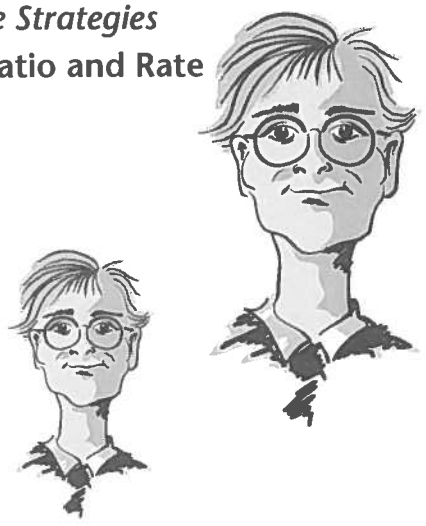
CHAPTER

3

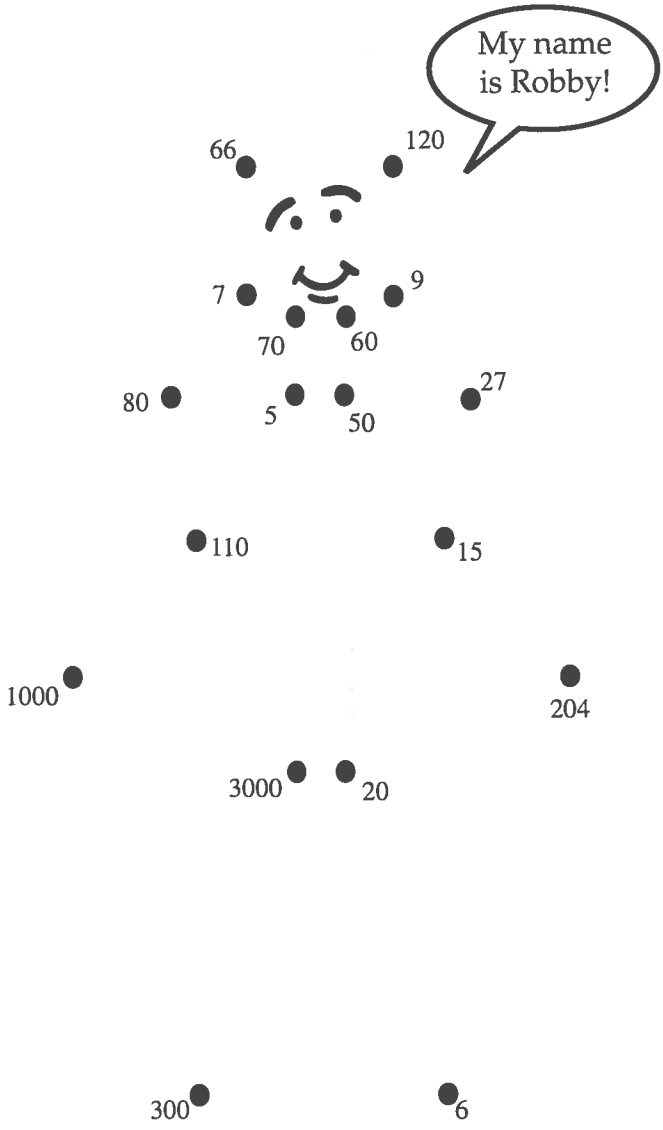
Ratio and Rate



Skill Builder

Who am I?

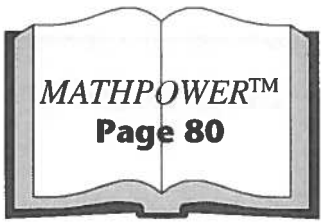
Complete the following exercises. Then, find the answers in the picture and join the dots in the order of the answers.



1. double 10 = _____
2. half of 12 = _____
3. triple 5 = _____
4. double 102 = _____
5. triple 9 = _____
6. half of 100 = _____
7. triple 20 = _____
8. half of 18 = _____
9. double 60 = _____
10. triple 22 = _____
11. 63 ÷ 9 = _____
12. 630 ÷ 9 = _____
13. 45 ÷ 9 = _____
14. 720 ÷ 9 = _____
15. 5000 ÷ 5 = _____
16. 220 ÷ 2 = _____
17. 2700 ÷ 9 = _____
18. 24 000 ÷ 8 = _____
19. half of 40 = _____

GETTING STARTED

Work together with your classmates, using your *MATHPOWER*™ student text, page 80.



Warm Up

1. *Complete.*

a) In 1 h, you drive 70 km. In 4 h, you drive ☐ km.

b) In 3 h, you walk 12 km. In 1 h, you walk ☐ km.

c) In 5 h, you earn $45. In 1 h, you earn $☐.

d) In 2 h, you read 40 pages. In 1 h, you read ☐ pages.

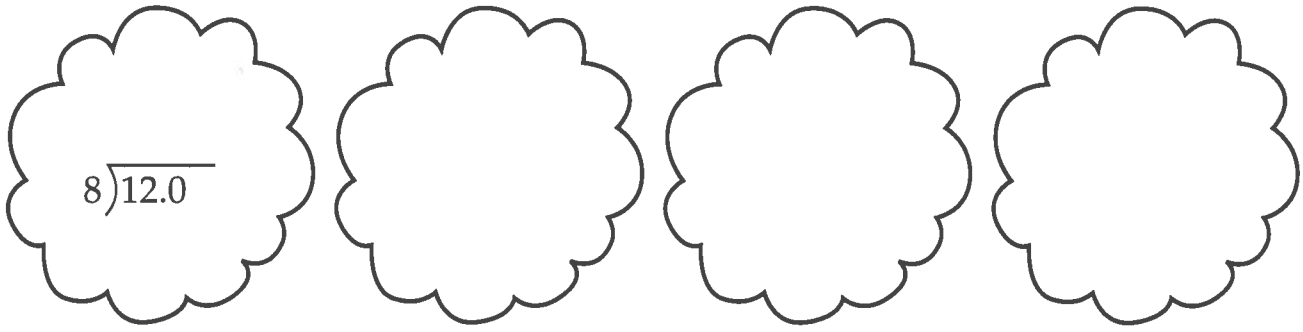
e) In 2 h, you read 40 pages. In 6 h, you read ☐ pages.

2. *Express each fraction as a* ***whole number****.*

a) $\frac{15}{3} =$ _____ **b)** $\frac{49}{7} =$ _____ **c)** $\frac{64}{8} =$ _____ **d)** $\frac{99}{11} =$ _____

3. *Express each fraction as a* ***decimal****.*

$\frac{12}{8} =$ _____ $\frac{15}{6} =$ _____ $\frac{5}{10} =$ _____ $\frac{3}{4} =$ _____



4. *Complete the table.*

Fraction	Equivalent Fraction out of 100.
a) $\frac{1}{2}$	$\frac{1}{2}\overset{\times 50}{=}\frac{\square}{100}$
b) $\frac{3}{10}$	
c) $\frac{7}{10}$	
d) $\frac{1}{4}$	
e) $\frac{3}{50}$	
f) $\frac{7}{20}$	
g) $\frac{2}{5}$	
h) $\frac{3}{25}$	

5. *Express each fraction as a* ***decimal****.*

Fraction	Decimal
a) $\frac{3}{10}$	*Press 3 ÷ 10 =*
b) $\frac{3}{5}$	
c) $\frac{9}{2}$	
d) $\frac{15}{8}$	
e) $\frac{7}{20}$	
f) $\frac{11}{4}$	
g) $\frac{64}{25}$	
h) $\frac{5}{16}$	

Mental Math

1. *Express each fraction in* ***lowest terms****.*

a) $\frac{3\overset{\div 3}{}}{9_{\div 3}}=\frac{\square}{\square}$

b) $\frac{2}{6}=$

c) $\frac{2}{4}=$

d) $\frac{5}{10}=$

e) $\frac{2}{8}=$

f) $\frac{8}{12}=$

g) $\frac{2}{12}=$

h) $\frac{3}{15}=$

i) $\frac{4}{16}=$

j) $\frac{12}{15}=$

k) $\frac{10}{15}=$

l) $\frac{6}{10}=$

2. *State an **equivalent** fraction.*

a) $\frac{1}{2} \overset{\times 2}{\underset{\times 2}{=}} \frac{\quad}{\quad}$ **b)** $\frac{1}{3} = \frac{\quad}{\quad}$ **c)** $\frac{1}{4} = \frac{\quad}{\quad}$

d) $\frac{2}{3} = \frac{\quad}{\quad}$ **e)** $\frac{3}{5} = \frac{\quad}{\quad}$ **f)** $\frac{3}{4} = \frac{\quad}{\quad}$

g) $\frac{4}{7} = \frac{\quad}{\quad}$ **h)** $\frac{5}{6} = \frac{\quad}{\quad}$ **i)** $\frac{3}{8} = \frac{\quad}{\quad}$

j) $\frac{9}{10} = \frac{\quad}{\quad}$ **k)** $\frac{2}{9} = \frac{\quad}{\quad}$ **l)** $\frac{5}{12} = \frac{\quad}{\quad}$

3. *Multiply.*

a) 60×50 **b)** 30×90 **c)** 70×90 **d)** 14×20

e) 11×30 **f)** 12×40 **g)** 32×20 **h)** 32×30

4. *Divide.*

a) $7\overline{)1400}$ **b)** $5\overline{)2500}$ **c)** $3\overline{)1800}$ **d)** $4\overline{)3600}$

e) $2\overline{)1000}$ **f)** $3\overline{)1500}$ **g)** $4\overline{)1600}$ **h)** $9\overline{)2700}$

Use the numbers from 1 through 6 only once and write them in the boxes (☐) to make each statement **true**.

☐ + ☐ = 4

☐ − ☐ = 3

☐ − ☐ = 2

Skill Builder

NO CALCULATOR

1. *Calculate.*

   a) 257 + 1062 = _____

   b) 25 + 26 + 114 = _____

   c) 854 − 392 = _____

   d) 6003 − 5899 = _____

   e) 277 + 88 = _____

   f) 4007 − 2255 = _____

   g) 999 − 672 − 114 = _____

   h) 10110 + 1001 + 663 = _____

Rough Work:

a) *257*
+ 1062
_____

2. *Calculate.*

   a) **40 ÷ 8 + 6** = _____
   _____ **+ 6** = _____

   b) 56 ÷ 7 − 3 = _____

   c) 63 ÷ 7 + 4 = _____

   d) 12 ÷ 2 − 6 = _____

   e) 12 ÷ 12 + 15 = _____

   f) 70 ÷ 7 + 9 = _____

   g) 18 ÷ 9 − 2 = _____

   h) 8 ÷ 4 − 1 = _____

   i) 48 ÷ 6 + 9 = _____

   j) 12 ÷ 1 − 1 = _____

Do division first!

3.1 Problem Solving: Guess and Check

Problems and Applications

Understand the Problem

Think of a Plan

Carry Out the Plan

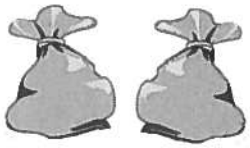
Look Back

1. There are 2 bags of dried peas in a row. The second bag has 5 more peas than the first. The total number of peas is 157. How many peas are in the first bag?

Facts: _____

_____

_____



Guess

Bag 1	Bag 2	Total	Is the total 157?
50	*50 + 5 =* ☐	*50 + 55 =* ☐	*Too low*
60	*60 + 5 =* ☐	*60 + 65 =* ☐	

CHECK:

☑

Sentence: _____

2. If you multiply a number by 3 and add 8, the result is 44. What is the number?

Guess Number	Result of (Number × 3) + 8	Is the result 44?
6	*(6 × 3) + 8 =* ☐	*Too low*
7		

CHECK:

☑

Sentence: _____

3. Heather and Justin played a game of SCRABBLE® Heather scored 21 more points than Justin. Together they scored a total of 333 points. How many points did each of them score?

Guess

Justin's Score	Heather's Score	Total Score	Is the Total Score 333?
100	*100 + 21 =* ☐		

CHECK:

Sentence: _____

4. Find **3 consecutive whole numbers** whose **sum is 66.**

Guess

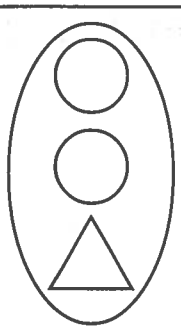
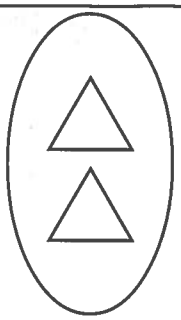
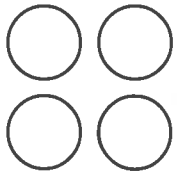
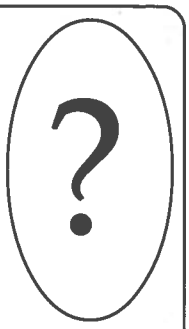
Consecutive numbers differ by 1.
e.g., 6, 7, 8

1st Number	2nd Number	3rd Number	Total	Is the sum 66?
6	*7*	*8*	*6 + 7 + 8 = 21*	*Too low*

CHECK:

Sentence: _____

Logic Zapper

If  =  then  = 

Skill Builder

1. *Write each ratio in* ***lowest terms.***

a) 4 to 10 = ☐ :5

b) 6:3 = ☐ : ☐

c) 10 to 4

Write the ratio as a ***fraction*** *first.*

$\frac{4}{10} \overset{\div 2}{=} \frac{\quad}{5}$

d) 3:6

e) 9 to 12

f) 12:9

g) 21 to 7

h) 4:12

i) 20:10

2. *Complete the table.*

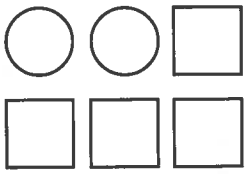
Fraction	Equivalent Fraction out of 100	Decimal
a) $\frac{97}{100}$	$\frac{97}{100}$	
b) $\frac{8}{10}$	$\frac{8}{10} \overset{\times 10}{=} \frac{\square}{100}$	
c) $\frac{1}{2}$		0.5
d) $\frac{1}{4}$		
e) $\frac{3}{5}$		

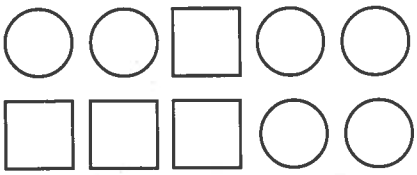
Fraction	Equivalent Fraction out of 100	Decimal
f) $\frac{3}{10}$		
g) $\frac{7}{50}$		
h) $\frac{3}{4}$		
i) $\frac{9}{100}$		
j) $\frac{9}{10}$		

3.2 Equivalent Ratios and Proportions

Practice

1. *Write the* ***ratio of circles to squares.***

a) 

b) 

_____ _____

2. *Write* ***3 ratios equal*** *to each ratio.*

a) 2:3 = _____ = _____ = _____ b) 8:16 = _____ = _____ = _____

Multiply *or* ***divide*** *each term by the* ***same number.***

*2:3 = (2 × **5**) : (3 × **5**)*
*= **10** : ☐*

*8:16 = (8 ÷ **2**) : (16 ÷ **2**)*
*= **4** : ☐*

3. *Circle* ***T or F*** *for each sentence.*

a) 2:3 = 4:9 T or F

Hint: *= (2 × **2**) : (3 × **2**)*
= 4 : ☐

b) 1:2 = 2:1 T or F

c) 5:8 = 10:24 T or F

d) 4:1 = 20:5 T or F

e) $\frac{12}{15} = \frac{3}{5}$ T or F

f) $\frac{12}{4} = \frac{3}{1}$ T or F

g) 7:2:3 = 14:4:6 T or F

Multiply *each term* ***by 2.***

h) 10:12:14 = 5:6:8 T or F

Divide *each term* ***by 2.***

4. *Find the **unknown value** in each proportion.*

a) $\frac{9}{18} = \frac{x}{2}$

$= \frac{9 \div 9}{18 \div 9}$

$= \frac{\square}{2}$

So, the missing term is $\square$.

b) $\frac{3}{2} = \frac{15}{a}$

c) $\frac{9}{12} = \frac{m}{4}$

d) $\frac{x}{5} = \frac{4}{20}$

Rewrite! $\frac{4}{20} = \frac{x}{5}$

$= \frac{4 \div 4}{20 \div 4}$

$= \frac{\square}{5}$

So, the missing term is $\square$.

e) $\frac{t}{15} = \frac{3}{5}$

Rewrite!

f) $\frac{w}{25} = \frac{1}{5}$

5. *Find the **unknown value** in each proportion.*

a) 12:18 = x:3

Write ratio as a fraction.

$\frac{12 \div \square}{18 \div 6} = \frac{\square}{3}$

$x = \square$

b) 15:25 = y:5

c) 2:3 = p:12

d) 1:6 = r:24

e) 3:12 = n:4

f) 4:c = 12:15

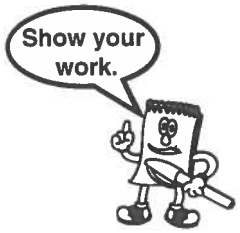
Rewrite! **12:15 = 4:c**

g) 12:t = 2:3

h) x:2 = 2:1

i) 3:2 = 15:a

Problems and Applications



6. Find the unknown values in each proportion.

a) $\frac{3}{n} = \frac{6}{14} = \frac{p}{28}$

b) $\frac{9}{15} = \frac{m}{5} = \frac{18}{y}$

Step 1: $\frac{3}{n} = \frac{6}{14}$ **Step 2:** $\frac{6}{14} \overset{\times\_\_}{\underset{\times\_\_}{\ }} = \frac{p}{28}$

Rewrite! $\frac{6 \div 2}{14 \div 2} = \frac{3}{\square}$

$p = \square$

$n = \square$

7. *Find the **unknown value** in each proportion.*

a) 1:3:5 = 2:y:10

Multiply each term by 2.

1:3:5 = (1 × **2**):(3 × **2**):(5 × **2**)

= $\square$: $\square$: $\square$

b) 6:3:4 = 36:a:24

Multiply each term by ____.

c) 3:6:9 = x:12:18

d) 2:5:7 = 8:20:n

8. The ratio of the **length to the width** of a flag is **2:1**. If the flag is 50 cm long, what is the width?

length / width

$\frac{2}{1} = \frac{50}{\square}$

9. The ratio of the length to the width of the Japanese flag is **3:2**. What is the length of a 30-cm wide Japanese flag?

length / width

10. At the Winter Olympics in Norway, the ratio of Norway's medals to Germany's medals was **13:12**. If Germany won 24 medals, how many did Norway win?

Skill Builder

1. Tick–Tack–Toe

First: Find the missing term in each proportion.

Second: Draw a straight line through the 3 proportions that have the **same** missing term.

$\frac{1}{3} = \frac{\square}{24}$	$\frac{20}{4} = \frac{\square}{1}$	$\frac{15}{\square} = \frac{5}{1}$
$\frac{1}{3} = \frac{3}{\square}$	$\frac{3}{4} = \frac{\square}{12}$	$\frac{3}{5} = \frac{\square}{15}$
$\frac{10}{8} = \frac{5}{\square}$	$\frac{1}{2} = \frac{5}{\square}$	$\frac{3}{5} = \frac{\square}{10}$

2. *What are the **next three** numbers in each pattern?*

a) 3, 6, 9, _____ , _____ , _____ .

b) 9, 18, 27, _____ , _____ , _____ .

c) 14, 21, 28, _____ , _____ , _____ .

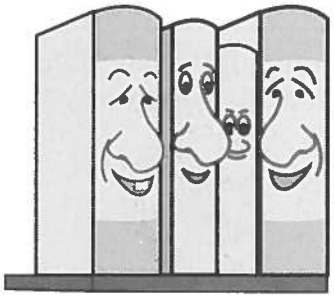
d) 10, 20, 30, _____ , _____ , _____ .

e) 12, 16, 20, _____ , _____ , _____ .

f) 40, 45, 50, _____ , _____ , _____ .

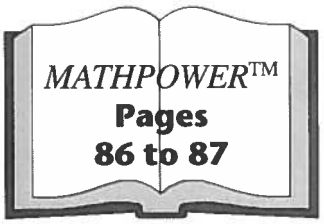
g) 18, 20, 22, _____ , _____ , _____ .

h) 15, 18, 21, _____ , _____ , _____ .



LEARNING TOGETHER Estimating With Ratios

Work together with your classmates, using your *MATHPOWER*™ student text, pages 86 and 87.



Skill Builder

1. *What is the **remainder (R)** in each division?*

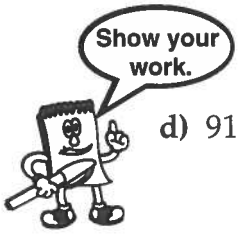
a) $11 \div 4$

$$4\overline{)11} \quad 2\ \text{R}\ \square \quad 8 \quad 3$$

R = □

b) $72 \div 7$ R = □

c) $17 \div 2$ R = □



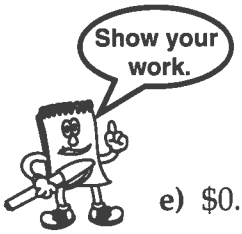
d) $91 \div 3$ R = □

e) $56 \div 5$ R = □

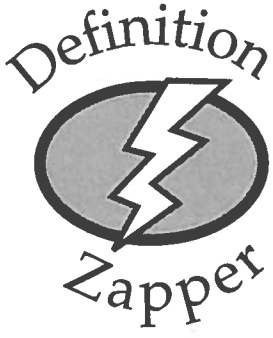
f) $85 \div 2$ R = □

2. *How much **change** would you receive from **$10.00** if your grocery bill was each of the following amounts?*

a) \$2.50 **b)** \$3.25 **c)** \$9.10 **d)** \$5.75



e) \$0.35 **f)** \$1.99 **g)** \$7.85 **h)** \$3.70



Write the definition of:

ratio _____

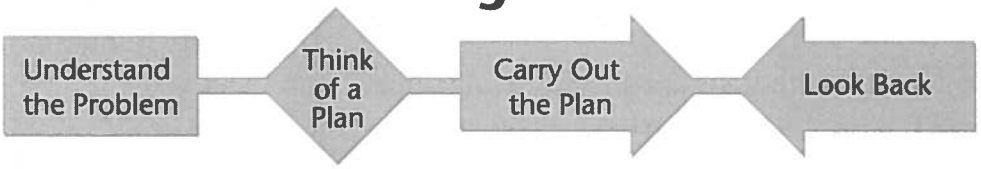
_____

_____

_____

_____

3.3 Problem Solving: Draw and Read Graphs

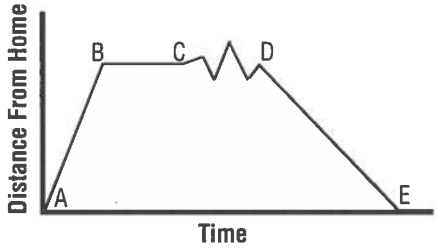


PROBLEM SOLVING

Problems and Applications

1. Karen and Isabel live near a lake. They left their house at noon to go for a walk on the beach. The graph shows their distance from home at any one time.

Describe what was happening between each of the following:



a) between **A and B,**

_____

_____

_____

b) between **B and C,**

_____

_____

c) between **C and D,**

_____

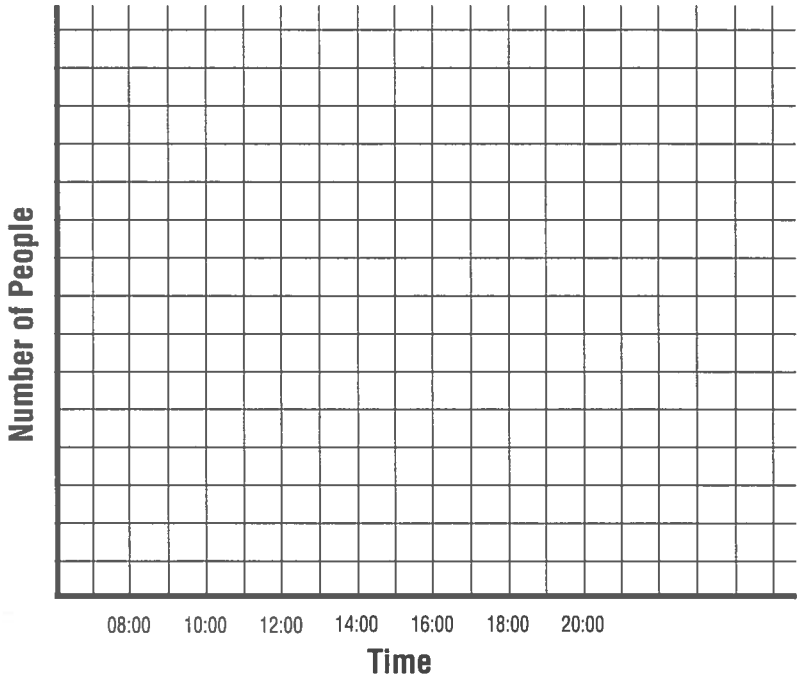
_____

d) between **D and E.**

_____

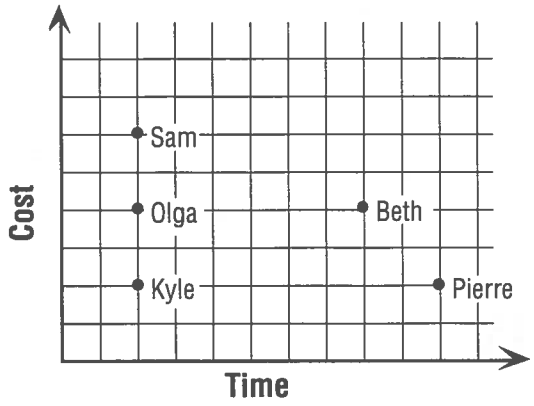
_____

2. Sketch a graph of the number of people in your school compared to the time of day.



Think:
"About how many people are in your school during the dinner hour..?"

3. Karl phoned 5 of his friends from the airport. The graph shows the friends he called. It also shows how long he talked and the cost of each call.



a) Which calls cost the same?

_____

_____

b) To whom did he talk for the longest time?

_____

_____

c) Which of his friends lives the farthest from the airport? _____

Explain. _____

4. a) Write a problem that requires a sketch of a graph.
   b) Sketch the graph of your problem.

Use a sheet of looseleaf and/or grid paper.

Skill Builder

1. *Are the ratios in each pair* ***equivalent****? "Yes" or "No"*

a) $\frac{4}{8} = \frac{8}{14}$ _____

b) $\frac{3}{4} = \frac{30}{40}$ _____

Think: $\frac{4}{8} \overset{\times 2}{=} \frac{8}{\square}$ ($\times 2$)

c) $\frac{27}{9} = \frac{3}{1}$ _____

d) $\frac{9}{4} = \frac{27}{20}$ _____

e) $\frac{1}{6} = \frac{16}{24}$ _____

f) $\frac{8}{7} = \frac{24}{21}$ _____

2. *Divide.*

a) $53 \div 10 =$ _____

b) $652 \div 1000 =$ _____

c) $219 \div 100 =$ _____

d) $101 \div 1000 =$ _____

e) $61 \div 100 =$ _____

Move the decimal to the ***left.***

NO CALCULATOR

3. *Divide.*

a) $78 \div 0.1 =$ _____

b) $34 \div 0.01 =$ _____

c) $9 \div 0.01 =$ _____

d) $96 \div 0.01 =$ _____

e) $8 \div 0.1 =$ _____

Move the decimal to the ***right.***

3.4 Rate

Practice

1. *Complete each proportion.*

Example: $\frac{12}{4} = \frac{\square}{1}$

Method 1: $\frac{12}{4} \overset{\div 4}{\underset{\div 4}{}} = \frac{\boxed{3}}{1}$ *or* Method 2: *Press* C 12 ÷ 4 =

$\frac{12}{4} = \frac{\boxed{3}}{1}$

a) $\frac{15}{3} = \frac{\square}{1}$ b) $\frac{21}{7} = \frac{\square}{1}$ c) $\frac{30}{5} = \frac{\square}{1}$

d) $\frac{28}{4} = \frac{\square}{1}$ e) $\frac{49}{7} = \frac{\square}{1}$ f) $\frac{40}{5} = \frac{\square}{1}$

2. *Complete each statement.*

a) 48 bread rolls in 6 bags = ☐ rolls/bag.

rolls / bags

$\frac{48}{6} = \frac{\square}{1}$

b) 90 students on 3 buses = ☐ students/bus.

students / buses

c) \$28 for 4 hours work = \$☐/hour.

d) 300 km in 5 h = ☐ km/h.

e) 5 pairs of socks for \$25 = \$☐/pair.

f) One dozen eggs for \$1.20 = ☐¢/egg.

3. *Write as a **unit rate**.*

a) 1000 paper clips in 10 boxes

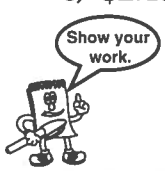
$\frac{1000}{10} = \frac{\square}{1}$

☐ paper clips/box.

b) 60 cm in 6 s

Unit price — *price of* **1** *item*

c) \$2.40 for 6 bagels

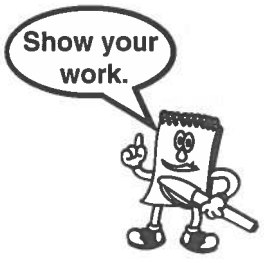


d) \$1000 for 5 plane tickets

e) 40 slices of apple pie for 20 people

f) wages of $50.00 for 5 h

Problems and Applications



4. Scott drove at 90 km/h. How far did he drive in 3 h?

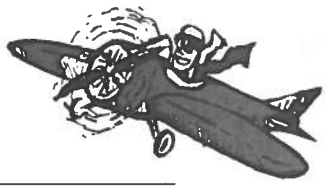
$\frac{speed}{h}$ $\quad \frac{90}{1} = \frac{\square}{3}$

5. Eight bus tickets cost $12.

a) What is the cost of 1 ticket?

b) What is the cost of 5 tickets?

6. An aircraft flies at 700 km/h. How far will it fly in 4 h?



7. a) Look at the job section of a newspaper. Find 4 jobs that pay by the hour. Cut them out and paste them on a sheet of looseleaf.

b) Order the jobs from lowest paid to highest paid.

Skill Builder

1. *Complete each proportion.*

a) $\frac{8}{2} = \frac{\square}{1}$ $\quad$ b) $\frac{30}{6} = \frac{\square}{1}$ $\quad$ c) $\frac{9}{3} = \frac{\square}{1}$

d) $\frac{35}{5} = \frac{\square}{1}$ $\quad$ e) $\frac{10}{2} = \frac{\square}{1}$ $\quad$ f) $\frac{42}{7} = \frac{\square}{1}$

2. *What is the **total value** of the <u>underlined</u> digit in each number?*

a) 72 4<u>5</u>6 ⟶ 5 tens *or* 50 $\quad$ b) 3<u>6</u>04 ⟶ _____

c) 8<u>7</u> 506 ⟶ _____ $\quad$ d) 52 3<u>1</u>6 ⟶ _____

e) 1<u>2</u> 764 ⟶ _____ $\quad$ f) 0.<u>3</u>8 ⟶ _____

g) 1.29<u>4</u> ⟶ _____ $\quad$ h) 10.6<u>5</u>8 ⟶ _____

3.5 Comparing Unit Rates and Unit Prices

Practice

1. *Find the **unit price**.*

a) \$4.50 for 5 pens

cost / number of pens

$\frac{4.50}{5} = \square$

Press C 4.50 ÷ 5 =

Unit price—price of 1 item

"#" symbol for number

____ /pen

b) \$17.80 for for 10 floppy disks

cost / # of floppy disks

c) \$4.40 for 4 L of milk

d) 12 biscuits for \$3.60

2. *Find the **unit price**. **Round** to the nearest cent (2 decimal places).*

a) 24 cans of soda for \$8.99

cost / # of cans

$\frac{8.99}{24} = \square$

Press C 8.99 ÷ 24 =

____ /can

b) 10 kg of flour for \$5.88

c) 3 L of orange juice for \$5.97

d) 200 sheets of paper for \$5.97

3. *Find the **unit rate**.*

a) keyboarding 520 words in 10 min

words / min

$\frac{520}{10} = \square$

Press C 520 ÷ 10 =

The unit rate is ____ words/min

b) driving 180 km in 4 h

c) running 27 km in 6 days

d) sharing 6 pizzas among 8 students

Problems and Applications

Round your answers to the nearest cent.

Show your work.

4. Fruit juice is advertised at \$5.99 for 8 packages.
   a) What is the unit price per package?

CHECK:

Sentence: _____

b) If there are 3 boxes in each package, what will one box of juice cost?

CHECK:

Sentence: _____

5. Jason bought 3.5 kg of apples for \$5.25. What is the cost of 10 kg of apples?

Step 1: Find the cost of 1 kg of apples.

Step 2: Find the cost of 10 kg of apples.

CHECK:

Sentence: _____

6. *Which is the **better buy**?*
   8 granola bars for \$1.89 ***or*** 12 bars for \$2.99

*Find the cost of **1 bar**.*

$\frac{\text{cost}}{\text{bars}}$ $\frac{\$1.89}{8} = \square$ ***or*** $\frac{\$2.99}{12} = \square$

$\square$/bar $\square$/bar

$\square$ is the better buy.

7. Which is the *better buy*?

a) $13.00 for 10 bus tokens ***or*** $4.50 for 3 tokens

_____

b) 1 L of orange juice for $1.99 ***or*** 2 L for $2.99

_____

8. Aaron earned $105.00 for 12 h of cutting lawns.
Brad earned $126.75 for 15 h of packing groceries.

a) What is the rate of pay per hour that each boy made?

Aaron: Brad:

_____ _____

b) Who had the higher rate of pay and by how much?

_____

Skill Builder

1. *Round each number to the stated place value.*

a) 40.31 (nearest ten) ⟶ _____

b) 0.268 (nearest hundredth) ⟶ _____

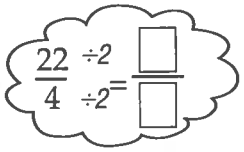
c) 1.89 (nearest one) ⟶ _____

d) 7.052 (nearest tenth) ⟶ _____

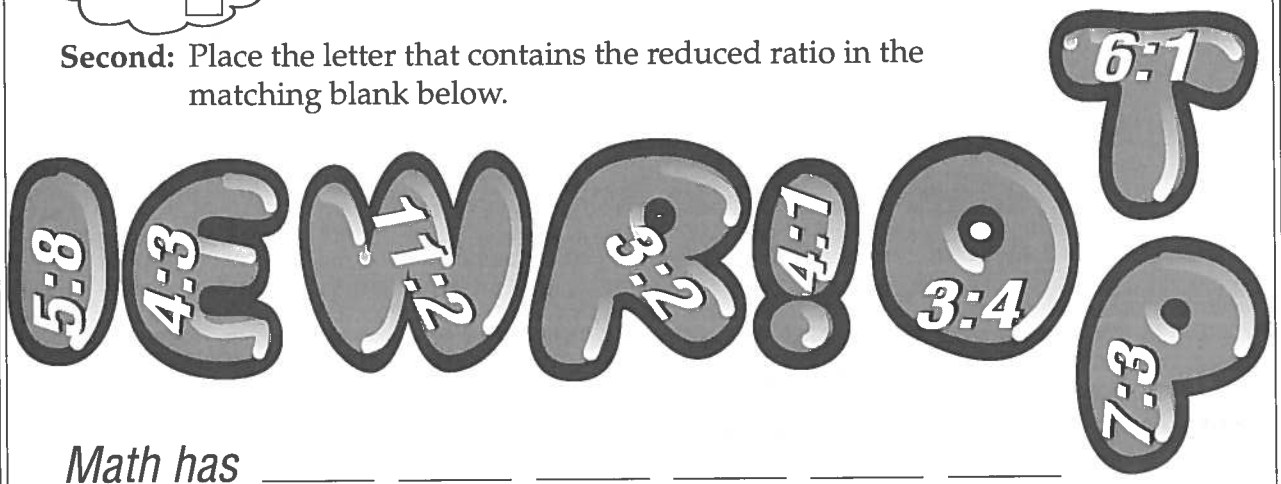
2. *What is the message?*

First: Reduce each ratio to **lowest terms**.

a) 22:4 **b)** $\frac{32}{8}$ **c)** $\frac{21}{9}$ **d)** $\frac{18}{12}$ **e)** $\frac{33}{44}$ **f)** $\frac{20}{15}$



Second: Place the letter that contains the reduced ratio in the matching blank below.

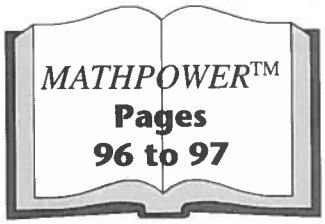


Math has _____ _____ _____ _____ _____ _____

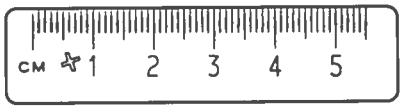
c) e) a) f) d) b)

LEARNING TOGETHER Enlargements And Reductions

Work together with your classmates, using your *MATHPOWER*™ student text, pages 96 and 97.



Skill Builder



1. *Complete each statement.*

a) 4 m = _____ cm **b)** 25 m = _____ cm *1 m = 100 cm*

c) 60 mm = _____ cm **d)** 120 mm = _____ cm *1 cm = 10 mm*

e) 3 km = _____ cm **f)** 40 km = _____ cm *1 km = 100 000 cm*

2. *Place* **>** *or* **<** *in each* □ *to make the statement true.*

> means greater than.

a) 53.5 □ 55.5 **b)** 6.002 □ 6.02 **c)** 3.11 □ 3.01

d) 77.71 □ 77.17 **e)** 0.09 □ 0.9 **f)** 21.21 □ 21.12

3.6 Scale Drawings

Practice

1. *Write each ratio in* ***lowest terms.***

a) 4:12 = ☐ : ☐

$\frac{4}{12} \overset{\div 4}{=}$

b) 5:15 = _____

c) 10:100 = _____

d) 10:1000 = _____

e) 40:4 = _____

f) 20:2 = _____

2. *Write each* ***scale*** *as a* ***ratio*** *in lowest terms.*

Remember: *cm:cm or mm:mm or m:m*

a) 1 cm represents 25 cm — 1: ☐

b) 1 cm represents 1 m

1 m = 100 cm

c) 1 cm represents 3 m

3 m = ☐ cm

d) 5 cm represents 5 m

Step 1: 5 m = ☐ cm

Reduce!

Step 2: $\frac{5}{\square} = \frac{1}{\square}$

e) 1 cm represents 1 km

1 km = 100 000 cm

f) 1 cm represents 4 km

4 km = _____ cm

g) 1 cm represents 1 mm — 10: ☐

Note: 1 cm = 10 mm

h) 1 cm represents 2 mm

Think: *1 cm = _____ mm* → ***Then,*** *____ : 2* → *Reduce!*

i) 1 cm represents 5 mm

____ : ____

Reduce!

Examples:

1. 1 cm represents 15 cm

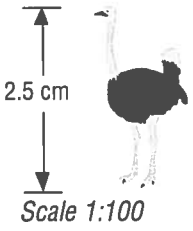
1:15

2. 1 cm represents 2 m

1 m = 100 cm
*2 m = **200** cm*

1:200

3. Find the actual height of the ostrich, in **metres**.



length of drawing / actual length (a)

$$\frac{1}{100} = \frac{2.5}{a}$$

$$\frac{1}{100} \times \frac{2.5}{2.5} = \frac{2.5}{\square}$$

$a = \square$ cm

*Change **cm** to **m***
1 m = 100 cm

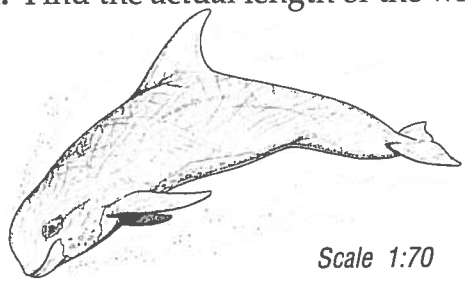
$\square$

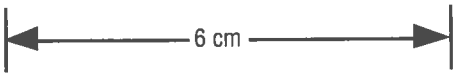
m c

$= \_\_\_\_\_$ m

Sentence: _____

4. Find the actual length of the whale, in **metres**.

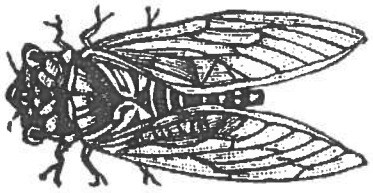


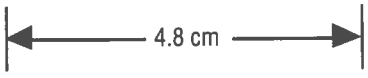


length of drawing / actual length (a)

Remember:
*Change **cm** to **m***

5. Find the actual length of the housefly, in **millimetres**.





length of drawing / actual length (a)

$$\frac{8}{1} = \frac{4.8}{a}$$

$$\frac{1}{100} \times \frac{0.6}{0.6} = \frac{4.8}{\square}$$

$a = \square$ cm

Change cm to mm
1 cm = 10 mm

$\square$ cm $= \square \times 10$

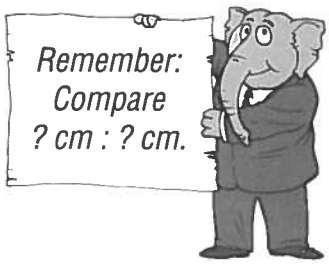
$= \_\_\_\_\_$ mm

6. Decide on a suitable scale you would use to make a drawing of yourself. Try to draw yourself!

Do on grid paper!

Skill Builder

1. *Write each scale as a ratio in* ***lowest*** *terms.*



a) 1 cm represents 10 cm 1: ☐

b) 1 cm represents 5 m

1 m = 100 cm
5 m = _____ cm

1: ☐

c) 1 cm represents 10 m

d) 1 cm represents 15 cm

e) 1 cm represents 8 m

f) 1 cm represents 1 km

1 km = 100 000 cm

2. *Estimate.*

NO CALCULATOR

a) 64 × 76

Est.
60
×80

b) 27 × 436

Est.

c) 19 × 805

Est.

d) 82 × 330

Est.

e) 36 × 72

Est.

f) 53 × 572

Est.

Design Zapper

Make an enlargement of the map of one province of Canada.
Now, mark the capital city on your map with a ★.

3.7 Maps and Scales

Remember: 1 m = 100 cm
1 km = 100 000 cm

Practice

1. *Represent each of the following scales in another way.*

a) 1:400 **1 cm represents** ☐ **m**

Hint: 400 cm = _____ m

b) 1:800

800 cm = _____ m

c) 1:500 000 **1 cm represents** ☐ **km**

500 000 cm = _____ km

d) 1:100 000

e) 0 10 20 30 km

Think: 1 cm represents 10 km
10 km = _____ cm

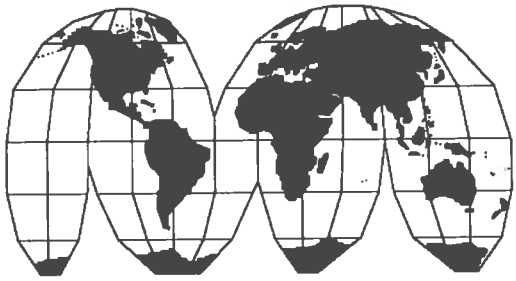
1: ☐

f) 0 100 200 300km

1 cm represents _____ km
_____ km = _____ cm

1: ☐

g) 0 25 50 75 km



2. A map has a scale of 1:1 500 000. What actual distance, in **kilometres**, is represented
a) by 1 cm? **b)** by 3 cm? **c)** by 4.8 cm?

$$1\ 500\ 000 \text{ cm} = \frac{1\ 500\ 000}{100\ 000}$$

$$= \_\_\_\_\_$$

So, 1 cm represents

☐ **km.**

3. A map has a scale of 1:3 000 000. What distance, **in centimetres**, represents an actual distance of 150 km?

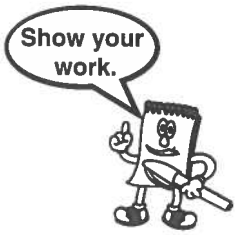
Remember: 1 m = 100 cm
1 km = 100 000 cm

Step 1: 150 km = ☐ cm

Step 2: $\frac{\square}{3\ 000\ 000}$ = ____ cm

Sentence: ☐ cm represents 150 km.

Problems and Applications



4. On a map, the distance from Montréal to Berlin is 7.5 cm. The scale is 1 cm represents 800 km. What is the actual distance, in kilometres, from Montréal to Berlin?

Let d = distance from Montréal to Berlin.

$\frac{\text{distance on map (cm)}}{\text{actual distance (km)}}$

$$\frac{1}{800} = \frac{7.5}{d}$$

$$= \frac{1 \times 7.5}{800 \times 7.5}$$

$$= \frac{7.5}{\square}$$

d = ____

Sentence: _____

5. The scale on a map is 1 cm represents 100 km. Find the actual distance for

a) 8 cm.

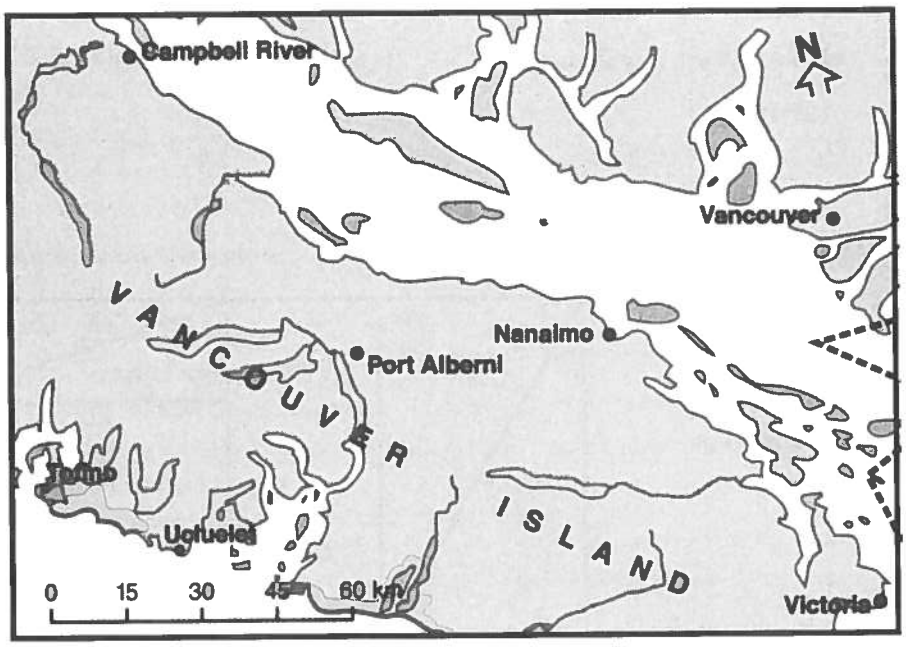
b) 2.3 cm.

Sentence: _____

Sentence: _____

Remember: 1 m = 100 cm
1 km = 100 000 cm

6. *Use the map of Vancouver Island to complete the questions below.*



a) Find the distance from Victoria to Nanaimo.

Distance on map is _____ cm.

First: *Use a ruler to measure the distance, in cm, between the cities.*

Second: *Let d = distance from Victoria to Nanaimo.*

$$\frac{1}{15} = \frac{5}{d}$$

cm on map / actual distance

$$= \frac{1 \times 5}{15 \times 5}$$

$$= \frac{5}{\square}$$

$$d = \square$$

Sentence: _____

b) Find the distance from Vancouver to Nanaimo.

Sentence: _____

Skill Builder

1. *Write the missing factors.*

   a) $4 \times 3 \times \square = 24$

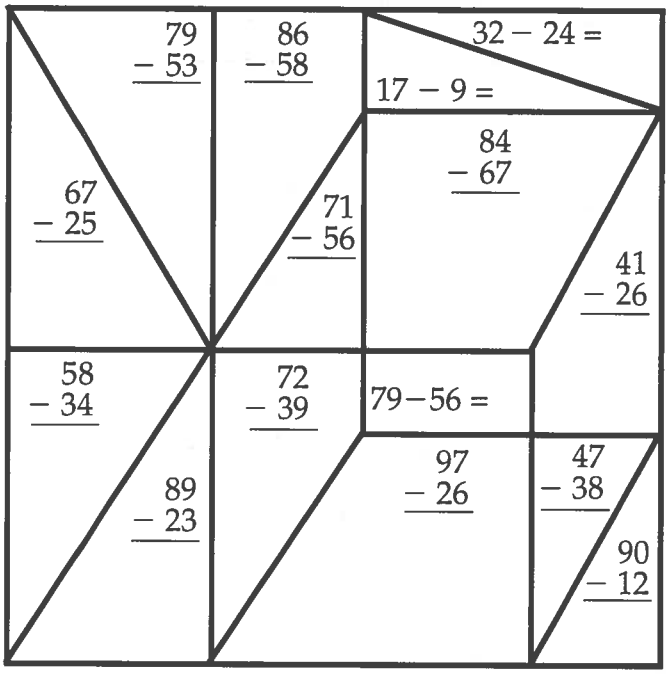
   b) $2 \times \square \times 5 = 30$

   c) $\square \times 2 \times 2 = 8$

   d) $\square \times 3 \times 2 = 12$

Guess and check!

2. a) *Do the subtraction in the square below.*
   b) *Then, shade all areas that have an* ***odd*** *number* ***for an answer.***



c) Describe the hidden shape.

_____

Pattern Zapper

Complete the following:

a) **3** *is to* **15** *as* **4** *is to* **20** *as* **8** *is to* ☐.

b) **6** *is to* **3** *as* **18** *is to* **9** *as* **40** *is to* ☐.

c) **Horse** *is to* **colt** *as* **cat** *is to* **kitten** *as* **goose** *is to* ☐.

d) **A** *is to* **C** *as* **D** *is to* **F** *as* **G** *is to* ☐.

e) **Walk** *is to* **run** *as* **whisper** *is to* ☐.

f) **Plane** *is to* **pilot** *as* **car** *is to* **driver** *as* **train** *is to* ☐.

g) **Spring** *is to* **rain** *as* **winter** *is to* ☐.

3.8 Problem Solving: Use a Diagram

Problems and Applications

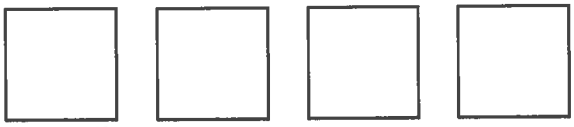
Understand the Problem

Think of a Plan

Carry Out the Plan

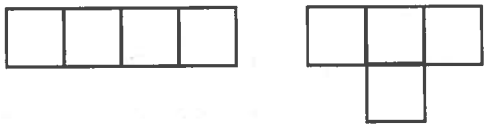
Look Back

1. Four identical squares can be made with 16 toothpicks.



"Identical" means exactly the same.

The following diagrams show how 4 identical squares can be made with 13 toothpicks.



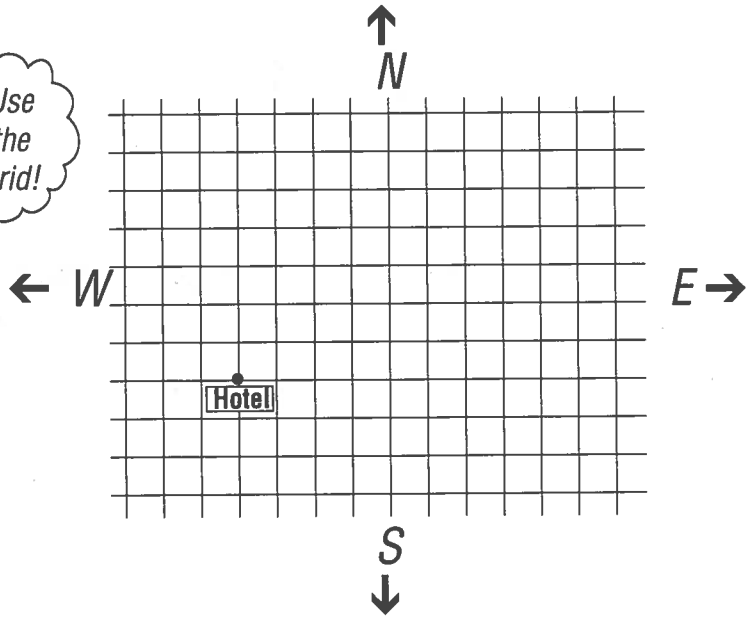
Try *different ways of putting the 4 squares together.*

Use **12** toothpicks to make a different model of 4 identical squares. Draw your model.

Use toothpicks!

2. Mr. Rivers was going on a sightseeing tour. His bus left the hotel and went 3 blocks due south, 8 blocks due east, 3 blocks due north, and 2 blocks due west, and stopped. Where did the bus stop in relation to the hotel?

Use the grid!



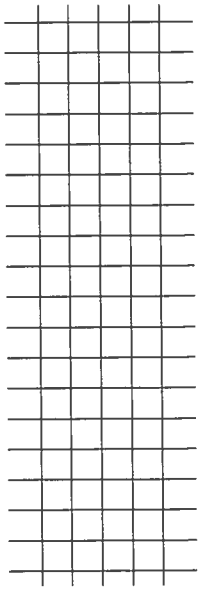
Sentence: _____

_____

_____

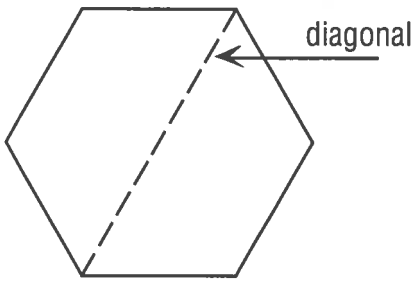
3. An elevator started on the ground floor. It rose 12 floors, came down 5 floors, rose 3 floors, came down 2 floors, rose 4 floors, and came down 6 floors. Now, on which floor is the elevator?

Use the grid!



Sentence: _____

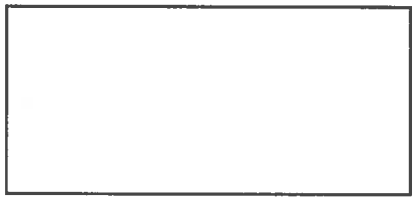
4. How many diagonals does a regular hexagon have?



Hint: Draw the diagonals.

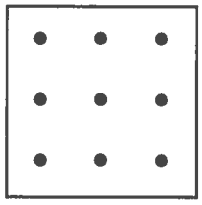
Sentence: _____

5. Norah needs to fence a rectangular yard 8 m by 12 m. She wants the fence posts 2 m apart with a post in each corner. How many fence posts will she need?



Sentence: _____

6. How many different-sized squares can you make on a 3 by 3 geoboard?



Sentence: _____

Review

1. *Find the missing value in each proportion.*

a) $\frac{6}{5} = \frac{18}{\square}$

Hint: $\frac{6}{5} \overset{\times 3}{\underset{\times 3}{}} = \frac{8}{\square}$

b) $\frac{7}{10} = \frac{\square}{50}$

c) $\frac{\square}{9} = \frac{4}{3}$

Hint: $\frac{4}{3} = \frac{\square}{9}$

d) $\frac{5}{4} = \frac{15}{\square}$

e) $\square :2 = 5:10$

Hint: $\frac{5}{10} = \frac{\square}{2}$

f) $12:15 = 4:\square$

g) 32: $\square$ = 8:7 h) 40:25 = $\square$:5 i) $\square$:3 = 6:9

2. *Find the unknown values in each proportion.*

a) $\frac{n}{16} = \frac{4}{8} = \frac{2}{m}$

Step 1:

Solve:

$\frac{4}{8} = \frac{\square}{16}$

$= \frac{4}{8}$ (×2)

$= \frac{\square}{16}$

$n =$ _____

Step 2:

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

$= \frac{4}{8}$ (÷2)

$= \frac{2}{\square}$

$m =$ _____

b) $\frac{3}{w} = \frac{1}{12} = \frac{2}{x}$

c) 100:200:700 = 1:*p*:7

= (**100** ÷ 100):(**200** ÷ 100):(**700** ÷ 100)

= 1 : $\square$: 7

So, *p* = _____

Hint: *Divide each term by 100.*

d) 6:8:12 = 3:4:*y*

e) 3:7:2 = 15:*x*:10

3. *Write **two** ratios equivalent to each ratio.*

Example:

$5:10 = (5 \times 3):(10 \times 3) = 15:30$ *or* $5:10 = (5 \div 5):(10 \div 5) = 1:2$

***Multiply** each term by the same number.* *or* ***Divide** each term by the same number.*

a) 9:12 **b)** 5:10:25

4. Michelle's mass and Jeanine's mass are in the ratio of 5:4. Michelle's mass is 45 kg. What is Jeanine's mass?

Michelle / Jeanine $\frac{5}{4} = \frac{45}{\square}$ *or* $5:4 = 45:\square$

CHECK:

Sentence: _____

5. A car travels 300 km in 3 h.

a) How far would the car travel in 1 h?

distance / time

CHECK:

Sentence: _____

b) How far would the car travel in 5 h?

Sentence: _____

6. The ratio of the top speed of a lion to the top speed of a hyena is 5:4. A lion's speed is 80 km/h. What is the hyena's top speed?

lion / hyena

CHECK:

Sentence: _____

7. Don earned $30.00 for 6 h of window washing. Whitney earned $24.00 for 4 h of painting. Who had the higher rate of pay?

Hint: *What did Don earn in 1 h?*

Hint: *What did Whitney earn in 1 h?*

CHECK:

Sentence: _____

8. *Calculate the* ***unit price.***

Find the cost of 1 item.

a) $15.00 for 3 pens

cost / pen $\frac{15}{3} = \square$

$\frac{\square}{\text{pen}}$

b) $5.00 for 10 apples

_____

c) $40.00 allowance for 4 weeks

_____

d) 8 hot dogs for $16.00

_____

9. *Which is the better buy?*

a) 2 kg of potatoes for $1.28 ***or*** 5 kg for $3.00

Find the unit price.

$\frac{\$1.28}{2} = \square$

Press: C 1.28 ÷ 2 =

$\frac{\$3.00}{5} = \square$

Press: C 3 ÷ 5 =

Sentence: _____

b) 3 bagels for $1.29 ***or*** 8 bagels for $2.99

Sentence: _____

c) 12 cans of soda for $4.92 ***or*** 6 cans for $2.39

Sentence: _____

10. **Measure** the length of the car. The scale is **1:80**. What is the actual length of the car?

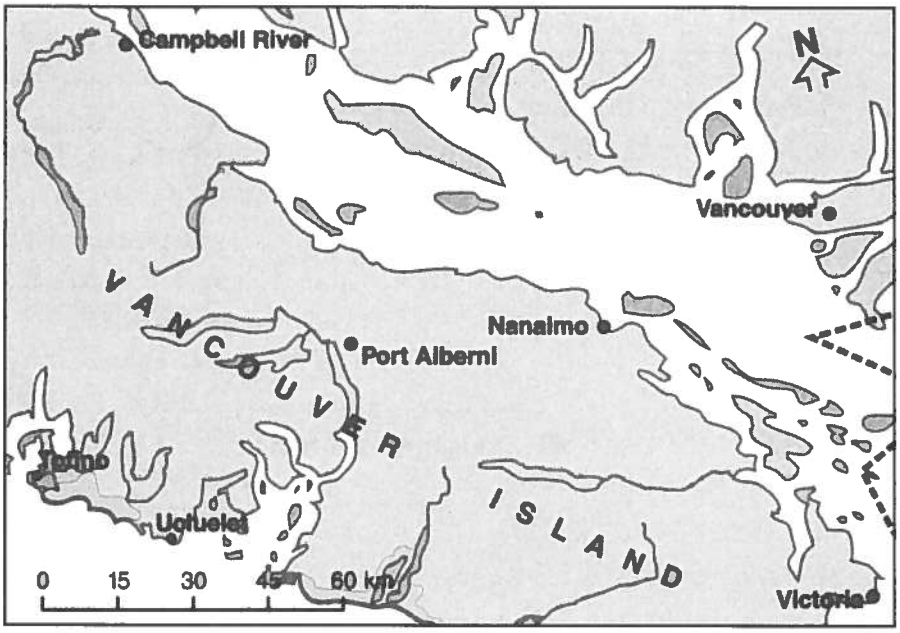
$$\frac{1}{80} = \frac{\square}{a}$$

length of drawing ← $\square$

actual length ← a

Sentence: _____

11. Use the map below to find the actual distance from Vancouver to Victoria, in km.

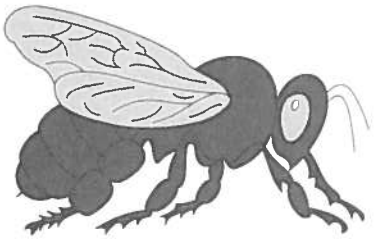


Hint: See page 146.

$$\text{Scale} = \frac{\text{length in cm on map}}{\text{actual distance}}$$

Sentence: _____

12. Find the actual length of a bee, in millimetres.



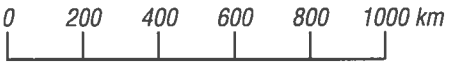
Scale 5:1

Hint: Measure the bee.

$$\frac{\text{length of drawing}}{\text{actual length}}$$

Sentence: _____

13. The distance on a map between Whitehorse and Saskatoon is 13 cm. The scale is



What is the actual distance in km between Whitehorse and Saskatoon?

Sentence: _____

14. The table shows the masses and volumes of different amounts of materials.

a) *Complete the table.*

Density = Mass ÷ Volume

Material	Mass (g)	Volume (cm^3)	Density (g/cm^3)
Aluminum	41.85	15.5	41.85 ÷ 15.5 = ☐
Steel	192.5	25	192.5 ÷ 25 = ☐
Turpentine	34.4	40	

b) Arrange the materials from the lowest density to the highest density.

_____

_____

Chapter Check

1. *Write 3 ratios equivalent to* ***6:4****.*

$\frac{6}{4} = \frac{\square}{\square} = \frac{\square}{\square} = \frac{\square}{\square}$

Hint: $\frac{6}{4} \overset{\times 3}{=} \frac{\square}{12}$ *or* $\frac{6}{4} \overset{\div 2}{=} \frac{\square}{12}$

2. *Find the missing value in each of the following proportions.*

a) $\frac{9}{11} = \frac{18}{\square}$

$\frac{6}{4} = \frac{9 \times 2}{11 \times 2}$

$= \frac{18}{\square}$

b) $\frac{10}{6} = \frac{\square}{3}$

c) $\frac{24}{x} = \frac{8}{3}$

Rewrite: $\frac{8}{3} = \frac{24}{x}$

$\frac{8}{3} = \frac{8 \times 3}{3 \times \square}$

$= \square$

d) $\frac{x}{4} = \frac{28}{16}$

3. *Find the missing vlaue in each proportion.*

a) $5:2:10 = 25:a:b$

$= (5 \times 5) : (2 \times 5) : (10 \times 5)$

So, $a =$ _____

$b =$ _____

Multiply each term by 5.

b) $4:3:2 = x:12:y$

Multiply each term by _____.

c) $\frac{4}{7} = \frac{p}{70} = \frac{4}{7}$

$\frac{4}{7} = \frac{p}{70}$

$= \frac{4 \times \square}{7 \times 10}$

$= \frac{\square}{70}$

$\frac{4}{7} = \frac{400}{q}$

d) $\frac{15}{10} : \frac{30}{k} : \frac{w}{2}$

$\frac{15}{10} = \frac{30}{k}$

4. A basketball team won 2 out of every 3 games they played in a season. They played 30 games. How many games did they win?

wins / games played

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

Sentence: _____

5. Camille Noel is a Canadian runner. She won the 400 m race in about 53 s. What was her speed in metres/second?

Hint: Divide!

Round your answer to 2 decimal places.

Sentence: _____

6. The ratio of cities in New Brunswick to cities in Saskatchewan is **3:6**. There are 12 cities in Saskatchewan. How many cities are there in New Brunswick?

Hint:
New Brunswick:Sask.

Sentence: _____

7. Darcy ran 8 laps of the track in 12 min. Orly ran 5 laps of the same track in 8 min.

a) How many laps did Darcy run in 1 min?

$\frac{8}{12}$ = _____ laps/min.

b) How many laps did Orly run in 1 min?

Sentence: _____ **Sentence:** _____

c) Who ran faster? _____

8. If 125 g of fruit cost $3.75, what is the unit price?

Find:
□/g

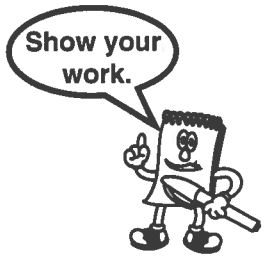
Sentence: _____

9. Which is the better buy?

a case of 24 fruit drinks for $6.99

or

a 6-pack of the same fruit drinks for $1.99

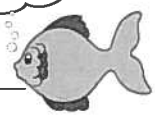


Sentence: _____

10. The length of a fish is 30 cm. What is the length of the drawing if the **scale is 1:5**?

$\frac{\text{length of drawing}}{\text{actual length}}$

Set up a proportion!



Sentence: _____

11. Halifax is 880 km from St. John's. If the two cities are 4 cm apart on the map, what is the scale?

1 km = 100 000 cm

880 km = ☐ cm

length on map (cm) / actual length (cm) → $\frac{4}{\square} = \frac{1}{\square}$ ← ***Reduce the fraction!*** *(÷ 4)*

Sentence: _____

Problem Solving: Using the Strategies

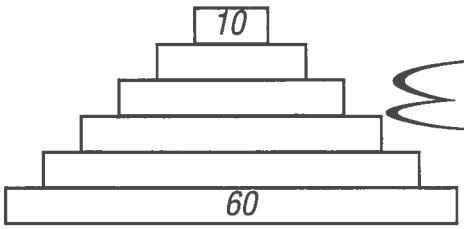
Show all your work on looseleaf!

PROBLEM SOLVING

Understand the Problem → Think of a Plan → Carry Out the Plan → Look Back

1. As you move from the top step to the bottom step on this set of stairs, the length of each step increases by the same amount.

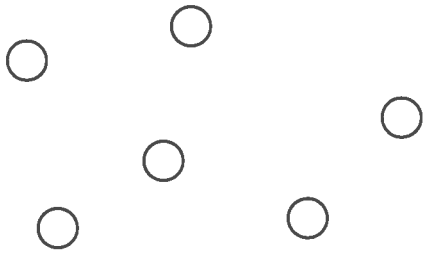
Find the lengths of the middle four steps.



Pattern is 10, _____ , _____ , _____ , _____ , 60.

2. Here are 6 towns. There are **only 5 roads** joining the towns. You can start at any town and get to any other town on these roads. The roads **may not** cross.

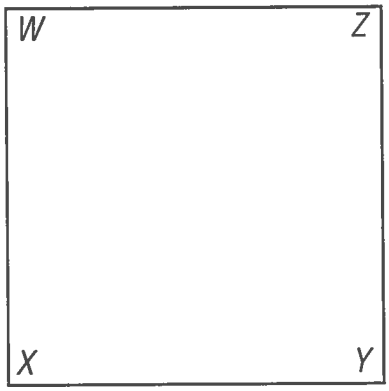
Draw where these roads can be located.



3. You must be at work by 08:30. You take 30 min to get there by bus. Before you leave, you need 30 min to shower and get dressed. You need 25 min to make and eat breakfast. At what time should you get up?

Work backward!

4. **Trace** the square below. Then, cut it out. What figure is formed when you make each on the following folds?



a) Fold *W* onto *Z*.

Figure is a _____.

b) Fold *W* onto *Y*.

Figure is a _____.

c) Fold *W* onto *Z*; then, *Z* is folded onto *Y*.

Figure is a _____.

DATA BANK

1. Jan lives in Windsor, Ontario. She called her friend in Vancouver, British Columbia at 22:00. What time was it in Vancouver when she called?

_____

2. List two cities on the TransCanada Highway 1

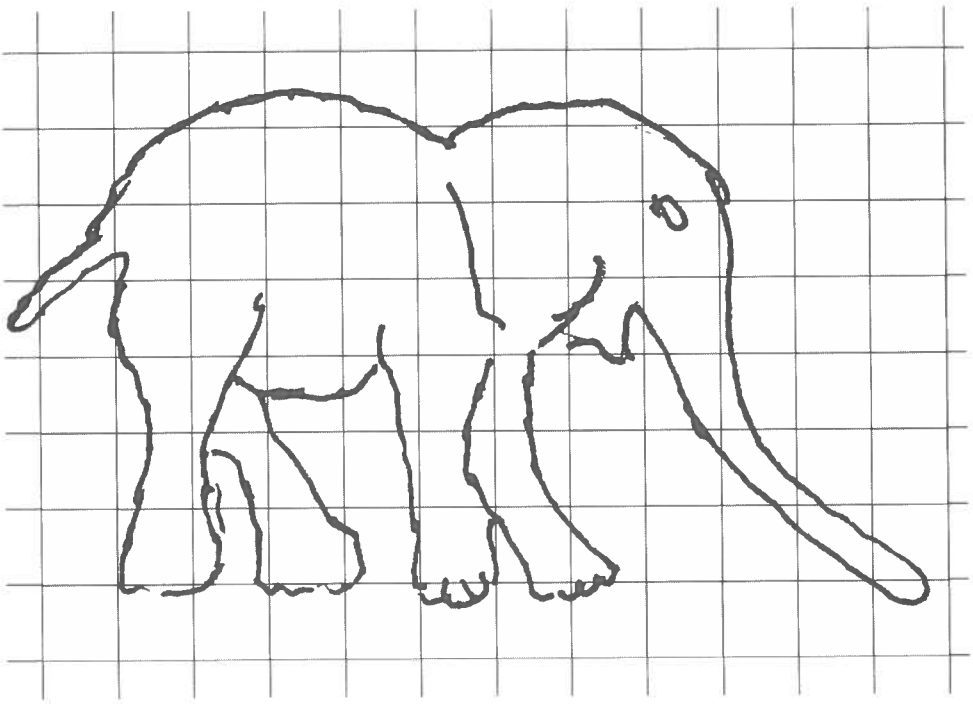
_____

See page 360 of your MATHPOWER™ student text.

Use an atlas!

Design Zapper

The following figure is drawn on 1 cm grid paper.
Draw its enlargement on a 3 cm grid.



Draw a 3 cm grid!

Use poster paper!