8 How to • • • • • • • • • • Use the Rules of Divisibility and Estimation

Facts to Know

In division there is a set of rules that makes division easier because of a pattern which indicates that a certain dividend is divisible by a specific divisor.

Rules of Divisibility

Divisor	Rule (A number is divisible by_____if . . .)
2	The last digit of the dividend (or ones digit) is 0, 2, 4, 6, or 8. (**Example:** 126 ÷ 2 = 21)
3	The sum of the digits in a dividend is divisible by 3. (**Example:** 126: 1 + 2 + 6 = 9; 9 is divisible by 3 so 126 is divisible by 3)
4	The number formed by the last two digits of the dividend is divisible by 4. (**Example:** 428: the last two digits are 28; 28 is divisible by 4 so 428 is divisible by 4)
5	The last digit of the dividend is 0 or 5. (**Example:** 115 is divisible by 5 but 412 is not divisible by 5.)
6	The dividend is divisible by 2 and 3. (**Example:** 642: the ones digit is even so it is divisible by 2 and the sum of the digits 6 + 4 + 2 = 12 is divisible by 3 so 642 is divisible by 6)
9	The sum of the digits in the dividend is divisible by 9. (**Example:** 693: the sum of the digits 6 + 9 + 3 is 18; 18 is divisible by 9 so 693 is divisible by 9)
10	The last digit of the dividend (or ones digit) is 0. (**Example:** 250: the last digit of the number is 0 so 250 is divisible by 10)

8 How to • • • • • • • • • • Use the Rules of Divisibility and Estimation *(cont.)*

Facts to Know

- Estimating the quotient can provide an approximate answer to long division problems.
- Use what you know about multiplication with multiples of 10 to help you with the estimation of quotients.

Solve: $10\overline{)560}$

1. Estimate what multiple of 10 can be used as the divisor for 560. (10 x 50 = 500 is a close estimate to 560.) Write (10 x 50) next to the estimated product.

```
                Estimate
10)560  |
 −500   |  10 x 50
```

2. Subtract 500 from 560 and the answer is 60.

```
                Estimate
10)560  |
 −500   |  10 x 50
  60    |
```

3. Estimate what multiple of 10 can be used as the divisor for 60. (10 x 6 = 60) Write 10 x 6 next to the estimated product. Subtract 60 from 60 and the answer is 0. Add the circled numbers written on the side to get your quotient. (50 + 6 = 56)

```
                Estimate
10)560  |
 −500   |  10 x (50)
  60    |
 − 60   |  10 x (6)
   0    |
```

4. Check your answer by using the Division Code. For the sample problem, the quotient estimate and the actual answer using the Division Code are the same. In some problems the estimated answer may be slightly less than the actual answer. The actual answer is 56.

```
   x56
10)560
 −50
  60
 − 60
   0
```

8 Practice • • • • • • • • • • Using the Divisibility Rules for 2, 3, 4, and 5

Directions: Using the Rules of Divisibility on page 30, solve the problems on this page. State the divisibility rule which proves each answer. The first one has been done for you.

1.

$$\begin{array}{r} x88 \\ 2\overline{)176} \\ -16 \\ \hline 16 \\ -\ 16 \\ \hline 0 \end{array}$$

Since the last digit of the dividend is an even number, 176 is divisible by the divisor 2.

2. $5\overline{)360}$

3. $3\overline{)126}$

4. $4\overline{)176}$

5. $5\overline{)645}$

6. $3\overline{)813}$

7. $4\overline{)324}$

8. $2\overline{)218}$

9. $4\overline{)520}$

10. $3\overline{)762}$

8 Practice • • • • • • • • • • Using the Divisibility Rules for 6, 9, and 10

Directions: Using the Rules of Divisibility on page 30, solve the problems on this page. State the divisibility rule which proves each answer. The first one has been done for you.

1.

$$\begin{array}{r} x55 \\ 10\overline{)550} \\ -50 \\ \hline 50 \\ -\ 50 \\ \hline 0 \end{array}$$

The last digit of the dividend is 0 so 550 is divisible by 10.

2. $6\overline{)324}$

3. $9\overline{)981}$

4. $6\overline{)336}$

5. $10\overline{)170}$

6. $9\overline{)765}$

7. $6\overline{)414}$

8. $10\overline{)860}$

9. $9\overline{)558}$

10. $10\overline{)230}$

2. 94 R8
3. 38 R6
4. 65 R7
5. 43 R9
6. 64 R1
7. 75 R2
8. 95 R3
9. 96 R1
10. 82 R9
11. 21 R8
12. 75 R9

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1. 34
2. 21
3. 22
4. 32
5. 24
6. 23
7. 42
8. 11
9. 21
10. 11
11. 32
12. 16

Page 28

1. 22 R17
2. 21 R6
3. 40 R13
4. 20 R19
5. 21 R14
6. 21 R2
7. 20 R27
8. 20 R5
9. 20 R19
10. 11 R26
11. 40 R14
12. 22 R3

Page 29

1. 21 R8
2. 21 R17
3. 22 R7
4. 22 R9
5. 22 R2
6. 11
7. 22 R8
8. 11
9. 11
10. 21 R20
11. 21 R24
12. 22 R15
13. 22 R3
14. 21 R3
15. 11 R22

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1. 88—Since the last digit of the dividend is an even number, 176 is divisible by the divisor 2.
2. 72—The last digit of the dividend is 0 so 360 is divisible by 5.
3. 42—The sum of the digits in the dividend adds up to 9, which is divisible by 3.
4. 44—The number formed by the last two digits of the dividend (76) is divisible by 4.
5. 129—The last digit of the dividend is 5 so 645 is divisible by 5.
6. 271—The sum of the digits in the dividend adds up to 12, which is divisible by 3.
7. 81—The number formed by the last two digits in the dividend (24) is divisible by 4.
8. 109—The last digit is an even number so 218 is divisible by 2.
9. 130—The number formed by the last two digits in the dividend (20) is divisible by 4.
10. 254—The sum of the digits of the dividend adds up to 15, which is divisible by 3.

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1. 55—The last digit of the dividend is 0 so 550 is divisible by 10.
2. 54—The dividend is divisible by both 2 and 3.
3. 109—The sum of the digits in the dividend adds up to 18, which is divisible by 9.
4. 56—The dividend is divisible by both 2 and 3.
5. 17—The last digit of the dividend is 0 so 170 is divisible by 10.
6. 85—The sum of the digits in the dividend adds up to 18, which is divisible by 9.
7. 69—The dividend is divisible by both 2 and 3.
8. 86—The last digit of the dividend is 0 so 860 is divisible by 10.
9. 62—The sum of the digits in the dividend adds up to 18, which is divisible by 9.
10. 23—The last digit of the dividend is 0 so 230 is divisible by 10.

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Actual and estimated answers are the same.

1. 21
2. 14
3. 23
4. 13
5. 14
6. 26
7. 16
8. 33

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1. 20 R1
2. 23 R10
3. 20 R17
4. 12 R7
5. 22 R5
6. 15 R24
7. 20 R5
8. 32 R2

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1. 8
2. 9 R1
3. 112 R3
4. 72 R2
5. 59 R1
6. 33 R1
7. 24 R2
8. 21 R2
9. 22 R2
10. 44 R9

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1. 14
2. 33
3. 25 R3
4. 48 R5
5. 27
6. 32 R3
7. 39
8. 22 R6
9. 30 R8
10. 20 R15
11. 12
12. 21 R23
13. 20 R5
14. 20 R3
15. 23

Page 39

1. 12 balls
2. 12 cards
3. 6 cards
4. 22 groups
5. 18 bars
6. 47 pennies
7. 40 carrots
8. 41 pieces

Page 40

1. 30 lollipops
2. 21 suckers
3. 21 ants
4. 31 corns
5. 41 yankers
6. 41 candies
7. 48 pieces
8. 27 drops

Page 41

1. 11 bags
2. 16 jars
3. 6 flies
4. 22 water bugs
5. 40 grasshoppers
6. 13 crickets
7. 32 bottles
8. 30 cases

Division Challenger: groups of 20

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1. 124 seeds
2. 359 clips
3. 20 oats
4. 211 coins
5. 186 peanuts
6. 244 gum balls
7. 302 fries
8. 203 bills

Division Challenger: 499 packs

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1. 111 bugs
   25 bugs
2. 111 snails
   14 snails
3. 107 pill bugs
   6 pill bugs
4. 302 spiders
   1 spider
5. 142 bugs
   11 bugs
6. 249 bugs
   21 bugs
7. 216 slugs
   18 slugs
8. 290 beetles
   4 beetles

Division Challenger: 48 beds
1,955 bed bugs

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1. total: 249
   average: 83
2. total: 267
   average: 89
3. total: 270
   average: 90
4. total: 261
   average: 87
5. total: 279
   average: 93
6. total: 294
   average: 98

Answers will vary for die-rolling problems.

