

Raymond read the greater fractional part because $\frac{10}{11} > \frac{9}{11}$.

**(a)** $\frac{}{27} = \frac{3!55}{3!3!3} = \frac{}{9}$

$\frac{}{36} = \frac{2!2!2!2}{2!2!3!3} = \frac{4}{9}$

**(a)** 300,000,000

36,000,000

$\frac{36,\blacksquare\blacksquare\blacksquare,000}{300,000,000} = \frac{36}{300} = \frac{2 !3!2!3}{2 !2!3!5!5} = \frac{3}{25}$

**(a)** 300,000,000

75,000,000

$\frac{300,\blacksquare\blacksquare\blacksquare,\blacksquare\blacksquare\blacksquare}{75,000,000} = \frac{300}{75}$

$$= \frac{2!2!3!5!5}{3!5!5} = \frac{4}{1}$$

4 times greater

**79.** For example, $\frac{6}{8}, \frac{9}{12}, \frac{12}{16}$

**80.** For example, $\frac{2}{6}, \frac{3}{9}, \frac{4}{12}$

**81.** For example, $\frac{6}{9}, \frac{4}{6}, \frac{2}{3}$

**82.** For example, $\frac{40}{50}, \frac{8}{10}, \frac{4}{5}$

**83.** $\frac{792}{891} = \frac{8}{9}$

**84.** $\frac{728}{784} = \frac{13}{14}$

**85.** $\frac{779}{969} = \frac{41}{51}$

**86.** $\frac{462}{220} = \frac{21}{10}$

**87.** $\frac{493}{510} = \frac{29}{30}$

**88.** $\frac{871}{469} = \frac{13}{7}$

**89.** $\frac{969}{646} = \frac{3}{2}$

**90.** $\frac{713}{437} = \frac{31}{19}$

## Section 2.4 Multiplication of Fractions and Applications

### Section 2.4 Practice Exercises

Pages 152−156; answers will vary.

A **power of one-tenth** is $\frac{1}{10}$ raised to a whole-number power.

Numerator: 10; denominator: 14

$$= \frac{2 \cdot 5}{2 \cdot 7} = \frac{5}{7}$$

Numerator: 32; denominator: 36

$$= \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 3 \cdot 3} = \frac{8}{9}$$

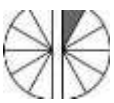
Numerator: 25; denominator: 15

$$\frac{25}{3 \cdot 5} = \frac{5 \cdot 5}{3 \cdot 5} = \frac{5}{3}$$

Numerator: 2100; denominator: 7000

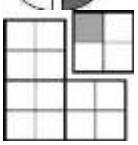
$$\frac{2100}{7000} = \frac{21}{70} = \frac{3 \cdot 7}{2 \cdot 5 \cdot 7} = \frac{3}{10}$$

**7.**

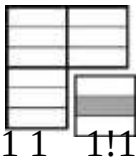


**8.**

**9.**



**10.**



$$\frac{1}{24} \cdot \frac{1}{4} = \frac{1 \cdot 1}{2 \cdot 4} = \frac{1}{8}$$

$$\frac{2}{35} \cdot \frac{1}{5} = \frac{2 \cdot 1}{3 \cdot 5} = \frac{2}{15}$$

$$4\frac{3}{8} \cdot 4\frac{3}{8} = \frac{35}{8} \cdot \frac{35}{8} = \frac{1225}{64}$$

$$5\frac{2}{20} \cdot 5\frac{2}{20} = \frac{102}{20} \cdot \frac{102}{20} = \frac{40}{5} = 8$$

13 1!3 3

! = = —

282!816

2

1

2

! = —

333!39

14 1 14!1 14

! = =

9 9 9!9 81

1 9 1!9 9

! = = =

**18.** 8 8 8!8 64

"12#"2# 12!2 24

**19.** $ %$ % = =

& 7 '&5' 7 ! 5 35

" 9 #"7# 9 ! 7 63

=

**20.** $ %$ % =

&10'&4' 10! 4 40

" 1 # 8 1 8 !1 8

=

**21.** 8!$ % ! = =

&11' 1 11 1!11 11

" 2 # 3 2 3 ! 2 6

=

**22.** 3!$ % = =

& 7 ' 1 7 1! 7 7

**23.** 4 . 4 ! 6 = 4 ! 6 24

5 5 1 5 !1 5

5 5 5 5!5 25

**24.** !5= ! = = =

8 8 1 8!1 8

**25.** 13 !5= 13!5= 65

949!436

6!7=6!7=42

555!525

**27.** 2 ! 3 = 2 ! 3 = 2

9 5 3 " 3 5 15

**28.** $\frac{1}{} \cdot \frac{4}{} = \frac{1}{} \cdot \frac{4}{} = \frac{1}{}$

$\frac{21}{5} \cdot \frac{25}{125} = \frac{3 \cdot 7}{2 \cdot 2 \cdot 34} \cdot \frac{5 \cdot 5}{} = \frac{35}{}$

$\frac{16}{} \cdot \frac{15}{} = \frac{16}{} \cdot \frac{3 \cdot 5}{} = \frac{3}{}$

**32.** $25 \cdot 32$
$= 5 \cdot 5 \cdot 2 \cdot$ [redacted]
$= 10$

**33.** $\frac{24}{15} \cdot \frac{5}{3} = \frac{2 \cdot 2 \cdot 2 \cdot 3}{3 \cdot 5} \cdot \frac{5}{3} = \frac{8}{3}$

$\frac{49}{} \cdot \frac{6}{} = \frac{7 \cdot 7}{} \cdot \frac{2 \cdot 3}{} = \frac{7}{}$

**34.** $24 \cdot 7 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 7 = 4$

**35.** $\frac{6}{} \div \frac{22}{} = \frac{6 \cdot 22}{2 \cdot 3 \cdot 2 \cdot 11} = \frac{4}{}$
$\frac{}{11} \div \frac{15}{} = \frac{11 \cdot 15}{11 \cdot 3 \cdot 5} = \frac{5}{}$

**36.** $\frac{12}{} \div \frac{5}{} = \frac{12 \cdot 5}{3 \cdot 4 \cdot 5} = \frac{1}{}$
$\frac{}{45} \div \frac{4}{} = \frac{45 \cdot 4}{3 \cdot 3 \cdot 5 \cdot 4} = \frac{3}{}$

**37.** $\frac{17}{} \div \frac{72}{} = \frac{17 \cdot 72}{17 \cdot 8 \cdot 9} = \frac{8}{}$
$\frac{9}{} \div \frac{17}{} = \frac{9 \cdot 17}{9 \cdot 17} = 1$

$\frac{39}{} \div \frac{11}{} =$

$\frac{39}{11} =$

$\frac{3 \cdot 13}{11} =$

$\frac{3}{} = 3$
$11 \div 13 = 11 \cdot$ [redacted] $= 1$

$\frac{21}{} \cdot \frac{16}{} =$

$\frac{3 \cdot 7}{} \cdot \frac{4 \cdot 4}{} =$

$= \frac{12}{} = 12$
$47 \quad 47 \cdot 1$

$\frac{85}{6} \cdot \frac{12}{10} = \frac{5 \cdot 17}{2 \cdot 3 \cdot 2 \cdot 5 \cdot 1} = \frac{17}{} = 17$

$\frac{15}{} \cdot \frac{2 \cdot 2 \cdot 3}{} = \frac{3 \cdot 5}{} = \frac{30}{}$

**41.** $12 \div 42 = \frac{1}{} \cdot \frac{2 \cdot 3 \cdot 7}{7} =$

**42.** $4 \div \frac{8}{} = \frac{2 \cdot 2}{} \div \frac{2 \cdot 2 \cdot 2}{} = \frac{8}{}$
$\frac{9}{2} \quad \frac{1}{} \quad 2 \cdot 2 \cdot 23 \quad 23$

**43.** $\frac{5}{3} \div \frac{9}{5} \cdot \frac{16}{15} \cdot \frac{25}{3} = \frac{3 \cdot 5}{10}$
$\frac{3}{5} \quad 8 \quad 3 \cdot 3$
$= !$

$2^{"}$ $5^{"}5$

$2^{"}$

$2^{"}$ $2"2"2$

!

3

**29.** $6 \; ! \; 4 = \frac{}{2"3} \; ! \; 4 = 8$ $= 1^{=10}$

**30.** $\frac{7}{12} \; "\frac{18}{5} = \frac{7}{2!2!3} \; " \; \frac{2!3!3}{5} = \frac{21}{10}$

**44.** $\frac{49}{8} \cdot \frac{4}{5} \cdot \frac{20}{7} = \frac{7 \cdot 7}{2 \cdot 2 \cdot 2} \cdot \frac{2 \cdot 2}{5} \cdot \frac{2 \cdot 2 \cdot 5}{7}$

$= \frac{14}{1} = 14$

$\frac{5}{2} \cdot \frac{10}{21} = \frac{7}{2} \cdot \frac{5 \cdot 2 \cdot 5}{3 \cdot 7} = \frac{5}{3}$

$\frac{55}{9} \cdot \frac{18}{32} \cdot \frac{24}{11}$

$5 \cdot \frac{2 \cdot 3 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 3}$

$= 3 \cdot 3 \cdot \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{11}$

$= \frac{1}{5} \cdot \frac{2}{}$

**47.** $\frac{7}{10} \cdot \frac{3}{28} \cdot 5 = \frac{7}{2 \cdot 5} \cdot \frac{3}{2 \cdot 2 \cdot 7} \cdot \frac{5}{1} = \frac{3}{8}$

**48.** $\frac{2}{11} \cdot 15 = \frac{11}{2} \cdot \frac{3 \cdot 5}{1} = \frac{11}{1}$

$18 \quad 20 \quad 2 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 5 \quad 1 \quad 12$

$\frac{100}{49} \quad \frac{14}{25} \quad \frac{2 \cdot 2 \cdot 5 \cdot 5}{7 \cdot 7} \quad \frac{3 \cdot 7}{1} \quad \frac{2 \cdot 7}{5 \cdot 5}$

**49.** $21 \cdot \frac{}{} = \frac{}{}$

$2 \quad 4$

$= \frac{}{1} = 24$

$\$$

**50.** $\frac{38}{} \cdot \frac{5}{} \cdot 19 \cdot \frac{11}{} \cdot \frac{5}{} = \frac{5}{} = 5$

$22 \quad 19 \quad 2 \cdot 11 \quad 11 \quad 91$

**61.**

$1 \quad \$ \quad 9$

$\frac{\%}{}$

$1,000,000,000$

$2$

$\frac{1}{} \quad \frac{11}{} \quad 1$

$\$\% = \#=$

$99 \quad 81$

$2$

$3 \quad 3 \quad 3 \quad 27$

$\$ \quad \%$

$2 \quad 2228\&'$

$4 \quad 4 \quad 4 \quad 64$

$\$ \quad \%$

$3 \quad 333 \quad 27 \quad \& \quad '$

$\$ \quad 4 \quad \$ \quad 1$

$\& \quad ' \quad ' \quad '$

$2 \quad 5 \quad 2 \quad 3 \quad 3$

**60.** $5 \# \_ \_ = \_ \_ \# \_ \_ = 2 = 8$

$\% \quad \$ \quad \%$

$\& \quad 5' \quad \& \quad 1 \quad 5'$

$1 \quad 2$

$\frac{2}{} \quad \frac{2}{}$

$\frac{1}{} \quad \frac{1}{} \quad \frac{1}{}$

$=$

$\$ \quad \# \quad \% \quad \$ \quad \% = \quad \# \quad =$

$\& \quad 5' \quad \& 15' \quad 15 \quad 15 \quad 225$

**51.** $!\frac{1}{\%}"^{3} = \frac{1}{\,} \cdot \frac{1}{\#} \cdot \frac{1}{\,} = \frac{1}{\,}^{3}$
&

1
0 ' 10 10 10 1000
1

$!1"^{4}\frac{}{} \quad \frac{1}{\,} \cdot \frac{1}{\,} \cdot \frac{1}{\,} \cdot \frac{1}{\,} \quad \frac{1}{\,}$

**52.** $ %= # # # =
&10 ' 10 10 10 10 10, 000

$"\frac{10}{\,} \cdot \frac{1}{\#}^{2} \quad "\frac{1}{\,}\#^{2} \quad \frac{1}{\,} \cdot \frac{1}{\,} \cdot \frac{1}{\,}$

**62.** $ ! % = $ % = ! =
& 3 100 ' &30' 30 30 900

6

!1" 1 . 1 . 1 1 . 1 1

**53.**$ %= # # # # 3 2 2

&10 ' 10 10 10 10 10 10 1 "21 8 # 1 6

$= \frac{1}{1{,}000{,}000}$

**63.** $\left(\frac{3}{4}\right)^{-3} \cdot \left(\frac{3}{4}\right)^{1} = 2$

$\left(\frac{1}{1}\right)^{1} \cdot \left(\frac{1}{1}\right)^{1}$

$\left(\frac{3}{24}\right)^{6} \cdot \left(\frac{3}{30}\right)^{-1} = \left(\frac{3}{18}\right)^{1}$

**64.** $\left(\frac{5}{1}\right)^{1} \cdot \left(\frac{8}{1}\right)^{1} \cdot \left(\frac{6}{1}\right)^{1}$

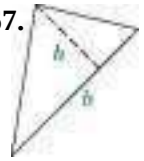
$16 \cdot 1\frac{3}{16} = \frac{2}{16} \cdot \frac{1}{2}$

**65.** $\frac{3}{9} \cdot \frac{2}{3} = \frac{1}{9} \cdot \frac{2}{3} = \frac{2}{27}$

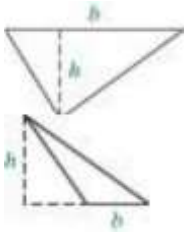
$28 \cdot 3\frac{2}{28} = \frac{7}{28} \cdot \frac{3}{9} = \frac{21}{2}$

**66.** $\frac{3}{6} \cdot \frac{2}{3} = \frac{1}{6} \cdot \frac{4}{2} = \frac{2}{2}$

**67.**

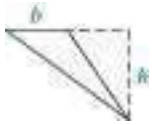


**68.**



**69.**

**70.**



$A = \frac{1}{2}bh = \frac{1}{2}(11)(8) = \frac{1}{2} \cdot \frac{11}{1} \cdot \frac{8}{1} = 44 \text{ cm}^2$

$A = \frac{1}{2}bh = \frac{1}{2}(15)(12) = \frac{1}{2} \cdot \frac{15}{1} \cdot \frac{12}{1}$

90 in.

$A = \frac{1}{2}bh = \frac{1}{2}(8)(8) = \frac{1}{2} \cdot \frac{8}{1} \cdot \frac{8}{1} = 32 \text{ m}^2$

$A = \frac{1}{2}bh = \frac{1}{2}(5)(4) = \frac{1}{2} \cdot \frac{5}{1} \cdot \frac{4}{1} = 4 \text{ yd}^2$

**76.** $A = \frac{1}{2}bh = \frac{1}{2}(3)\left(1\frac{16}{9}\right)$

$= \frac{1}{2} \cdot \frac{3}{1} \cdot \frac{25}{9} = \frac{75}{18} = 4\frac{3}{18} = 4\frac{1}{6} \text{ or } 4\frac{3}{6} \text{ mm}^2$

$A = l \cdot w = 1\frac{3}{4} \cdot \frac{1}{3} = \frac{7}{4} \cdot \frac{1}{3} = \frac{7}{12} \text{ cm}^2$

$A = l \cdot w = \frac{8}{3} \cdot 3\frac{1}{3} = \frac{8}{3} \cdot \frac{10}{3} = \frac{80}{9} = 8\frac{8}{9} \text{ m}^2$

**79.** $A = l \cdot w = \frac{13}{16} \cdot \frac{15}{16} = \frac{195}{256} \text{ in.}^2$

$A = l \cdot w = 23\frac{3}{24} \cdot 4 = \frac{23}{8} \cdot \frac{4}{1} = 32 \text{ ft}^2$

$A = (8)(4) + \frac{1}{2}(8)(4) = 32 + 4 \cdot 4 =$

$32 + 16$ 48 yd

$A = (8)(3) + \frac{1}{2}(8)(3) = 24 + 4 \cdot 3 =$

$24 + 12$ 36 m

**83.** $A = \frac{1}{2}(6) \cdot [7 + (7 + 3)]$

$A = \frac{1}{2}bh = \frac{1}{2}(1)(1) = \frac{1}{2}$ ft$^2$

**84.** $A = \frac{1}{2}(8)(9) + \frac{1}{2}(8)(15) = 4(9) + 4(15)$

$= 36 + 60 = 96$ cm$^2$

$P = 4 + 5 + 3 + 5 = 17$ cm

$A = \frac{1}{2}(4)(3) + 4(5) = 6 + 20 = 26$ cm$^2$

$$= 1\frac{4}{9} \times 4 + 1\frac{4}{15} \times 4 = 9 + 15 = 24 \text{ m}^2$$

**85.** $\frac{1}{8} \cdot 16 = \frac{1}{8} \cdot \frac{2}{1} = 10$

The amount left is 10 gal.

$\frac{3}{11} \cdot 11{,}000 = \frac{3}{11} \cdot \frac{2750}{11{,}000} = 8250$

The cost is $8250.

$\frac{1}{4} + \frac{1}{2} + \frac{1}{8} = \frac{1}{8}$

Jim ate $\frac{1}{8}$ of the pizza for breakfast.

$\frac{1}{4} \cdot \frac{2}{5} = \frac{1}{10}$

$\frac{1}{10}$ of the sample has O negative blood.

$\frac{2}{3} \cdot 9{,}825{,}000 = \frac{2}{3} \cdot$ [redacted]

6,550, 000

There are 6,550,000 viewers.

$3\frac{3}{4} = 1\frac{3}{4} = \frac{9}{4}$ or $2\frac{1}{4}$

Nancy spends $2\frac{1}{4}$ hr or $\frac{9}{4}$ a day.

First place: $\frac{2}{3} \cdot 1200 = \frac{2}{3} \cdot$ [redacted] $= \$800$

300

**92.** $\frac{3}{4} \cdot (40)(36) = \frac{3}{4} \cdot 1440 = 960$

$40 \times 36 = 1440$

$1440 - 960 = 480$

Frankie mowed 960 $yd^2$. He has 480 $yd^2$

**(a)** $\left(\frac{1}{6}\right)^2 = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$

**(b)** $\sqrt{\frac{1}{36}} = \frac{1}{6}$

**94. (a)** $\left(\frac{2}{7}\right)^2 = \frac{2}{7} \cdot \frac{2}{7} = \frac{4}{49}$

$\sqrt{\frac{4}{49}} = \frac{2}{7}$

$\sqrt{\frac{1}{25}} = \frac{1}{5}$

$\sqrt{\frac{11}{100}} = \frac{\sqrt{11}}{10}$

$\sqrt{\frac{64}{81}} = \frac{8}{9}$

**98.** $\sqrt{\frac{9}{4}} = \frac{3}{2}$

**99.** $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$

The next number is $16 \cdot \frac{1}{2} = 32$.

Second place: $\frac{1}{3}$ !1200 = $\frac{1}{3}$ ! $\frac{1200}{3}$ = \$300

**100.** $\frac{2}{3}, \frac{2}{9} = \frac{2}{3!3}, \frac{2}{27} = \frac{2}{9!3}$

$$\frac{4}{1}\cdot\frac{4}{1}\cdot\frac{1}{1}$$

The next number is $\frac{2}{27}\cdot\frac{2}{3}=\frac{2}{81}$.

Third place: $\frac{1}{12}\cdot 1200=\frac{1}{12}\cdot\frac{1200^{100}}{1}=\$100$

**101.** $\left(-\frac{1}{2}\right)\div\left(-\frac{1}{8}\right)=\left(-\frac{1}{2}\right)\cdot\left(-\frac{8}{1}\right)$

$=\frac{8}{2}=4$

$\left(-\frac{1}{2}\right)\div\left(-\frac{1}{8}\right)=\frac{1}{2}\cdot\frac{8}{1}=\frac{8}{2}=4$

They are the same.

**102.** $\frac{2}{3}\div\frac{1}{4}=\frac{2}{3}\cdot\frac{4}{1}=\frac{8}{3}$

$\frac{1}{4}\div\frac{2}{3}=\frac{1}{4}\cdot\frac{3}{2}=\frac{3}{8}$

They are the same.

## Section 2.5 Division of Fractions and Applications

### Section 2.5 Practice Exercises

Page 143 Answers

will vary.

To find the **reciprocal** of a nonzero fraction, interchange the numerator and denominator.

$\frac{9}{22}\div\frac{18}{11}=\frac{9}{22}\cdot\frac{11}{18}=\frac{1}{2}\cdot\frac{1}{2}=\frac{1}{4}$

$\frac{24}{7}\div\frac{8}{7}=\frac{24}{7}\cdot\frac{7}{8}=\frac{3}{1}\cdot\frac{1}{1}=3$

$\frac{34}{5}\div\frac{17}{5}=\frac{2}{\cancel{34}}\cdot\frac{\cancel{5}}{\cancel{5}}=2$

**6.** $\frac{3}{7}\div\left(-\frac{7}{3}\right)=\frac{3}{7}\cdot\left(-\frac{3}{7}\right)=-\frac{9}{49}$

$\left(-\frac{6}{7}\right)\div\frac{1}{2}=-\frac{6}{7}\cdot\frac{2}{1}=-\frac{12}{7}$

**7.** $\left(-\frac{8}{3}\right)\div\left(-\frac{24}{5}\right)=\left(-\frac{8}{3}\right)\cdot\left(-\frac{5}{24}\right)=\frac{5}{9}$

**8.** $\frac{1}{10}\div 10=\frac{1}{10}\cdot\frac{1}{10}=\frac{1}{100}$

**9.** $\frac{10}{10}\div 10=\frac{10}{10}\cdot\frac{1}{10}=\frac{10}{100}=\frac{1}{10}$

**10.** $\frac{10}{10}\div 10=\frac{10}{10}\cdot\frac{1}{10}=\frac{10}{100}=\frac{1}{10}$

**11.** $\frac{1}{3}\div 3=\frac{1}{3}\cdot\frac{1}{3}=\frac{1}{9}$

$3\div\frac{1}{3}=3\cdot\frac{3}{1}=9$

**12.** **(a)** Yes, $\frac{2}{1}=2$

**(b)** Yes, $\frac{3}{5}$

**(c)** Yes, $\frac{1}{6}$

**(d)** No, $\frac{1}{0}$ is undefined.

**13.** $\frac{8}{7}$

**14.** $-\frac{6}{5}$

**15.** $\frac{9}{10}$

$\frac{5}{14}$

!2$!7 $ 14

**17.** $\frac{1}{4}$

**8.** − − = — = 1

7 2 14

**9.** $\left(-\frac{9}{5}\right)\left(-\frac{5}{9}\right) = \frac{45}{45} = 1$

**18.** $\frac{1}{9}$

**19.** No reciprocal exists.

No reciprocal exists.

multiplying

multiplying

**37.**

**40.**

99 ~~921~~ 1
÷ = = −
102 109 5

2 2
2 1
30 15 30 8 2

5 1

3 3 3 4

4 12 4 4 3

12 1 6665 30

5 5 5 6 30 1

40 8 40 15 5

5 1

10

9 13 9 90

100 1000 100 13 13

1

**46.** $\frac{1000}{17} \div \frac{10}{3} = \frac{1000}{17} \cdot \frac{3}{10} = \frac{300}{17}$

$36\frac{9}{5} \div 25 = \frac{36}{5} \cdot \frac{25}{9} = 20$

$13\frac{17}{5} \div 10\frac{13}{5} = \frac{13}{5} \cdot \frac{10}{17} = \frac{26}{17}$

**49.** $\frac{7}{8} \div \frac{1}{4} = \frac{7}{8} \cdot \frac{4}{1} = \frac{7}{2}$

$\frac{7}{5} \div \frac{7}{3} \div \frac{7}{1}$

**50.** $12 \div 3 = 12 \cdot 5 = 20$

$5\frac{2}{8} \cdot 9 = 36$

$1\frac{4}{16} \cdot 3 = \frac{1}{12}$

**53.** $\frac{4}{6!} \cdot 3 = \frac{6}{1} \cdot 3 = 8$

$\frac{5}{12!} \cdot \frac{12}{8} = \frac{5}{1} \cdot \frac{6}{1} = 10$

**56.** $\frac{6}{11} \div 7 = \frac{42}{11} \cdot \frac{1}{7} = \frac{6}{11}$

$\frac{8}{16} \div \frac{2}{3} = \frac{16}{3} \cdot \frac{5}{2} = \frac{40}{3}$

**57.** $\frac{3}{5} \div \frac{3}{2} = \frac{3}{5} \cdot \frac{2}{3} = \frac{2}{5}$

$\frac{17}{8} \div \frac{1}{4} \div \frac{17}{2} = \frac{17}{8} \cdot \frac{4}{1} \cdot \frac{2}{17} = 2$

$\frac{1}{8} \div 16 = \frac{1}{8} \cdot \frac{1}{16} = \frac{1}{128}$

$2\frac{2}{3} \div 9 = \frac{8}{3} \cdot \frac{1}{9} = \frac{8}{27}$

**61.** $\frac{22}{7} \div \frac{5}{16} = \frac{22}{7} \cdot \frac{16}{5} = \frac{352}{35}$

$\frac{40}{21} \cdot \frac{18}{25} \cdot \frac{5}{8} \cdot \frac{3}{6} = \frac{40}{21} \cdot \frac{18}{25} \cdot \frac{5}{8} \cdot \frac{3}{6} = \frac{3}{35}$

**62.** $\frac{16}{3} \div 8 \cdot \frac{3}{16} = \frac{16}{3} \cdot \frac{1}{8} \cdot \frac{3}{16} = \frac{1}{2}$

**63.** $8 \div \frac{15}{4} \cdot \frac{4}{15} = \frac{8}{1} \cdot \frac{4}{15} \cdot \frac{4}{15} = \frac{128}{225}$

**64.** $5 \div \frac{5}{4} \cdot \frac{4}{15} = \frac{5}{1} \cdot \frac{4}{5} \cdot \frac{4}{15} = \frac{16}{15}$

**65.** $3\frac{2}{3} \cdot 6\frac{2}{3}$ multiplies $3\frac{2}{3}$ by

**55.** $\frac{16}{5585} \quad \frac{16}{5} \cdot \frac{1}{2} =$

$\frac{6}{1}$, and $\frac{2}{3} \div 6$ multiplies $\frac{2}{3}$ by $\frac{1}{6}$. So $\frac{2}{3} \cdot 6 = \frac{2}{3} \cdot \frac{6}{1} = 4$

3 3 6 9

1

and ÷6= ⁄! = .

**66.** $8\frac{2}{3}$ multiplies 8 by $3$, and $8 \div \frac{2}{3}$ multiplies 8 by $\frac{3}{2}$. So $8\frac{2}{3} = \frac{8}{1} \cdot \frac{3}{2} = \frac{24}{2} = 12$ and $8 \div \frac{2}{3} = 8 \cdot \frac{3}{2} = \frac{24}{2} = 12$.

**67.** $\frac{54}{27} \div \frac{54}{3} \cdot \frac{27}{9} = \frac{54}{27} \cdot \frac{3}{54} \cdot \frac{27}{9} = \frac{3}{9} = \frac{1}{3}$

**68.** $\frac{48}{56} \div \frac{3}{8} \div 8 = \frac{48}{56} \cdot \frac{8}{3} \div 8 = \frac{16}{7} \div 8$

$= \frac{16}{7} \cdot \frac{1}{8} = \frac{2}{7}$

**69.** $5\frac{3}{7} \div 7\frac{3}{5} = 5\frac{6}{7} \cdot \frac{5}{38} = \frac{41}{7} \cdot \frac{5}{38} = \frac{205}{266}$

**72.** $7 \div \frac{1}{2} \div \frac{1}{4} = 7 \cdot 2 \div \frac{1}{4} = 14 \div \frac{1}{4} = 14 \cdot 4 = 56$

**73.** $2\frac{1}{2} \div 8\frac{1}{5} = \frac{5}{2} \div \frac{41}{5} = \frac{5}{2} \cdot \frac{5}{41} = \frac{25}{82}$

**74.** $5\frac{1}{2} \div 2\frac{1}{2} = \frac{11}{2} \div \frac{5}{2} = \frac{11}{2} \cdot \frac{2}{5} = \frac{11}{5}$

$= 2\frac{1}{5}$

**75.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} = 2 \div \frac{1}{8} \div \frac{1}{16} = 2 \cdot 8 \div \frac{1}{16} = 16 \div \frac{1}{16} = 16 \cdot 16 = 256$

**76.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} = 2 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} = 2 \cdot 8 \div \frac{1}{16} \div \frac{1}{32} = 16 \div \frac{1}{16} \div \frac{1}{32} = 16 \cdot 16 \div \frac{1}{32} = 256 \div \frac{1}{32} = 256 \cdot 32 = 8192$

**77.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} = 2 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} = 2 \cdot 8 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} = 16 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} = 16 \cdot 16 \div \frac{1}{32} \div \frac{1}{64} = 256 \div \frac{1}{32} \div \frac{1}{64} = 256 \cdot 32 \div \frac{1}{64} = 8192 \div \frac{1}{64} = 8192 \cdot 64 = 524{,}288$

**78.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 2 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 2 \cdot 8 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 16 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 16 \cdot 16 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 256 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} = 256 \cdot 32 \div \frac{1}{64} \div \frac{1}{128} = 8192 \div \frac{1}{64} \div \frac{1}{128} = 8192 \cdot 64 \div \frac{1}{128} = 524{,}288 \div \frac{1}{128} = 524{,}288 \cdot 128 = 67{,}108{,}864$

**79.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 2 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 2 \cdot 8 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 16 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 16 \cdot 16 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 256 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 256 \cdot 32 \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 8192 \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} = 8192 \cdot 64 \div \frac{1}{128} \div \frac{1}{256} = 524{,}288 \div \frac{1}{128} \div \frac{1}{256} = 524{,}288 \cdot 128 \div \frac{1}{256} = 67{,}108{,}864 \div \frac{1}{256} = 67{,}108{,}864 \cdot 256 = 17{,}179{,}869{,}184$

**80.** $\frac{1}{2} \div \frac{1}{4} \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = \frac{1}{2} \cdot 4 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 2 \div \frac{1}{8} \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 2 \cdot 8 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 16 \div \frac{1}{16} \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 16 \cdot 16 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 256 \div \frac{1}{32} \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 256 \cdot 32 \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 8192 \div \frac{1}{64} \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 8192 \cdot 64 \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 524{,}288 \div \frac{1}{128} \div \frac{1}{256} \div \frac{1}{512} = 524{,}288 \cdot 128 \div \frac{1}{256} \div \frac{1}{512} = 67{,}108{,}864 \div \frac{1}{256} \div \frac{1}{512} = 67{,}108{,}864 \cdot 256 \div \frac{1}{512} = 17{,}179{,}869{,}184 \div \frac{1}{512} = 17{,}179{,}869{,}184 \cdot 512 = 8{,}796{,}093{,}022{,}208$

**70.** ÷ ! = ! ! = ! = !25 50 $ 25 9 $ ! 3 $ 2

'8=# &'8=

5

1 7 2 3 9 " 30 2

1 2 %

2

! 3$ 2 9339 9 9

2

**71.** 8 14 88 14 64 14 $= \frac{3}{2} \cdot \frac{3}{21} \cdot \frac{8}{} = \frac{9}{4} \cdot \frac{8}{1} = 18$

$$= \frac{9}{64} \cdot \frac{14}{9} = \frac{2}{32} \cdot \frac{9}{9} = \frac{32}{32} = 1$$

**83.** $2 \div 16 = \frac{2}{1}$

She can sell 80 parcels of land.

**81.** $36 \div 3 = 12 \times 2 = 54$

Li wrapped 54 packages.

$$\frac{3}{-}\ \frac{1}{-}\ \frac{3}{-}\ \frac{16}{-}^{8}$$

1

$$2\ !\ \frac{24,000}{1}^{8000} = 16,000$$

**85.** $16 \div \frac{3}{4} = \frac{\overset{4}{\cancel{16}}}{1} \cdot \frac{3}{\cancel{4}_{1}} = 12$

The stack will be 12 in. high.

$24 \div \frac{5}{4} = \frac{\overset{6}{\cancel{24}}}{1} \cdot \frac{5}{\cancel{4}_{1}} = 30$

Yes, the books will take up only 30 in.

**87. (a)** $18 \div \frac{2}{3} = \frac{\overset{9}{\cancel{18}}}{1} \cdot \frac{3}{\cancel{2}_{1}} = 27$

27 commercials in 1 hr

27×24=648

648 commercials in 1 day

**(a)** $20 \div 2 = 1 \cdot 1 = 40$

40 commercials in 1 hr

40×24=960

960 commercials in 1 day

**89. (a)** $10 \cdot 240,000 = 10 \cdot \frac{240,000}{1}$

$= \frac{240,000}{10}$

$= 24,000$

The down payment is \$24,000.

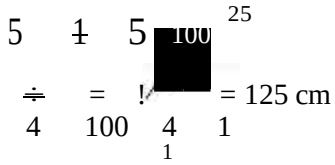
$\frac{2}{3} \cdot 24,000 =$

Ricardo's mother will pay \$16,000.

\$24,000 − \$16,000 = \$8000
Ricardo will have to pay \$8000.

= 24 cups of juice

**(c)** 0,000 − $24,000 = $216,000 He will have to finance $216,000.



**90. (a)** $\frac{1}{12}\cdot 18{,}000 = \frac{1}{12}\cdot\frac{18{,}000}{1}$

$$= \frac{18{,}000}{12}$$
$$= 1500$$

The down payment is \$1500.

$$\frac{1}{2}\cdot 1500 = \frac{1}{2}\cdot\frac{750}{1}\cdot\frac{1500}{1} = 750$$

Althea's parents will pay \$750.

\$1500 − \$750 = \$750
Althea will have to pay \$750.

**(c)** \$18,000 − \$1500 = \$16,500

She will have to finance \$16,500.

**(a)** $3\cdot\frac{9}{4} = \frac{3}{4}$

She plans to sell $\frac{3}{4}$ acre.

She keeps $\frac{2}{3}$ of the land.

$\frac{2}{3}\cdot\frac{9}{4} = \frac{3}{2}$ or $1\frac{2}{2}$ acres

**92. (a)** $\frac{1}{6}\cdot(24+18) = \frac{1}{6}\cdot(42) = \frac{1}{6}\cdot\frac{42}{1} = 7$

Josh has read 7 pages.

(24+18)−7=42−7=35 He still must read 35 pages.

**93.** $7 \div \frac{1}{4} = \frac{7}{1}\cdot\frac{4}{1} = 14$

She can prepare 14 samples.

**94.** $8 \div 16 = 8\cdot\frac{1}{16} = 14$

Tony must make 14 strikes.

The length is 12 ft, because

$$30 \div \frac{5}{2} = \frac{30}{1}\cdot\frac{2}{5} = \frac{6\cdot 2}{1\cdot 1} = 12$$

The width is $\frac{4}{7}$ m, because

$$8 \div 14 = 1\cdot\frac{1}{14} = \frac{1\cdot 2}{1\cdot 7} = \frac{2}{7}$$

## Problem Recognition Exercises: Multiplication and Division of Fractions

**1. (a)** $\frac{8}{3}\cdot 6 = \frac{8}{3}\cdot\frac{3}{2}\cdot\frac{2}{1} = \frac{16}{1}$

**(b)** $\frac{6}{5}\cdot 8 = \frac{3}{5}\cdot\frac{2}{1}\cdot\frac{8}{1} = \frac{16}{5}$

**(c)** $\frac{3}{5}\cdot\frac{5}{3}\cdot\frac{6}{3}\cdot\frac{5}{2} = \frac{3\cdot 5\cdot 6\cdot 5}{5\cdot 3\cdot 3\cdot 2} = \frac{5\cdot 2}{1\cdot 1} = 10$

**(d)**

**2. (a)** $10\cdot\frac{12}{7}\cdot\frac{10}{3} = \frac{10}{1}\cdot\frac{3}{7}\cdot\frac{4}{3} = \frac{40}{7}$

**(b)** $\frac{12}{7}\cdot\frac{10}{3} = \frac{3\cdot 4}{7}\cdot\frac{10}{3} = \frac{40}{7}$

**(c)** $\frac{10}{7}\cdot\frac{12}{3} = \frac{10}{7}\cdot\frac{7}{3}\cdot\frac{5}{3}\cdot\frac{7}{2} = \frac{35}{18}$

$\frac{6}{=6!3!}\div\frac{8}{2!3!}=9$

**(d)**

$$\frac{12}{10}=\frac{12!}{2!6!}=18$$

$$\frac{5}{3}\times\frac{8}{5}=\frac{20}{7}\times\frac{10}{7}=\frac{35}{2!4}$$

**3. (a)** $12 \cdot \frac{9}{8} = 12 \cdot \frac{9}{1} \cdot \frac{3 \cdot 4}{8} \cdot \frac{9}{2 \cdot 4} = \frac{27}{2}$

**(b)** $\frac{9}{8} \cdot 12 = \frac{9}{8} \cdot \frac{12}{1} = \frac{9}{1} \cdot \frac{3 \cdot 4}{2 \cdot 4} = \frac{27}{2}$

**(c)** $12 \div \frac{9}{8} = 12 \cdot \frac{8}{9} = \frac{3 \cdot 4}{1} \cdot \frac{8}{3 \cdot 3} = \frac{32}{3}$

**(d)** $\frac{9}{8} \div 12 = \frac{9}{8} \cdot \frac{1}{12} = \frac{3 \cdot 3}{8 \cdot 12} \cdot \frac{1}{3 \cdot 4} = \frac{3}{32}$

**(a)** $15 \cdot \frac{3}{5} = \frac{15}{1} \cdot \frac{3}{5} = \frac{3 \cdot 5}{1} \cdot \frac{3}{5} = \frac{9}{1} = 9$

**(b)** $\frac{3}{5} \cdot 15 = \frac{3}{5} \cdot \frac{15}{1} = \frac{3 \cdot 5}{1} \cdot \frac{3}{5} = \frac{9}{1} = 9$

**(c)** $15 \div \frac{3}{5} = \frac{15}{1} \cdot \frac{5}{3} = \frac{3 \cdot 5}{1} \cdot \frac{5}{3} = \frac{25}{1} = 25$

**(d)** $\frac{3}{5} \div 15 = \frac{3}{5} \cdot \frac{1}{15} = \frac{3}{5} \cdot \frac{1}{3 \cdot 5} = \frac{1}{25}$

**5. (a)** $\frac{6}{5} \cdot \frac{6}{1} \cdot \frac{36}{6} = 1$

$\frac{5}{6} \cdot \frac{6}{5} \cdot \frac{1}{1} = 1$

$\frac{5}{6} \cdot \frac{5}{1} \cdot \frac{6}{1} = \frac{5}{1} \cdot \frac{6}{6} \cdot \frac{1}{1} = 1$

$\frac{5}{6} \div \frac{6}{5} = \frac{5}{6} \cdot \frac{5}{6} = \frac{25}{36}$

**7. (a)** $\frac{1}{12} \cdot \frac{2}{3} \cdot \frac{16}{21} = \frac{1 \cdot 2 \cdot 4 \cdot 4}{3 \cdot 4 \cdot 3 \cdot 21} = \frac{8}{189}$

$\frac{1}{12} \cdot \frac{2}{3} \cdot \frac{16}{21} = \frac{1}{3} \cdot \frac{2}{21} \cdot \frac{16}{1} = \frac{2}{21} \cdot \frac{16}{1} = \frac{32}{21}$

**(b)** $12 \cdot \frac{3}{4} \div 21 = 12 \cdot \frac{3}{4} \cdot \frac{16}{21} = \frac{12 \cdot 3 \cdot 16}{4 \cdot 21} = \frac{3 \cdot 4 \cdot 16}{4 \cdot 21} = \frac{16}{7}$

$= 12 \cdot \frac{3}{4} \cdot \frac{2}{21} = \frac{12 \cdot 3 \cdot 2}{4 \cdot 21} = \frac{72}{84} = \frac{6}{7}$

**(c)** $\frac{1}{12} \div 2 \cdot \frac{16}{3} \cdot \frac{4}{21} = \frac{1}{12} \cdot \frac{3}{2} \cdot \frac{16}{3} \cdot \frac{4}{21} = \frac{1 \cdot 3 \cdot 4 \cdot 2 \cdot 2}{3 \cdot 4 \cdot 2 \cdot 21} = \frac{2}{21}$

$1 \div 2 \div 16 = 1 \cdot \frac{3}{21} = \frac{1 \cdot 3}{12 \cdot 21} = \frac{3}{252} = \frac{1}{84}$

$= 1 \cdot \frac{3}{16} \cdot \frac{21}{2} = \frac{3 \cdot 21}{16 \cdot 2} = \frac{63}{32}$

$\frac{3}{4} \cdot \frac{2}{1} \cdot \frac{16}{21} = \frac{128}{84} = \frac{32}{21}$

$\frac{1}{7} \cdot \frac{2}{7} = \frac{2}{49}$

$\frac{1}{7} \cdot \frac{7}{2} = \frac{7}{14} = \frac{1}{2}$

$\frac{1}{7} \cdot \frac{7}{1} = \frac{7}{7} = 1$

$\frac{1}{9} \cdot \frac{9}{1} = \frac{9}{9} = 1$

**8. (a)** $\frac{2}{3} \cdot \frac{27}{1} = \frac{54}{3} = 18$

$\frac{17}{29} \cdot \frac{2}{3} = \frac{34}{87}$

$\frac{17}{29} \cdot \frac{3}{2} = \frac{51}{58}$

$\frac{17}{29} \cdot \frac{3}{1} = \frac{51}{29}$

$\frac{17}{29} \div \frac{7}{3} = \frac{17}{29} \cdot \frac{3}{7} = \frac{51}{203}$

$\frac{1}{2} \div \frac{7}{9} = \frac{1}{2} \cdot \frac{9}{7} = \frac{9}{14}$

$\frac{1}{2} \cdot \frac{3}{2} = \frac{3}{4}$

$\frac{1}{2} \cdot \frac{3}{7} = \frac{3}{14}$

$\frac{1}{2} \cdot \frac{7}{3} = \frac{7}{6}$

$\frac{17}{29} \cdot \frac{3}{27} \cdot \frac{2}{7} = \frac{102}{5481}$

$\frac{17}{29} \div \frac{3}{27} \div \frac{2}{7} = \frac{17}{29} \cdot \frac{27}{3} \cdot \frac{7}{2} = \frac{3213}{174}$

$\frac{1}{9} \cdot \frac{6}{1} = \frac{6}{9} = \frac{2}{3}$

**9. (a)** $10 \cdot \frac{6}{1} \cdot \frac{4}{10} = \frac{10 \cdot 1 \cdot 4}{1 \cdot 10}$

$= 9 \cdot \frac{2}{1} \cdot \frac{3}{1} \cdot \frac{1}{2 \cdot 2} = \frac{54}{20} = 27$

6 5 6 6 36

$\frac{9}{\cdot}$

**6. (a)** 8 !0=0

$$0!\frac{9}{8}=0$$

$$10!6\div\frac{1}{4}=\frac{964}{10}!\frac{}{1}!\frac{}{1}$$

$$=9!2!3!\frac{4}{}=\underline{108}$$

2 ! 5 1 1 5

**(c)** $\frac{9}{}\div 0$ = Undefined

**(c)**

$$0 \div \frac{8}{89} = 0 ! \frac{9}{8} = 0$$

$$\frac{9}{10} \div 6 \div \frac{9}{4} \frac{1}{10} ! \frac{1}{6} ! 1$$

$$= \frac{3 ! 3}{3 ! 3} ! \frac{1}{10} \frac{1}{2 ! 3 \; 4 \; 80} ! \frac{1}{1} = \frac{3}{1}$$

$$= \frac{3 ! 3}{2 ! 5 \; 2 ! 3} ! \frac{1}{1} ! \frac{2 ! 2}{1} = \frac{3}{15}$$

**10. (a)** $4 \cdot \frac{1}{5} \cdot 10 = \frac{4}{5} \cdot \frac{1}{2} \cdot \frac{10}{1} = 2$

$\frac{4}{5} \cdot 20 \qquad \frac{4}{5} \cdot \frac{2 \cdot 10}{1} \qquad 5$

$4 \cdot \frac{1}{5} \div 10 = \frac{4}{5} \cdot \frac{1}{10} = \frac{4}{50} = \frac{2}{25}$

$5 \cdot 20 \qquad 5 \cdot 4 \cdot 5 \qquad 250$

$\frac{4}{5} \cdot \frac{1}{20} \div 10 = \frac{4}{5} \cdot \frac{20}{1} \cdot \frac{2 \cdot 5}{160} = \frac{1}{160}$

$5 \cdot 20 \qquad 5 \cdot 1 \cdot 1 \qquad 1$

$= 160$

**(d)** $\frac{4}{5} \cdot \frac{1}{20} \div 10 = \frac{4}{5} \cdot \frac{20}{1} \cdot \frac{1}{10}$

$5 \cdot 20 \qquad 5 \cdot 1 \cdot 10$

$= \frac{2 \cdot 2}{5} \cdot \frac{4 \cdot 5}{1} \cdot \frac{1}{2 \cdot 5} = \frac{8}{5}$

$\frac{2}{5} \qquad \frac{2}{5}$

**11. (a)** $3 \cdot 1 = 3$

$2 \qquad 2$

$1 \cdot 3 = 3$

$\div 1 = \frac{2}{3} \cdot \frac{2}{3}$

$1 \div = 1 \cdot \frac{3}{2} = \frac{3}{2}$

$3 \qquad 2 \qquad 2$

**12. (a)** $6 \div 10 = \frac{6}{1} \cdot \frac{1}{10} = \frac{2 \cdot 3}{1} \cdot \frac{1}{2 \cdot 5} = \frac{3}{5}$

$\frac{10}{1} \cdot \frac{1}{6} = \frac{2 \cdot 5}{1} \cdot \frac{1}{2 \cdot 3} = \frac{5}{3}$

**(b)** $10 \div 6 = 1 \cdot 6 = 1 \cdot 2 \cdot 3 = 3$

**(c)** $6 \cdot 10 = 60$

**14. (a)** $\frac{1}{7} \div 2 = \frac{1}{7} \cdot \frac{1}{2} = \frac{1}{14}$

$1 \qquad 1 \; 2 \; 2$

$\cdot 2 = \cdot = \frac{}{}$

$1 \qquad 7$

$\frac{}{} \cdot \frac{}{} = \frac{}{}$

$1$

$7 \cdot \frac{}{} = \frac{}{}$

$7 \qquad 2 \qquad 14$

$\frac{}{} \cdot \frac{}{} = \frac{}{}$

$1 \; 2 \; 2$

$7 \div 2 = 7 \cdot 1 = 7$

**(a)** $4 \cdot \frac{1}{2} = 4 \cdot 4 \cdot \frac{1}{2} = 16 \cdot \frac{1}{2} = \frac{2 \cdot 8}{2 \cdot 3} = \frac{8}{3}$

$6 \qquad 6 \qquad 6 \qquad 1 \qquad 2 \cdot 3$

$2 \cdot \frac{1}{6} \qquad \frac{1}{6} \qquad 6$

$4 \div = 4 \cdot 4 \div = 16 \cdot = 16 \cdot 6 = 96$

$6 \qquad 6 \qquad 1$

**(c)** $4 \cdot \left(\frac{1}{6}\right)^2 = \frac{4}{1} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{4}{36} = \frac{4}{4 \cdot 9} = \frac{1}{9}$

**(d)** $4 \div \left(\frac{1}{6}\right)^2 = \frac{4}{1} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{4}{1} \div \frac{1}{36}$

$= 4 \cdot 36$

$= 144$

$\left(1 \cdot \frac{2}{3}\right)^2 = \frac{2}{3} \cdot \frac{1}{3} \cdot \frac{2}{3} = \frac{4}{9}$

**16. (a)** $\left(\sqrt{3}\right)^2 = \sqrt{3} \cdot \sqrt{3} = 6$

**(d)** 10!6 = 60

**13. (a)** $8 \div \frac{1}{4} = 8 ! 4 = 32$

**(b)** $8 ! = = 2 \frac{}{4} \quad 4$

**(b)** $! \frac{1}{2} \$ \div \frac{2}{3} = \frac{1}{2} , \frac{1}{2} \frac{3}{2} = \frac{3}{8}$

$\frac{1}{2} ! \frac{"}{2} \% = 1 ! \frac{2}{3} ! = \frac{2}{9}$

$\frac{1}{2} ! 2 \$ \frac{1}{2} ! 2 \frac{2}{} \$ 1 \frac{}{4}$

**(d)** $2 \div 3 = 2 \div 3\% = 2 \div \frac{3}{100} = 2 \div \frac{1}{33}$

**(c)** $8 \div 4 = 2$

**(d)** $8 ! 4 = 32$

$= \frac{1}{2}, \frac{9}{4} = \frac{9}{8}$

# Section 2.6 Multiplication and Division of Mixed Numbers

## Section 2.6 Practice Exercises

Chapter Review Exercises, pages 157−160
Chapter Test, pages 160−161 Cumulative Review Exercises,
pages 161−162
Answers will vary.

1

$$5\frac{2}{7} = \frac{5}{1}$$

2

**3.** $13\frac{1}{10} = \frac{26}{2}$

1

$$20 \div 3\frac{9}{10} = \frac{3}{1}$$

$$\frac{42}{11} = \frac{7}{2} = \frac{42}{11} = \frac{2}{7} = \frac{12}{11}$$

$$32 \div 4 = \frac{32}{15} = \frac{1}{15} = \frac{8}{4} = \frac{2}{15}$$

$$52 \div 13 = \frac{52}{18} = \frac{1}{18} = \frac{4}{13} = \frac{2}{9}$$

1. Multiply the whole number by the denominator.
2. Add the result to the numerator.
3. Write the result from step 2 over the denominator.

$$1\frac{4}{7} = \frac{1!7+4}{7} = \frac{11}{7}$$

**12.** $4\frac{1}{8} = \frac{4!8+1}{8} = \frac{33}{8}$

**13.** $6\overline{)77}$ $12\frac{5}{6}$

!6
17
!12
5

**14.** $11\overline{)57}$ $5\frac{2}{11}$

!55
2

**15.** $4\overline{)39}$ $9\frac{3}{4}$

!36
3

**16.** $2\overline{)31}$ $15\frac{1}{2}$

!2
11
!10
1

**17.** $\#\frac{2}{\%}\ \$\#\frac{3}{5\&\%}\ \&\$ = \frac{5}{12} = \frac{37}{12} = 5\frac{37}{12}$

1

$$\frac{7}{1} \quad 2$$

3

$$5\ \ 37 \quad =7\ \overline{5}$$
$$\frac{!35}{2}$$

5

3!5

2= 5 5

2 =17 _____ —

$2^{7} = 2!10+7 = 27$

101010

**18.** $\frac{5}{6} \div \frac{3}{4} = \frac{\cancel{26}^{13}}{5} \times \frac{4}{\cancel{15}_{3}} = \frac{52}{15} = 3\frac{7}{15}$

$2\overline{)39}\ = 19\frac{1}{2}$

$\begin{array}{r} 19 \\ -18 \\ \hline 1 \end{array}$

**19.** $1\frac{5}{7} \div 3\frac{1}{7} = \frac{12}{7} \div \frac{22}{7} = \frac{\cancel{12}^{1}}{7} \times \frac{7}{\cancel{22}_{11}} = \frac{6}{11}$

$3\overline{)5}\ = 1\frac{2}{3}$

$\begin{array}{r} 3 \\ -3 \\ \hline 2 \end{array}$

$6\frac{1}{8} \div 7 = \frac{49}{8} \times \frac{1}{7} = \frac{\cancel{49}^{7}}{8} \times \frac{1}{\cancel{7}_{1}} = \frac{7}{8}$

$2\overline{)7}\ = 3\frac{1}{2}$

$\begin{array}{r} 6 \\ -1 \\ \hline \end{array}$

$\begin{array}{r} 2 \\ \hline \end{array}$

$9 \div 9\frac{1}{2} = 9 \div \frac{19}{2} = \frac{\cancel{9}^{1}}{1} \times \frac{2}{\cancel{19}_{1}} = \frac{18}{19}$

$10 \div 6\frac{2}{3} = \frac{\cancel{10}^{5}}{1} \times \frac{3}{\cancel{20}_{2}} = \frac{15}{2} = 7\frac{1}{2}$

$3 \div 6\frac{1}{3} = 3 \div \frac{19}{3} = \frac{\cancel{3}^{1}}{1} \times \frac{3}{19} = \frac{9}{19}$

**23.** $5\frac{5}{16} \div 8\frac{3}{16} = \frac{85}{16} \div \frac{131}{16} = \frac{\cancel{85}^{5}}{16} \times \frac{16}{\cancel{131}_{1}} = \frac{80}{131}$

$8\frac{2}{3} \div 1\frac{5}{9} = \frac{26}{3} \div \frac{14}{9} = \frac{\cancel{26}^{13}}{3} \times \frac{\cancel{9}^{3}}{\cancel{14}_{7}} = \frac{39}{7} = 5\frac{4}{7}$

$7\frac{1}{4} \div 10 = \frac{29}{4} \times \frac{1}{\cancel{10}_{2}} = \frac{145}{72} = 2\frac{1}{72}$

$\begin{array}{r} 72 \\ -144 \\ \hline 1 \end{array}$

$\begin{array}{r} 2 \\ \hline \end{array}$

$4 \div 8\frac{1}{2} = 0$

$\begin{array}{r} 1 \\ -0 \\ \hline \end{array}$

$\begin{array}{r} 2 \\ \hline \end{array}$

**28.** $0.6 \div 10 = 0$

$3\frac{1}{2} \div 2\frac{1}{7} = \frac{7}{2} \div \frac{15}{7} = \frac{7}{2} \times \frac{7}{15} = \frac{49}{30}$

**30.** $1\frac{3}{4} \div 1\frac{5}{8} = \frac{7}{4} \div \frac{13}{8} = \frac{\cancel{7}^{1}}{\cancel{4}_{1}} \times \frac{\cancel{8}^{2}}{13} = \frac{14}{13} = 1\frac{1}{13}$

$10 \div 4\frac{1}{2} = \frac{\cancel{10}^{5}}{1} \times \frac{2}{\cancel{9}_{1}} = \frac{20}{9} = 2\frac{2}{9}$

$2\frac{4}{27} \div 2\frac{1}{9} = \frac{58}{27} \times \frac{\cancel{9}^{1}}{19} = \frac{54}{16} = 3\frac{3}{16}$

**31.** 5 $ ! $ ! $

1
=

# &# &# & ' = = 2
" 5%"9%" 5%
59525 25

1

3) 83 =27 $^{2}$

3

!6

23

2

**32.** ! 1 $ ! 3 $ ! 8 $ 49118 77 = = 19

6 2 & = ' ' = =

8 4 7 % 8 4 7 4 4

1 1

**33.** $1\frac{7}{10} \div 2\frac{3}{4} = \frac{17}{10} \div \frac{11}{4} = \frac{17}{10} \cdot \frac{4}{11} = \frac{34}{55}$

**35.** $5\frac{1}{9} \div 1\frac{3}{4} = \frac{46}{9} \div \frac{7}{4} = \frac{46}{9} \cdot \frac{4}{7} = \frac{184}{63} = 2\frac{58}{63}$

**36.** $12\frac{5}{13} \div 2\frac{1}{2} = \frac{161}{13} \div \frac{5}{2} = \frac{161}{13} \cdot \frac{2}{5} = \frac{322}{65} = 4\frac{62}{65}$

**37.** $2\frac{1}{16} \div 1\frac{1}{2} = \frac{33}{16} \div \frac{3}{2} = \frac{33}{16} \cdot \frac{2}{3} = \frac{66}{48} = 1\frac{18}{48} = 1\frac{3}{8}$

**38.** $7\frac{5}{12} \div 1\frac{5}{12} = \frac{89}{12} \div \frac{17}{12} = \frac{89}{12} \cdot \frac{12}{17} = \frac{89}{17} = 5\frac{4}{17}$

**39.** $4\frac{1}{2} \div 2\frac{1}{4} = \frac{9}{2} \div \frac{9}{4} = \frac{9}{2} \cdot \frac{4}{9} = 2$

**40.** $5\frac{1}{6} \div 2\frac{1}{2} = \frac{31}{6} \div \frac{5}{2} = \frac{31}{6} \cdot \frac{2}{5} = \frac{62}{30} = 2\frac{2}{30} = 2\frac{1}{15}$

**44.** $6\frac{1}{2} \div 2\frac{1}{2} = \frac{13}{2} \div \frac{5}{2} = \frac{13}{2} \cdot \frac{2}{5} = \frac{26}{10} = 2\frac{6}{10} = 2\frac{3}{5}$

**46.** $27\frac{1}{3} \div 5\frac{1}{7} = \frac{82}{3} \div \frac{36}{7} = \frac{82}{3} \cdot \frac{7}{36} = \frac{574}{108} = 5\frac{34}{108} = 5\frac{17}{54}$

$3\frac{1}{2} \div 1\frac{1}{2} = \frac{7}{2} \div \frac{3}{2} = \frac{7}{2} \cdot \frac{2}{3} = \frac{14}{6} = 2\frac{2}{6} = 2\frac{1}{3}$

$4\frac{2}{3} \div 3\frac{1}{3} = \frac{14}{3} \div \frac{10}{3} = \frac{14}{3} \cdot \frac{3}{10} = \frac{42}{30} = 1\frac{12}{30} = 1\frac{2}{5}$

$44\frac{3}{8} \div 8 = \frac{355}{8} \cdot \frac{1}{8} = \frac{355}{64} = 5\frac{35}{64}$

Tabitha earned $38.

$7\frac{2}{3} \quad 3500 \quad 10{,}500$

2 !10,500 = ! =
28,000
3 3 1

1

The land will cost Kurt
$28,000.

5

**51.** 25 !25 = ! = =
642
10 10 1 2 2

2

1
Average Americans consume 642 2
lb.

5
21

**42.** $0 \div 1\frac{1}{11} = 0$

**43.** $26 \div 6 = 6 \div 6 = 6 ! 1 = 17\frac{1}{6}$

$5 \quad 1 \quad 17 \quad 1 \quad 17 \quad 1$

**52.** $6 3 ! 15 4 = 3 ! 4 = 1 = 105$

$2 \quad 3 \quad 20 \quad 63 \quad \underline{105}$

$1 \quad 1$

Kayla is paid $105.

**(a)** $4 \div 4 = 4 \cdot \frac{1}{4} = 1$ = 7 weeks old

$$2\frac{1}{8} \div 4 = \frac{17}{8} \cdot \frac{1}{4} = \frac{17}{32} = 8\frac{1}{2} \text{ weeks old}$$

$$1\frac{4}{7} \div 3 = \frac{11}{7} \div \frac{3}{1} = \frac{11}{7} \cdot \frac{1}{3} = \frac{11}{21}$$

Each child will inherit $\frac{11}{21}$ million.

$$28\frac{17}{24} \div 41 = \frac{689}{24} \div \frac{41}{1} = \frac{689}{24} \cdot \frac{1}{41} = \frac{16}{24}$$

$$= 16\frac{16}{24}$$

The roll is $16\frac{16}{24}$ ft long.

**(a)** Lucy: $35\frac{1}{2} \cdot 14 = \frac{71}{2} \cdot \frac{14}{1} = 497$

Ricky: $42\frac{1}{2} \cdot 10 = \frac{85}{2} \cdot \frac{10}{1} = 425$

$497 - 425 = 72$

Lucy earned \$72 more than Ricky.

$497 + 425 = 922$

Together they earned \$922.

**59.** $6 \div 18 = 1 \div 8 = 1 \cdot 9 = 3 = 53$

**60.** $8 \div 23 = 1 \div 3 = 1 \cdot 7 = 7 = 37$

**61.** $2 \div \frac{3}{10} = \frac{2}{1} \cdot \frac{10}{3} = \frac{20}{3} = 1$

**62.** $3 \cdot 58 = 3 \cdot \frac{8}{2} = 6 = 66$

**64.** $53 \cdot 6 = \frac{3}{1} \cdot 1 = 32$

**66.** $\frac{1}{7} \cdot 1 = \frac{1}{9} = \frac{1}{63}$

**67.** $0 \div 93 = 0$

Ä Ā

1 1 1111 1110

2 ÷1 = — ÷ = ! =2

510510511

1 1

3 1 3 5 3 2 3

÷2 = ÷= !

8 2 8 2 8 5 20

Ā 4 Ā Ā

3 — —

1121 3 1

**69.** 12! = — ! = =1

$$\frac{3}{}\quad\frac{5}{}\quad\frac{\overset{5}{\cancel{15}}}{}\quad 11\quad\frac{55}{}\quad\frac{7}{}$$

**58.** $3^{4}\quad !16=4!\frac{\overset{2}{\cancel{6}}}{}\quad =8=68$

$$8\quad\frac{\cancel{}}{}\quad 1\quad\frac{\overset{2}{\cancel{8}}}{}\quad 2\qquad 2$$

$$20!\ =\ \frac{\overset{4}{\cancel{20}}}{}\ !\ =\ =2$$

$$2\quad 2\quad 8\qquad 2$$

$$15\quad 1\quad\frac{\overset{3}{\cancel{15}}}{}\quad 3\qquad 3$$

8
6 =0 is undefined.

9

1
0!2 =0
8

**73.** ! 2 $ ! 7 $ ! 3 $ 17 7 15 21
3

5 34 3 = '
4% 5 34 4=8

1 2
5

= 2 8

1 2
**74.** ! 1 $ ! 4 $! 14$ 31 11 14
5 =
# 1 &

6 " 7 33% ' '

= 6 7 33
1 3

62 = 31 = 3 4
18 9 9

1 1 1 57 4 9
**75.** 7 ÷1 ÷2 = ÷ ÷ –

8 3 4 8 3 4

19 1 1
57 3 4 19 3

8 ! 4 ! 9 = 8=28

1

1 5 5 254021

3 ÷5 ÷1 = ÷ ÷
8 7 16 8 7 16

5 1 2
=25 ! 7 ! 16 =10 = 5
8 40 21 24 12

3 1
1 1 129 43 129 2

2 2 2 2 2 2 .

**78.** 64 ÷21 = ÷ = 1 != 3

It takes 3 gallons of gas for Sara to get to and from work.
3×$5=$15
It costs Sara $15 each day.

2 1 1

12 !25 = 318

3 8 4

1 1 1
38 3÷12 2=315

–5 1 18

56 6 ÷36 =1719

– 11

255!18 2 = 4665

–7 1 99

3212 ÷12 6 = 2146

5404
– – Ā Ā Ā

1069 ÷416 =2753

1 3 1

1 8 3

The perimeter of the garden is
2(20) + 2(15) = 40 + 30 = 70 ft.

14
1 70 5 70 4

70÷1 4= 1÷ 4= 1! 5=56
1

11 !41 = 480
2 4 8

8
1
5
9 !28 =280
9327

56 bricks will be needed.
56 × $3 = $168
The total cost is $168.

# Chapter 2 Review Exercises

## Section 2.1

**1.** $\frac{1}{2}$

**2.** $\frac{4}{7}$

**3. (a)** $\frac{5}{3}$

**(b)** Improper

**4. (a)** $\frac{1}{6}$

**(b)** Proper

**5.** $\frac{7}{15}$

$2\frac{3}{8}$ or $\frac{7}{8}$

$7\frac{1}{6}$ or $\frac{1}{6}$

**8.** $6\frac{1}{7} = \frac{6 \cdot 7 + 1}{7} = \frac{43}{7}$

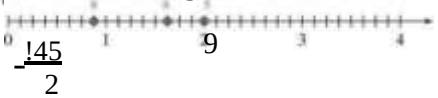
$2\frac{11}{5} = \frac{11 \cdot 5 + 2}{5} = \frac{57}{5}$

**9.** $11 \div 5 = \frac{11}{5} = 5\frac{1}{5}$

$1\frac{1}{17} = \frac{1}{17} = 4\frac{1}{17}$

$4\frac{4}{4} \div \frac{4}{4} = 4 \div 4 = 4 \cdot 1 = 17$

**11.** $9\frac{5}{47}$




$\frac{45}{2}$

$\frac{23}{21} = 1\frac{2}{21}$

**16.** $7\overline{)941}$ $134\frac{3}{7}$

134
!7
24
!21
31
!28
3

**17.** $26\overline{)1582}$ $60\frac{22}{26} = 60\frac{11}{13}$

60
!156
22
!0
22

## Section 2.2

21, 51, 1200

55, 140, 260, 1200

58, 124, 140, 260, 1200

Prime

Composite

$44 = 4 \times 11$

Neither

Neither

2

$2\overline{)4}$
$2\overline{)8}$
$2\overline{)16}$
$2\overline{)32}$

**13–15.**

$2^6$

$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^6$

$5\overline{)55}$
$3\overline{)165}$

2 330

$2 \cdot 3 \cdot 5 \cdot 11 = 330$

$= 64$

**27.** 3 | 3 9
45
225
450
900

2 2 2

1, 2, 3, 4, 6, 8, 12, 16, 24, 48

1, 2, 4, 5, 8, 10, 16, 20, 40, 80

## Section 2.3

3!9 ! 6!5
18"30

3 5
!
6 9

15!14 ! 21!10
210 = 210

15=10
21 14

**32.** 5/20 = 4!5/5 = 1/4

14/ 2!7/ 2

**33.** 49 = 7! 7 = 7

24/ 3!8/ 3
= / = /

**34.** 16 2!8 2

**35.** 63= 9!7= 7
279!3 3

**36.** 17/17=1

**37.** 42/2121 = 2!21/2121 =2

— —

42/45 = 3 !14/3 !15 =
14

15 45−42=3
1

3/45 = 3/3 !15 = 1/15
1

Ä Ā Ā

**(a)** —/10 = !33=
2!5 5

6 2!32
= /=
15 3!5 5 —

## Section 2.4

3 2 6
—!—=—
5 7 35

4 8 32
!=
3 3 9

9149
14! = ! =63
2 1 2
1

3
5 33 5

**45.** 33!11 = 1 ! 11 =15
1

1
1 1 4
2 3 36 1

**46.** 9!8!25=5
1 41 5
1
5 3 4
45 6— 28·· 12

**47.** 7 ! ! 63= 7

**38.** — 12
3!4 4 1 4 51 7
!1"
1 1

1 1 /

150 15 315 5

1

120 = = = 48. $ % = # # =

-

—

&10 ' 10 10 10 10 10, 000

**39.** 1400 142177
2000 = 20 = 2!10 =10

81

**49.** $\left(2\frac{2}{5}+1\frac{1}{10}\right)\div\left(22\frac{1}{2}+11\frac{1}{4}\right)$

$$=\left(\frac{12}{5}+\frac{11}{10}\right)\div\left(\frac{45}{2}+\frac{45}{4}\right)$$

$$=\left(\frac{24}{10}+\frac{11}{10}\right)\div\left(\frac{90}{4}+\frac{45}{4}\right)$$

$$=\frac{35}{10}\div\frac{135}{4}$$

$$=\frac{\cancel{35}^{7}}{\cancel{10}_{2}}\cdot\frac{4}{\cancel{135}_{27}}$$

$$=\frac{14}{27}$$

**50.** $\left(\frac{3}{20}\right)^{3}\cdot\left(\frac{1}{10}\right)^{3}\div\left(\frac{1}{1000}\right)^{2}=\frac{1}{\cancel{20}_{1}^{3}}\cdot\frac{1}{\cancel{10}_{1}^{3}}\div\frac{1}{\cancel{1000}_{1}^{2}}$

$$=\frac{1}{1000}\cdot\frac{1000}{1}$$

$$=1$$

**51.** $\left(\frac{1}{10}\right)^{3}\div\left(\frac{1}{17}\right)^{2}\cdot 17=\frac{1}{\cancel{1000}_{1}}\cdot\frac{\cancel{17}^{1}\cdot 17}{1}$

$$=\frac{17}{1000}$$

**52.** $A=\frac{1}{2}bh$

**53.** $A=lw$

$$A=\frac{1}{2}(12)\left(\frac{17}{2}\right)=6\left(\frac{17}{2}\right)=\frac{\cancel{6}^{3}\cdot 17}{\cancel{2}_{1}}=51\text{ ft}^2$$

$$A=lw=\left(4\frac{1}{2}\right)\left(3\frac{1}{3}\right)=\frac{\cancel{9}^{3}}{\cancel{2}_{1}}\cdot\frac{\cancel{10}^{5}}{\cancel{3}_{1}}=\frac{15}{1}\text{ or }15\text{ m}$$

$$A=\frac{1}{2}(3+6)\left(\frac{20}{3}\right)$$

$$=\frac{\cancel{20}^{10}}{\cancel{2}_{1}}\cdot\frac{\cancel{9}^{3}}{\cancel{3}_{1}}$$

$$=30$$

$$\left(\frac{1}{4}\right)^{2}\cdot 3600=\frac{1}{16}\cdot 3600=\frac{3600}{16}=900$$

There are 900 African American students.

$$40\text{ yd}^2$$

1 1 1

20+20

$$\frac{1}{12}\times 3600 = \frac{1}{12}\times\frac{3600}{1} = 300$$

There are 300 Asian American students.

$$\frac{1}{2}\times\frac{1}{6}\times 3600 = \frac{1}{2}\times\frac{1}{6}\times\frac{3600}{1} = \frac{3600}{12} = 300$$

There are 300 Hispanic female students.

$$\frac{1}{5}\times 1500 \qquad 1 \quad 5 \quad 3600 \quad 1500$$

**61.** $2 \times 12 \times 3600 = 2 \times \frac{12}{1} \times 1 = 2 = 750$

There are 750 Caucasian male students.

**Section 2.5**

$$\frac{3}{4}\div 1 = 1$$

$$4 \quad 3$$

$$1 \quad 1$$

$$\frac{1}{12}\times 12 = \frac{12}{12} = 1$$

**64.** $\frac{2}{7}$

**65.** $\frac{1}{7}$

**66.** Reciprocal does not exist.

**67.** 6

**57.** $4\frac{7}{8} = \frac{4 \cdot 7}{8} + \frac{7}{8} = \frac{28}{8} + \frac{7}{8} = \frac{35}{8} = 4\frac{3}{8}$ or $3\frac{1}{2}$

Maximus requires $3\frac{1}{2}$ or $3\frac{4}{8}$ yd of lumber.

$\frac{5}{8}$

Multiplying

$\frac{28}{15} \div \frac{21}{20} = \frac{28}{15} \cdot \frac{20}{21} = \frac{4 \cdot 7}{3 \cdot 5} \cdot \frac{4 \cdot 5}{3 \cdot 7} = \frac{16}{9}$

$7 \div 35 = 7 \cdot \frac{1}{63} = 7 \cdot \frac{1}{9} = 7$

$6 \quad 6 \quad 1 \quad 1$

$7 \div 18 = 7 \cdot \frac{1}{18} = 21$

$3 \quad 9 \quad 3 \quad 5 \quad 1$

$\frac{}{10} \div \frac{}{5} = \frac{}{10} \cdot \frac{}{9} = \frac{}{6}$

$200 \div 25 = 200 \cdot \frac{1}{17} = 25 \cdot 8 \cdot \frac{1}{17} = 8$

$51 \quad 17 \quad 51 \quad 25 \quad 17 \cdot 3 \quad 25 \quad 3$

**75.** $12 \div \frac{6}{7} = \frac{12}{1} \cdot \frac{7}{6} = 14$

**76.** $\frac{2}{19} \div \frac{8\%}{19} = \frac{2}{19} \cdot \frac{19}{8\%} = \frac{1}{4} \cdot \frac{3}{1} \cdot \frac{1}{4} \cdot \frac{3}{1} = \frac{3}{64}$

**77.** $\frac{12\%}{36} \div \frac{36}{144} = \frac{36}{144} \cdot \frac{144}{25} = \frac{5}{36}$

$4 \quad 4 \quad 20$

$\frac{}{5} \cdot 20 = \frac{}{5} \cdot \frac{}{1} = 16$

$2183$

$18 \div \frac{}{3} = \frac{}{1} \cdot \frac{}{2} = 27$

$2 \quad 24 \quad 3$

**82.** $24 \div 3 = 1 \cdot \frac{2}{1} = 36$

36 bags of candy

$4 \quad 4 \quad 40$

$\frac{}{5} \cdot 40 = \frac{}{1} \cdot \frac{}{1} = 32 \text{ hr}$

$32 \times \$18 = \$576$

Amelia earned $576.

$\frac{44}{33} \cdot \frac{16}{9} = \frac{}{4}$

$10 \cdot 12 = \frac{16}{9} \cdot \frac{10}{9} \cdot \frac{12}{1} \cdot \frac{1}{3} = \frac{640}{3}$

$\frac{640}{3} = 213\frac{1}{3}$ ft$^2$.

The area is $213\frac{1}{3}$ ft$^2$.

$9 \div 8 = 1 \cdot 3 = 24$

$\frac{9}{27} \quad \frac{}{1}$

Yes, he will have 24 pieces, which is more than enough for his class.

81 ÷ 3 = 3 81 ÷ 2 = 18

**78.** ÷ = ! ¡ =

**Section 2.6**

! 2"! 2" = 11 # 32 = 352

55 11 2 55 3 3 5

5 1 1

4 "1 %3 1

! 4 1 1

**79.** ÷2 = ! ÷2 = ÷2

13 2 13 8 26

1 1 2

= ! = 1

26 2 52

**86.** $3 %$6

3 5% 3 5 15

& '& '

23

7

15 352

!30 = 23 15

52

!45

7

$$\left(1\frac{1}{2}\right)\left(3\frac{1}{3}\right)=\frac{3}{2}\cdot\frac{10}{3}=\frac{30}{6}=5$$

**93.** $7\frac{1}{2}\div 1\frac{5}{9}=\frac{15}{2}\div\frac{14}{9}=\frac{15}{2}\cdot\frac{9}{14}=\frac{135}{28}=4\frac{23}{28}$

$$\frac{1}{6}\cdot\frac{50}{25}=\frac{1}{3}$$

**88.** $6\frac{2}{3}\cdot 1\frac{1}{8}=\frac{20}{3}\cdot\frac{9}{8}=\frac{15}{2}=7\frac{1}{2}$

$$4\frac{11}{13}\div 2=\frac{63}{13}\div\frac{2}{1}=\frac{63}{13}\cdot\frac{1}{2}=\frac{63}{26}=2\frac{11}{26}$$

$$\left(5\frac{1}{4}\right)\left(4\frac{5}{21}\right)=\frac{21}{4}\cdot\frac{89}{21}=\frac{89}{4}=22\frac{1}{4}$$

**89.**

$$\frac{1}{2}\cdot 8\frac{1}{2}=\frac{1}{2}\cdot\frac{17}{2}=\frac{17}{4}=4\frac{1}{4}$$

$$\frac{5}{13}\cdot 0=0$$

**95.** $10\div 17=\frac{10}{17}\cdot\frac{5}{5}=\frac{50}{85}$

$$0\div\frac{12}{25}=0\cdot\frac{25}{12}=0$$

**91.** $4\frac{5}{16}\div 2\frac{7}{8}=\frac{69}{16}\div\frac{23}{8}=\frac{\cancel{69}^{3}}{\cancel{16}_{2}}\cdot\frac{\cancel{8}^{1}}{\cancel{23}_{1}}=\frac{3}{2}=1\frac{1}{2}$

$$2\frac{1}{24}=\frac{49}{24}=\frac{49}{48}=1\frac{1}{48}$$

$$1\frac{1}{2}\div 3\frac{1}{8}=\frac{3}{2}\cdot\frac{8}{25}=\frac{12}{25}$$

It will take $3\frac{8}{25}$ gal.

**92.** $3\frac{5}{11}\div 3\frac{4}{5}=\frac{38}{11}\div\frac{19}{5}=\frac{\cancel{38}^{2}}{11}\cdot\frac{5}{\cancel{19}_{1}}=\frac{10}{11}$

$$1\frac{1}{4}\div 2\frac{4}{25}=\frac{5}{4}\cdot\frac{25}{54}=\frac{125}{216}$$

**98.** $12\div 1\frac{4}{5}=12\div\frac{9}{5}=\frac{\cancel{12}^{4}}{1}\cdot\frac{5}{\cancel{9}_{3}}=\frac{20}{3}=6\frac{2}{3}$

There will be 10 pieces.

## Chapter 2 Test

**(a)** $\frac{5}{8}$

Proper

**(a)** $3\frac{7}{8}$

Improper

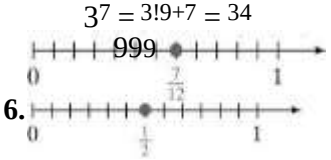
$2\frac{1}{2}$

**5. (a)** $12\overline{)44}$ $3\frac{8}{12}=3\frac{2}{3}$

$$\begin{array}{r}36\\ \hline 8\end{array}$$

$3^7 = 3^{9+7} = 3^{4}$

**6.**



$\frac{7}{7}$ is an improper fraction because the numerator is greater than or equal to the denominator.

**7.** 


**8.**

**9.** 

**10. (a)** Composite $15 = 3 \times 5$
Neither
Prime
Neither

Prime
**(f)** Composite $39 = 3 \times 13$

**(a)** 1, 3, 5, 9, 15, 45

3
3 9
5 45

$3!3!5 = 3^2 !5 = 45$

**(a)** Add the digits of the number. If the sum is divisible by 3, then the original number is divisible by 3.

Yes; 1 + 9 + 8 + 1 + 0 + 1 + 1 = 21 and 21 is divisible by 3.

**(a)** No; 1155 is not even.

Yes; 1 + 1 + 5 + 5 = 12 is divisible by 3.

Yes; the digit in the ones-place is a 5.
No; the digit in the ones-place is not 0.

15!4 ! 12!5
60=60

$= \frac{5}{4}$

2!25!5 !

" 20

$\frac{2}{5^{!}} \frac{4}{25}$

$150 = 5 ! 5 ! 2 ! 3 = 10$ or $1\frac{3}{10}$
1055!3!777

$\frac{1,200,}{} = \frac{12}{} = 2!6 = \frac{6}{}$

Brad has the greater fractional part completed since $\frac{4}{5} > \frac{3}{5}$.

**19.** $\frac{2}{9} \text{ "} \frac{57}{46} = \frac{2}{3!3} \cdot ! \frac{3!19}{2!23} = \frac{19}{69}$

1

**20.** $!\frac{75}{24\%} \$ \frac{75}{24} \frac{4}{1} \frac{75}{6} \frac{3}{3} \frac{'25}{'2}$
$\&'4=$ $' = =$
6

$= \frac{25}{2}$ or $12\frac{1}{2}$

$\frac{28}{24} \frac{21}{8} \div = \frac{28}{24} \frac{8}{21}$ !

$= \frac{2!2!7}{2!2!2!3} ! \frac{2!2!2}{3!7} = 9\frac{4}{21}$

$\frac{105}{1155} \div 5 = \frac{105}{5422} ! 1 = \frac{21}{42} = \frac{1}{2}$

1

**23.** $\frac{2}{18} \text{ "} \frac{9}{25} \text{ "} \frac{40}{6} = \frac{2}{2!3!3} \frac{3!3}{!5!5} ! \frac{2!2!2!5}{2!3}$

$= 15\frac{4}{5}$

1

$\frac{600}{1200} \frac{50}{65} \div \frac{13}{15} \div \frac{1}{2} \frac{5!10}{\div 5} \frac{13}{!13 \div 15}$

1

$= 1\frac{1}{2} ! 13 ! \frac{3}{15} = 3\frac{1}{10}$

2 $\frac{13}{4}$

2 1

$\frac{}{} \frac{11025}{} \frac{}{}$

$21 \div 4 = 21 \div 6$

1,400, [redacted] 14 2 !7 7

15 3!5 3

$= \frac{10!6}{21\ 25}$

$$\frac{2!5\ \ 2!3}{!} = \frac{3!7\ 5!5}{4} = 35$$

$$25 = 5!5 = 5$$

**18.** **(a)** Christine: $16 \quad 4!4 \quad 4$

Brad: $\overline{20} = \overline{4 ! 5} = 5$

$4 \quad 4 \quad 72\ 34^{2} \quad 144 \quad 3!48$

$4 \quad !2 = \quad ! \quad = \quad =$

$17 \quad 15 \quad 17 \quad 15 \quad 15 \quad 3!5$

$1^{1}$

$= \frac{48}{5} = 9\frac{3}{5}$

$1 \quad 20^{5} \quad 1$

$20! \quad = \quad ! = 5$

$4 \quad 1 \quad 4$

$20 \div \frac{1}{4} = \frac{20}{1} \div \frac{20}{4} = \frac{!}{!} = 80$

$20 \div \frac{1}{4}$ is greater.

**27.** $52 \quad !1 \quad 8 + 52 \quad (1 \quad 8 + 52 \quad 2$

$\div \quad - \quad \div \quad \div$

$) 4 \qquad 3 \quad 72 \quad 3$

$72 \ *2 \quad = \quad *$

$) \quad 3 - 72 \quad 1$

$26 \quad 1$

$= \frac{52}{72} \cdot \frac{3}{2} = \frac{26}{24} = \frac{13}{12}$

$24 \quad 1$

$3$

$1 \quad 12 \quad 1124$

$12 \div 4 = 1 \div 4 = 1!1$

=48 48 quarter-pounders

$15 \quad 1 \quad 5 \quad 120 \quad 15$

$15 \quad 8 \quad 15 \quad 8 \quad 1 \quad 3$

$1$

5 dogs are female pure breeds.

**28.** $A = \frac{1}{2}bh = \frac{1}{2}(8)\#$ &

$1 \qquad 8, 11 \quad 44 \quad 2$

$= 12, 1 \quad 3 = 3$ or $14\ 3$ cm

$\frac{1}{4} \quad \frac{4}{1} \quad \frac{2}{2}$

$= \qquad \qquad 2$

**32.** $2!5 \quad 10 = 5$ acre.

They can build on a maximum of

## Chapters 1–2 Cumulative Review Exercises

17,000; nineteen thousand, three hundred forty; 22,047; fifteen thousand, seven hundred seventy-one

$24$
$) 433$
$\underline{139}$

$432$
$\underline{998}$
$1430$

$4122$

Ä Ā

16 384
!32
64
!64
0

2
244
206 100
214,344

23
81
23
1840
1863

Ā Ā
18R2
4 74
!4
34

Ā

3,000,000
40,000
120,000,000,000

1007

823
184

48
8 =6

6+2·8=6+16=22

5 !3 =25!9=16

2 2

(5!3) =2 =4

c

b

e

a

**19. (a)** 4 7
7 1
**(b)** 3 or 2 3

**20. (a)** Proper
**(b)** Improper
**(c)** Improper

**21. (a)** 1, 2, 3, 5, 6, 10, 15, 30

3 15
2 30
2·3·5=30

144 2!2!2!2!3!3 12 5
**22. (a)** = = = or 1

**23.** 35 ! 51 = 5 ! 7 ! 3 ! 17 = 119
27 95 3 !3!3 5!19 171

2 4 17 34 17 5 5

**24.** 5 3 6 5 = 3 ÷ 5 = 3 34 6
2

**25.** Yes; 8 5 5 5 8 5
13 16 = 26 and 16 ! 13 = 26.
2 2

1
!12"5 1 5 5

**26.** Yes; $ # = = and
#% #
& 9' 3 9 3 27
2 1

! 5 5
# 2 # 5 "= 1# 10 = .
$ %
2 & 9 3 ' 2 27 27
1

**27.** " 5 12 % 2 1 2 2
! 2 "2% 2 2 4 2
$ ' ÷ = ÷ = ÷
#6 25& 3 5 & 3253

1 5
= 4 3 6
25 ! 2 =
1

1
11 5 11 2 2
*A* = *lw* = 5 ! 9 = 9 or 19 m
1

84 2!2!3!7 7 7

60,000 = 6 =2!3 =2

150, 15 5! 3 5

$A = \frac{1}{2}bh$

$= \frac{1}{2}(25)(8) = 100\ \text{ft}^2$

$\frac{1}{10} = \frac{3}{40}$

$\frac{3}{40}$ of the students are males from out of 40 students.

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