EVALUATING
ACADEMIC READINESS
FOR APPRENTICESHIP TRAINING
Revised for
ACCESS TO APPRENTICESHIP

MATHEMATICS SKILLS
RATIO AND PROPORTION

AN ACADEMIC SKILLS MANUAL
for
The Horticulture Trades
This trade group includes the following trades:
Arborist, and
Horticulturist

Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities

Revised 2011

In preparing these Academic Skills Manuals we have used passages, diagrams and questions similar to those an apprentice might find in a text, guide or trade manual.

This trade related material is not intended to instruct you in your trade. It is used only to demonstrate how understanding an academic skill will help you find and use the information you need.

MATHEMATICS SKILLS
RATIO AND PROPORTION

An academic skill required for the study of the Horticulture Trades

INTRODUCTION

Comparing Numbers

Numbers are compared in a variety of ways. One way to compare numbers is to note their difference.

> **Example:** If you plant a 6 meter maple tree and a 4 meter one, you say that the first tree is 2 meters taller than the second. In this comparison, we subtract to find the difference.

We can also compare the height of the two trees by division.

> **Example:** If the height of the first tree is divided by the height of the second one (6 ÷ 4 = 1 1/2), we can say that the first tree is one and a half times taller than the second.

We can compare by using a ***ratio***. A ratio also compares numbers in a form that indicates division. Usually the numbers in a ratio are reduced to lowest terms but not actually divided.

Ratios give useful information about the relationship between numbers. Ratios are used to describe such things as the relationship between the amounts of nitrogen to potassium in green grass tissue or the relationships among chemicals in pesticides and fertilizers.

> **Example:** If we say that the ratio of nitrogen to potassium is 5 to 2, it means that there are 5 parts of nitrogen for every 2 parts of potassium in grass leaf tissue. Although we don't know the actual amounts of nitrogen and potassium in a leaf, we know that grass needs two and a half times (5 ÷ 4 = 2 1/2) the amount of nitrogen compared to the amount of potassium.

> **Example:** To make a solution of an acidifying fertilizer and water, you must mix the fertilizer and water in the ratio of 5 milliliters of fertilizer to 1 liter of water. If you want to make 6 liters of solution, you know that you have to mix 30 milliliters (5 x 6 = 30) of fertilizer to 6 liters of water.

Ratios are also used to solve problems of proportion, and to read blueprints that are drawn to scale.

This skills manual looks at the following topics concerning ***ratio, proportion, and scale***:

- Ratio, including
  - finding ratios from given information
  - rates
- Proportions, including
  - direct and indirect (inverse) proportions
  - solving a proportion when three out of four terms are known
  - solving problems using proportions
- Scale

RATIO

Comparing two numbers by writing a ratio: Say one tree is 3 meters high and another is 4 meters high. You can compare the two heights by writing them as a ratio.

There are several ways to indicate this ratio:

1. **By comparing one amount to another**, as when we say 3 to 4 (or 3 out of 4).
2. **By putting a colon between the numbers.** The ratio is written 3:4. We read this as "*the ratio of three to four*".
3. **By writing the ratio as a fraction.** The first number being compared becomes the numerator, which is placed over the second number, the denominator. The ratio is written 3/4. The fraction is usually written in lowest terms.. Remember that the fraction form indicates division of the numerator by the denominator.

When you write a ratio, you don't actually do the division unless you want one of the terms of the ratio to be 1.

Lowest terms: The ratio 3:4 is already in lowest terms. The ratio 8 to 32 is not in lowest terms. When this ratio is reduced to lowest terms, it is written as 1 to 4. A ratio, like a fraction, is usually, but not always, written in lowest terms.

To reduce a fraction or a ratio to lowest terms:

1. Look for a number (a common factor) that will divide evenly into the numerator and denominator of the fraction or the terms of the ratio.
2. Divide the common factor into the numerator and the denominator or into each term.
3. Continue dividing until there are no more common factors.
4. The last division answers form the fraction or ratio in lowest terms.

Example: You are laying out a patio of interlocking brick in a design that requires two colours. For each 1 square meter area, you need 18 light grey paving stones and 54 dark grey stones. The ratio is 18:54. This ratio is not in lowest terms. The common factor is 18. If you divide 18 into each of the terms, you get the ratio 1:3. There should be one light grey stone to every three dark grey ones.

Notice there are no units in this ratio. Because we are comparing paving stones to paving stones, the units cancel out. When the numbers being compared have the same unit of measurement, there are no units in the ratio.

Labelling fertilizer: One place where ratios are not written in lowest terms is in the labelling of fertilizer.

- The amounts of nitrogen, phosphorus and potassium are given as ratios such as 30:20:10.
- However, it is understood that these numbers are percents; they are out of a total of 100 parts.
- So the ratio is actually 30 %:20%:10%.
- The percent sign is not written and the ratios are not reduced. (Note that 30% + 20% + 10% = 60 %. The remaining 40% of the material is carrier ingredients that contain the nutrients.)

Ratios with 1: The ratio 2:1 has the number 1 as one of its terms. The ratio 3:4 does not. Sometimes a ratio like 3:4 is more useful if one of the terms is 1. You could divide both terms by 4 and then express the ratio as .75 to 1, or you could divide both terms by 3 and express the ratio as 1 to 1.33.

Equivalent ratios: Reducing a fraction to lowest terms does not change the value of the fraction, nor will it change the value of a ratio. The fractions 2/8 and 4/16 can each be reduced to 1/4. 1/4, 2/8, and 4/16 are ***equivalent fractions***. They each represent the same amount.

In the same way, ratios representing the same amount are called ***equivalent ratios***. The ratio 3 to 4 and the ratio .75 to 1 represent the same comparison and are equivalent ratios.

Finding Ratios from Given Information

Before using ratios to solve problems or to read blueprints, we will look at setting up ratios from given information.

Questions that ask you to set up ratios are generally worded in one of two ways.

1. You might need to compare part of an amount to the total amount; or
2. You might be asked to compare two parts to each other.

Situation one: You are asked to compare part of the amount to the total amount. If the total amount isn't given, you first have to find it.

Example: A class of apprentices consisted of 6 women and 24 men. What is the ratio of women to the whole class and the ratio of men to the whole class?

First you have to find the total number of students.
Adding 6 + 24 gives a total of 30 apprentices in the class.

Now find the ratios:

a) Ratio of women to the whole class is 6 out of 30, reduced to 1 out of 5, 1/5 or 1:5.
b) Ratio of men to the whole class is 24 out of 30, reduced to 4 out of 5, 4/5 or 4:5.

Situation two: The question asks you to compare one amount to another. This time you don't need to know the total.

Example: Using the class of 6 women and 24 men, what is the ratio of women to men and men to women?

Ratio of women to men is 6 to 24, reduced to 1 to 4, 1/4 or 1:4.

Ratio of men to women is 24 to 6, reduced to 4 to 1, 4/1 (or 4:1.

Note: if the denominator is 1 when writing a ratio, you must show it)

General Rules For Reading And Writing Ratios

Rule 1: *When you read or write ratios, compare the parts in the same order in language and in numbers, unless they are part of a table or formula*.

To compare the number of women to the class total, the number of women is stated before the class total.

Ratio of women to class = 6:30
This is reduced to 1:5.

To compare the number of men to women, the number of men is written before the number of women.

Ratio of men to women = 24:6
This is reduced to 4:1.

Rule 2: *If the units in each term of the ratio are the same, they will cancel each other out. If the units cancel out, you don't need to include them in the ratio.* (Sometimes, however, you want to keep the units in the ratio or they don't cancel out. We will look at them later.)

The ratio of 25 centimeters to 1 meter is not 25:1. The ratio has to be written as 25 cm to 1 m or 25cm:1m.

Usually it is easier to work with ratios if there are no units, so make the units the same. If you convert 1 meter to 100 centimeters, the units will be the same. You can then cancel them out. The ratio is then written as 25:100 without any units.

If you can't write the ratio with the same unit for all terms, the units must remain in the ratio.

Rule 3: *Ratios without units are usually expressed in lowest terms.*

Example: Write the ratio of part time to full time employees in a shop with 25 part time and 15 full time workers.

Answer: The units, which are employees, are the same. Since the question lists part time before full time, that is how the numbers are listed. The ratio is 25:15

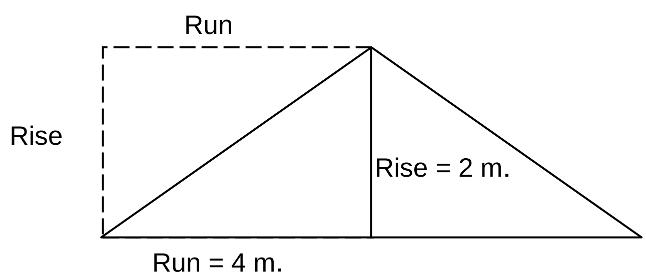
Reduce the ratio to lowest terms.
Five is a common factor that divides into 25 and 15, giving the answers 5 and 3.
The ratio 25:15 reduced to lowest terms is 5:3.
The ratio of part time to full time workers is 5:3.

Example: A nursery took a survey and found that 8 shrubs out of every 60 planted die from lack of adequate moisture the first growing season after planting. Write the ratio of shrubs that die to the total number of shrubs planted.

Answer: The units, which are shrubs, are the same. They cancel out and are not written in the ratio. The ratio is 8:60.

Reduce the ratio to lowest terms. Four is a common factor that divides into 8 and 60, giving the answers 2 and 15. The ratio 8:60 reduced to lowest terms is 2:15.

Example: What is the slope of the roof of a gazebo if the rise (the vertical distance) is 2 meters and the run (the horizontal distance) is 4 meters.



Slope = Rise over Run

Use the ratio:

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

$$= \frac{2}{4} \qquad \text{reduce to lowest terms}$$

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

The slope of roof is 1 to 2.

Rates

When the units of the quantities in a ratio are the same, they cancel out and so are not shown. When the units in a ratio are different, or there is only one unit, the units must be included in the ratio.

Ratios can be used to compare quantities of different types, such as kilometers per hour or cost per kilowatt-hour. These comparisons are called **rates**.

> *A **rate** is a quantity or amount of something measured per unit of something else.* A rate includes the word "per" which is indicated by the fraction line.

Usually a ratio is divided so the amount of the unit following the word "per" is 1. If a rate involves two different kinds of units, they must be included in the ratio.

> **Example:** Driving speed is a rate. Say you drove 300 km in 3 hours. The ratio 300 km/3 hr is reduced to 100 km/1 hr or 100 km/hr. Your rate of speed is 100 km per hr.

Rates that involve a cost per unit, such as the rate you pay for electricity, include the dollar sign. Your electrical bill might say that your electrical rate is $.30/kw-hr. For every kilowatt-hour of electricity you use, you pay $.30.

Answer the following questions on ratios. Answers are at the end of this skills manual.

1. Write as ratios using a colon between the two quantities. Convert quantities to the same unit where possible (that is, if the units are cm and m, convert so both quantities are either cm or m). Reduce to lowest terms.

   a) 1 to 4 b) 5 to 8 c) 5 in to 1 ft d) 2 kg to 125 g

   e) 1 m to 50 cm f) 15 min to 1 hr g) 5 ft to 6 ft 6 in h) one nickel to a quarter

2. Write as ratios using the fraction form. Reduce to lowest terms.

   a) 6 m to 3 m b) 20 in to 45 in c) 15 L to 9 L d) 3 m to 90 cm

3. What is your rate of speed if you travel 400 km in 4 hr?

4. What is the cost of gas per liter if you pay $12.50 for 10 L?

5. What is the cost per cubic meter of soil if you pay $65.90 for 10 cubic meters? In other words, express the two numbers as a rate.

6. If it cost $6.30 for enough peat moss to cover 9 square meters, what is the cost of covering one square meter?

7. The directions on a bottle of pesticide say to mix 1.5 liters with 45 liters of water. What is the ratio of pesticide to water?

PROPORTIONS

Two equivalent ratios express the same relationship but are written using different but related terms or numbers. For example, 1/4 and 2/8 are equivalent ratios and they represent the same amount. We can say that 1/4 equals 2/8. We can write this statement as:

1/4 = 2/8

Equivalent ratios written in fraction form with an equal sign between them form a **proportion***.*

- A proportion has four *terms*, or parts.
    - The terms of the proportion above are 1, 4, 2 and 8.
    - When we read the proportion, we name all four terms. 1/4 = 2/8 is read as “1 to 4 equals 2 to 8.”

Direct and Indirect (or Inverse) Proportions

There are two basic types of proportions: direct proportions and indirect (sometimes called inverse) proportions.

In a ***direct proportion****, as one quantity increases, the corresponding quantity also increases.* Similarly, as one quantity decreases, the other one also decreases.

Example: The relationship between the size of drill bit you choose and the size of hole you drill is a direct proportion.

- The larger the bit, the larger the hole.
- The smaller the bit, the smaller the hole.

This is a direct proportion because as the bit changes in size, the hole changes in size *in the same way*.

In an ***inverse, or indirect, proportion****, as one quantity increases, the corresponding quantity decreases.* As one quantity decreases, the other one increases.

Example: The relationship between the number of teeth on a gear and the speed of the gear is an indirect proportion. The number of teeth in a gear determines the amount of torque or turning force.

- But the more teeth on a gear, the less speed there is available.
- As one quantity (the number of teeth or the torque) increases, the other quantity (speed) decreases.
- You cannot have an increase in both torque and speed in one gear.
- Torque is inversely proportional to speed.

Solving a Proportion When Three of Four Terms Are Known

Proportions such as 1/4 = 2/8 in the example above don’t tell us much. We already know that two ratios or fractions that represent the same amount are equal to each other.

But what if you need find out how many palettes of paving stone to order to cover an area of 125 square meters. If you know that 1 palette of paving stone will cover 10 square meters, you can calculate the number of palettes you will need.

We will find the solution to this problem later, but first we will look at a simpler version of it.

We can use proportion to find the fourth term in a proportion if we know three of the four terms.

Here are the steps to find the fourth, unknown term:

1. **Set up a proportion using a letter to represent the unknown amount** in one of the ratios. The letter can be manipulated (moved around) in an equation just like a number. Write the ratios with an equal sign between them, forming an equation.

   Example: Write the proportion using the two ratios n:10 and 8:20.

   $$\frac{n}{10} = \frac{8}{20}$$

2. ***Cross-multiply to get rid of the denominators on both sides.*** To cross-multiply, multiply the diagonal numbers across the equal sign. In other words, multiply the numerator of one ratio by the denominator of the other ratio.

   If an unknown term is represented by a letter, cross multiply in the same way.

   Example: Cross-multiply in the equation below to get rid of the denominators.

   $$\frac{n}{10} = \frac{8}{20}$$

   Notice that n represents the unknown term.

   Multiply n by 20 and 10 by 8. Keep the equal sign.

   20n = 10(8)

   20n = 80

3. ***Isolate the unknown term*** (get it alone on one side of the equal sign). To do this divide both sides by the number in front of the unknown term.

   Example: Isolate n in the following equation.

   20n = 80

   $$\frac{20n}{20} = \frac{80}{20}$$

   Divide both sides by 20.

   n = 4

Here are some other manipulations that can help isolate the letter representing the unknown term.

A. If the letter representing the unknown term is on the right side, reverse the equation before dividing. You can reverse an equation without changing its value.

Example: You can reverse:

3(15) = 5n to 5n = 3(15).

Both equations have the same value.

B. You can invert (turn all of the terms upside down) both sides of the equation without changing its value.

Example: You can invert

4/s = 5/6 to s/4 = 6/5.

Both equations have the same value.

Note: *If you invert one side of an equation, you must invert the other side to keep the equation equal.*

Now let's look at some examples of finding an unknown term in a proportion using these steps.

Example: Solve for n in the following proportion.

$\frac{4}{5} = \frac{n}{15}$ Set up the proportion

4(15) = 5n cross-multiply

60 = 5n

5n = 60 Reverse the equation so that n is on the left side of the equal sign.

5n ÷ 5 = 60 ÷ 5 Divide both sides of the equation by the number in front of the unknown term.

n = 12 The letter is isolated on the left hand side of the equation.
The answer is on the right hand side

Substitute 12 for n to write the complete proportion.

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

Example: Find the value of n when:

$$\frac{n}{12} = \frac{5}{15}$$

15n = 5(12)	cross multiply
5n = 60	divide by 15 to isolate n

$$\frac{15n}{15} = \frac{60}{15}$$

n = 4	
4/12 = 5/15	Substitute 4 for n to write the complete proportion.

Example: Find the value of n when:

$$\frac{n}{8} = \frac{10}{16}$$

16n = 10(80)	cross multiply
16n = 80	divide both sides by 16
n = 5	

Example: Find the value of s.

$$\frac{3}{4} = \frac{9}{s}$$

3s = 9(4)	cross multiply
3s = 36	
3s ÷ 3 = 36 ÷ 3	divide by 3
s = 12	

Solving Problems Using Proportions

Proportions can be used to solve problems. You have to figure out what goes with what and then set up your proportion to find the unknown quantity. Notice that when you first set up your ratios, you do not usually reduce to lowest terms.

We will look at two methods of setting up the proportion. The second method will probably be more useful in solving problems in the horticulturalist and arborist trades.

Method 1: These suggestions are one method to set up a proportion.

a) Set up the ratios (or fractions) so the same units are over each other.
   a. Set up minutes over minutes, kilometers over kilometers, or meters over meters.
b) The units of the two given quantities that form one fraction will cancel out.
   a. The unit of the third known quantity will be the unit of the unknown quantity
c) Set up the smaller unit over the larger unit. The proportion will look like this:

$$\frac{\text{small}}{\text{large}} = \frac{\text{small}}{\text{large}}$$

Now let's look at finding how many palettes of paving stone you need to order to cover 125 square meters if 1 palette covers 10 square meters.

Example: How many palettes of paving stone do you need to cover 125 square meters if 1 palette covers 10 square meters?

Set up your proportion.
Put square meters over square meters and palettes over palettes.
Let h equal the unknown number of palettes needed.
The proportion looks like this:

$$\frac{10 \text{ sq m}}{125 \text{ sq m}} = \frac{1 \text{ palette}}{h} \qquad \frac{\text{small}}{\text{large}} = \frac{\text{small}}{\text{large}}$$

This looks like the proportions we already know how to solve. Find the answer by solving for h:

$\frac{10 \not{\text{sq m}}}{125 \not{\text{sq m}}} = \frac{1 \text{ palette}}{h}$ sq m cancel out

10 h = 125 x 1 cross-multiply

10 h = 125 divide both sides by 10
h = 12.5 palettes

You need 12.5 palettes of paving stone.

Method 2: You can also set up the two ratios so each is given as a rate. When the ratios are set up as rates, in each ratio, one unit is over the other, different, unit. This method will probably be more useful in solving problems in the horticulturalist and arborist trades.

Example: You travel 25 km in 50 minutes. How long will it take to travel 75 km at that speed?

The first ratio or rate is 50 min/25 km.
The second ratio is *unknown minutes*/75 km.
Set up the proportion by writing the two ratios.
Let m represent the unknown time.

$$\frac{50\text{ min}}{25\ \not{\text{km}}} = \frac{m}{75\ \not{\text{km}}}$$

km cancel
you can leave out the other unit, minutes, until the end

50(75) = 25m cross-multiply

25m = 3750 min reverse the equation
m = 150 min divide both sides by 25 and put in the unit min

It will take 150 minutes to travel 75 km.

Example: One tankful of your sprayer will cover 15 hectares. The product recommends spraying at a rate of 2.5 liters per hectare. How many liters of product do you need to add to the tank before filling it with water?

We will use the second method. The first ratio is 2.5 liters/hectare. The second ratio is unknown liters/15 hectares. Let t represent the unknown number of liters. Set up the proportion.

$$\frac{2.5\text{ L}}{1\text{ ha}} = \frac{t}{15\text{ ha}}$$

cross multiply

37.5 L = 1t reverse the equation and divide both sides by 1 ha

t = 37.5 L

You need to put 37.5 liters of product in the tank of your sprayer before filling it with water.

Here are some questions on proportions. Answers are at the end of this skills manual.

8. Solve for the unknown quantity.

a) $\frac{n}{24} = \frac{1}{2}$ b) $\frac{2}{x} = \frac{10}{40}$ c) $\frac{16}{2} = \frac{s}{3}$

d) $\frac{5}{10} = \frac{12}{n}$ e) $\frac{n}{7} = \frac{3}{21}$ f) $\frac{2}{6} = \frac{2.45}{7.35}$

9. If it takes 70 minutes to travel 35 km, how long will it take to travel 85 km at the same speed?

10. Lilac shrubs sell wholesale at $63.50 for 10. How much would 36 shrubs cost?

11. If an engine requires a 1:20 oil to gas mixture, how much oil has to be added to 70 L of gas?

12. If a liter of fertilizer covers 520 sq ft, how much is needed to cover 6240 sq ft?

13. If a steel bar weighs 2.5 kg per linear foot, what is the weight of a 10 ft bar?

14. Your sprayer holds 1100 liters and has an output of 125 liters/hectare. How many hectares will a full tank cover?

15. To make a solution to treat roses for blackspot, you mix 1 g of baking soda with 1 liter of water. If you need 5 liters of solution, how much baking soda should you add?

16. Your sprayer holds 600 liters and has an output of 30L/100 m^2 . How many square meters will one tankful cover?

SCALE

If you plan to work in landscape design, you will need know how to make working sketches and how to read and interpret blueprints. A blueprint is a drawing of a building or part of a building. The dimensions on a blueprint are scaled-down representations of the actual dimensions. It would be impossible to manage the drawing of a large property if actual dimensions were used on a site plan.

The ***scale*** of a site plan expresses the relationship between the dimensions of the blueprint and the actual dimensions of the gardens shown in the diagram. The scale is the ratio of the drawing size to the actual size. An equal sign (=) is used instead of a colon when indicating a scale.

A scale uses a smaller unit of measure to represent an actual, larger unit of measure. A scale can be considered as similar to a rate, where the distance on the blueprint is compared to a standard unit, usually 1 foot in imperial units.

> **Example:** A 1/4 inch line on a drawing can represent an actual length of 1 foot. The scale of the drawing is 1/4 in = 1 ft. In this case, a 5 inch pipe on the drawing represents a pipe that is actually 20 feet long.

The word scale is used to indicate the relationship between the drawing and the actual dimensions, as described above.

- In equations used to convert drawing dimensions to actual dimensions, scale indicates the number with the first, smaller unit.
- The unit of the second number is called the *standard unit*.
- So in the example above, the scale is 1/4.

To convert a length on a drawing to an actual measurement, follow these steps:

1. Divide the length on the diagram by the scale, the first number listed.
2. Use the unit of the standard unit (the larger unit) in the answer.

Example: If the length on a blueprint of an object is 2 1/2 inches and the scale is 1/4 inch = 1 feet, what is the actual length of the object?

length on diagram ÷ scale = actual length

The scale is 1/4. The standard unit is feet.

2 ½ ÷ ¼ = 10 ft use the standard unit ft

2 ½ inches represent 10 feet.

Example: A blueprint is drawn to the scale of 1/4 inch = 1 inch. If the dimensions of an object are drawn as 6 inches by 7 1/2 inches, what are the actual dimensions?

length on diagram ÷ scale = actual length

The scale is 1/4. The standard unit is inches.
6 ÷1/4 = 24 inches
7 1/2 ÷ 1/4 = 30 inches
The actual dimensions are 24" by 30".

In metric dimensions, the scale is usually a decimal or whole number, not a fraction.

Example: Find the actual length of a walkway if it is 4 centimeters long on a diagram. The scale is 1 centimeter = 1 meter.

length on diagram ÷ scale = actual length

The scale is 1. The standard unit is meters.

4 ÷ 1 = 4 m

If you know a distance on a diagram and the actual distance, you can find the scale by following these steps:

1. Divide the scale length by the actual length.
2. If the scale is imperial, write the answer as a fraction. If the scale is metric, write it as a decimal.

Example: Find the scale of a blueprint if 10 centimeters on the diagram represents 20 meters.

scale distance ÷ actual distance
= 10 m ÷ 20
= .5

The scale is .5. To express this as a ratio, put the unit of the blueprint length with the scale (cm). The standard unit is 1 followed by the unit of the actual object. The two units are separated by an equal sign.

.5 cm = 1 m

Answer the following questions about scale. Answers are at the end of this skills manual.

17. If the scale of a blueprint is 1/5 in = 1 ft, what is the actual length of an object that is 3 inches on the diagram?

18. What are the actual dimensions of a yard that measures 20 centimeters by 24 centimeters on a blueprint with a scale of 4 cm = 1 m?

19. If 2 inches on a blueprint represent 6 feet, what is the scale? Express the scale as a ratio.

20. What is the actual length and width of an object if it is shown as 4 inches by 3 inches on the blueprint. The scale is 1/2 in = 1 ft?

21. A blueprint has a scale of 10 cm = 1 m. What is the actual diameter of a circle if the diameter measures 20 cm on the blueprint?

ANSWER PAGE

RATIOS Page 5

1. a) 1 : 4
   b) 5 : 8
   c) 1 : 20 (change 1 m to 100 cm, reduce)
   d) 16 : 1 (change kg to g)
   e) 2 : 1 (change m to cm)
   f) 1 : 4 (change hr to min)
   g) 10 : 13 (change 5' to 60" and 6′ 6" to 78")
   h) 1 : 5 (change nickels and quarters to cents)

2. a) 2/1
   b) 4/9
   c) 5/3
   d) 10/3 (change m to cm)

3. 100 km/hr

4. $12.50/10L = $1.25/L

5. $6.59/cu m

6. Divide each by 9 to find cost per sq m.
   $.70/sq m

7. 1.5 : 45 reduced to 1 : 30

PROPORTIONS Page 10

8. a) 12
   b) 8
   c) 24
   d) 24
   e) 1
   f) 27/11, or 2.45

Note: *You may set up your proportions differently than we have. It doesn't matter which way you set up your proportion as long as you get the correct answer.*

9. $\frac{70 \text{ min}}{35 \text{ km}} = \frac{m}{85 \text{ km}}$
   70(85) = 35m
   35m = 5950
   m = 170 min

10. $\frac{\$63.50}{10} = \frac{k}{36}$
    10k = $63.50 x 36
    10k = $2286.
    k = $228.60

11. $\frac{1}{20} = \frac{t}{70}$
    20t = 70
    t = 3.5 L

12. $\frac{1 \text{ liter}}{520 \text{ sq ft}} = \frac{s}{6240 \text{ sq ft}}$

    520s = 6240
    s = 12 liters

13. $\frac{2.5 \text{ kg}}{1 \text{ ft}} = \frac{n}{10 \text{ ft}}$
    n = 25 kg

14. $\frac{1100}{s} = \frac{125}{1 \text{ ha}}$

    125s = 1100
    s = 8.8 hectares

15. $\frac{1 \text{ g}}{1 \text{ liter}} = \frac{x}{5 \text{ liters}}$

    x = 5 g

16. $\frac{30 \text{ L}}{100 \text{ m}^2} = \frac{600 \text{ L}}{m}$

    30m = 60000
    m = 2000 m^2

SCALE Page 13

17. 3 ÷ 1/5
    = 15 ft

18. 20 ÷ 4
    = 5
    24 ÷ 4
    = 6
    Dimensions are 5 m by 6 m

19. 2 ÷ 6 = 2/6 = 1/3
    Scale is 1/3 inch = 1 ft.

20. 4 ÷ 1/2
    = 8
    3 ÷ 1/2
    = 6
    Length is 8 ft.
    Width is 6 ft.

21. 20 ÷ 10
    = 2
    Diameter is 2 meters.