EVALUATING
ACADEMIC READINESS
FOR APPRENTICESHIP TRAINING
Revised for
ACCESS TO APPRENTICESHIP

MATHEMATICS SKILLS
OPERATIONS WITH PERCENT

AN ACADEMIC SKILLS MANUAL
for The Food Preparation Trades
Baker & Cook, and
Retail Meat Cutter

Workplace Support Services Branch
Ontario Ministry of Education and Training

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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
OPERATIONS WITH PERCENT

An academic skill required for the study of the Food Preparation Trades

This skills manual looks at different ways to use percent. It covers the following topics:

- The meaning of percent
- Writing a number as a percent
  - changing a percent to a decimal
- Finding a percent of a number
  - rounding off
- Finding what percent one number is of another
- Finding a number when a percent of it is known
- Word Problems

THE MEANING OF PERCENT

*A **percent** is an amount expressed out of a total of one hundred. The sign % indicates percent.* Any percent less than 100 % represents a smaller amount than one whole.

Example: 25% means 25 parts out of a total of 100 parts.

Example: When your course states that you need to achieve 65% on your tests to pass, this means you need to get 65 marks out of every 100 possible marks.

Example: Imagine a large cake cut into 100 pieces. The hundred pieces altogether make up **one** whole cake. If 50 of the pieces get eaten, you now have only 50 pieces left. You don't have as much cake as when you had one whole or the total 100 pieces. If you have 50 out of a total of 100, you have 50% or .5 or 50/100, which reduces to ½. As you can see, 50% is the same amount as that represented by the fraction ½ . You know that ½ is less than 1.

A Percent is a Special Kind of Fraction

A percent expresses an amount out of a total of 100 hundred equal parts. Since the 100 parts represent one whole amount, any percent less than 100 is a partial amount. A partial amount can be written as a percent, a fraction or a decimal.

Fraction: A fraction tells how many equal parts a whole amount is divided into; it also tells you how many of those parts you have.

Example: In the fraction 19/100, the bottom number tells you how many parts, in this case 100, that the total amount is divided into. The top number tells you how many of these parts, in this case 19, you have.

- The top part of the fraction, representing the partial amount 19, is called the *numerator*.
- The bottom part of the fraction, representing the total amount 100, is called the *denominator.*
- The numerator and denominator are divided by the *fraction line*.

Percentages are fractions too: A percent is a kind of fraction whose denominator, like the fraction 19/100, is 100.

- When we write a percent, we only write the numerator.
- The numerator is written with the percent (%) symbol after it.
- The % symbol represents the fraction line and indicates that the unwritten denominator is 100.

Example: To express the fraction 19/100 as a percent:

- The numerator 19 is written with the % sign after it.
- The denominator 100 is not shown.
- Nineteen percent is written as 19%.

Percent is usually used to express amounts that are less than one whole (100 parts being equal to 1 whole). Any percent less than 100% represents an amount smaller than one whole.

You also use percents when calculating financial amounts.

Example: The amount of income tax, and the HST you pay, are all calculated as percentages.

Example: An estimate for a catering job might state that 60% of the cost of a job is for labour charges and 40% is for food costs; you need to know how to do these calculations.

WRITING A NUMBER AS A PERCENT
To write any number as a percent, multiply it by 100 and add the % sign.

A quick way to multiply by 100 is to move the decimal point two places to the **right.** If the decimal point comes at the end of the whole number like 34, it isn't usually shown. However, it is always assumed to be after the last digit in the number. (Digits are the symbols we use to write numbers. The digit for four is 4.)

If you are multiplying a whole number by 100, you have to add zeros as place holders as you move the decimal point to the right.

34 x 100 = 3400

If the number you are multiplying by 100 is a decimal number like 1.725, you move the decimal point over two places to the right.

1.725 x 100 = 172.5

If the number being multiplied by 100 is a fraction like 7/10, follow the steps for multiplying fractions by whole numbers.

2/5 x 100 = 40

To make any of the above examples into a percent, add the % sign after multiplying by 100.

Examples:

a) Express .25 as a percent
.25 x 100 = 25%

b) Express 1 as a percent.
1 x 100 = 100%

c) Express 1/4 as a percent
1/4 x 100 = 25 %

d) Express 65 out of a 100 as a percent
65/100 x 100 = 65%

TO WRITE A NUMBER AS A PERCENT:
1. Multiply the number by 100 by moving the decimal point two places to the right.
2. Add the percent sign (%).

Answer the following questions. **The answers are at the end of this skills manual.**

1. Express the following as a percent:

a) 10 out of 100 b) 12.5 out of 100 c) 100 out of 100

d) 150 out of 100 e) 85 out of 100 f) 275 out of 100

TO CHANGE A PERCENT TO A DECIMAL:
1. Remove the percent sign
2. Divide by 100 by moving the decimal **two** places to the **left**. Use zeros as place holders when needed.
3. If the decimal point is not shown, it is always after the last digit in the number.

Change the following percents to decimal numbers.

2. a) 28% b) 56.7% c) 7%

d) 100% e) 8.5% f) 250%

g) 15% h) .2% i) 62.5 %

Because percent is often used to make calculations such as the amount of sales tax owed, the interest on credit, the number of people who actually come to an event compared to the number of tickets sold or the increase in volume of egg whites when they are beaten, it is useful to know how to do problems involving percent.

When doing percent problems, a calculator can help do the calculations quickly and accurately but you need to know what steps to use and in what order. The most difficult part about doing percent problems is figuring out exactly what you are asked to do and the calculator can't help with that. Once you know which method to use, then you can use your calculator. We will look at the three main methods of doing percent problems so you will know what method to choose for different situations.

TO FIND A PERCENT OF A NUMBER

The most common kind of percent problem is finding a percent of a number.

> **Example:** In Ontario, we pay 13% HST for many goods and services we buy. If we want to know the total price of a thing before we buy it, we need to calculate the amount of tax we have to pay.

To find the percent of a number:
1. Change the percent to a decimal.
2. Then multiply the number by the decimal.

To divide by 100 quickly, move the decimal point two places to the **left.** When dividing by 100, the decimal point is moved in the opposite direction than when multiplying by 100. If there are empty spaces between the decimal point and the digits of the number after you have moved the decimal point to the left, fill in the spaces with zeros.

Example: Divide 3.67 by 100 the quick way

Move the decimal point two places to the left in 3.67 and fill in the empty space with a zero. The answer is .0367

Example: Change 5% to a decimal

Drop the percent sign and move the decimal point two places to the left giving .05 as the answer. The zero is added as a place holder.

Example: Find 25% of $150.

$150 Change 25% to the decimal .25 and multiply.
x .25
7500
3000
$37.50

25% of $150 = $37.50

When doing questions involving money, you usually round the answer off to two decimal places.

To round off an answer:

1. Look at the digit one place to the right of the place you are rounding off to.
2. If that digit is five or more, change the digit you are rounding off to one more than it is.
3. If the digit to the right is less than five, leave the digit you are rounding off the same.
4. Discard any digits after the one you have rounded off.
5. If the number you are rounding off to is 9 and the digit one past it is five or greater, the 9 becomes 10 and the place value where the 9 was becomes 0. The one from the 10 is added to the digit to the left of the 9, which becomes one larger in value.

Example: Round $.6769 to two decimal places.

We look at the digit one past the 7, the second decimal place, which is a 6. Since it is five or larger, the 7 becomes 8 and the other digits are dropped.
$.6769 rounded off to two decimal places is $.68

Sometimes when you are doing percent problems, your answer might be a repeating decimal or it might be very long. For example, one third (1/3) expressed as a percent is a repeating decimal, 33.3333..%. The 3 goes on repeating forever. You have to round off these types of answers. 1/3 expressed as a percent is 33.33% rounded off. Two-thirds (2/3) expressed as percent is 66.66666 ....%. Rounded off, it becomes 66.67%

Sometimes you are told how many places to round off to in the question. If you are not told, answers are generally rounded off to two places, although there are often exceptions. One eight (1/8) is 12.5% as a percent and .125 as a decimal number. When a decimal number ends evenly in three or four places, we don't usually round it off.

TO FIND A PERCENT OF A NUMBER:
1. Change the number with the percent to a decimal by dropping the percent sign and moving the decimal **two** places to the **left.**
2. Multiply the two numbers together.

Solve the following questions. Round off money values to two decimal places. **Answers are at the end of this skills manual.**

3. a) Find 50% of 200. b) Find 33.3% of 150. c) Find 4.25% of 30.

   d) Find 12% of $48.50. e) Find 15% of $1.99. f) Find .25% of 12.

   g) What is 100% of 75? h) What is 150% of 68? i) What is 9% of $10.75?

4. 80% of the students in a course passed their test. If there are 40 students in the class, how many failed the test? (Hint: If 80% passed, what % failed?)

5. What is the tax on an item that costs $45.98 if the sales tax is 15%?

6. If there are 28 knives in a kitchen and 25% needed sharpening, how many knives were still sharp? (Hint: If 25% needed sharpening, what % were still sharp?)

FINDING WHAT PERCENT A NUMBER IS OUT OF ANOTHER

The next type of percent problem deals with finding what percent a number is out of another. Since one number expressed out of another is a fraction, you are making a fraction and then changing it to a percent. If 620 homeowners out of 1000 prefer whole wheat bread, you might want to express this preference as a percent, which in this case is 62 %.

These questions are worded in two ways:

- “15 is what percent of 25?"
- and “what percent of 48 is 30?”

To solve these problems, first you make a fraction. The number representing the total, or the number following “of”, is the ***denominator****, which forms the bottom part of the fraction***.** The other number is the ***numerator****, which forms the top part of the fraction.*

Make the fraction into a decimal number by dividing the numerator by the denominator.

You only make the fraction so you can see clearly what part is the numerator and what is the denominator before you divide. If you already know what number to divide by, you can skip the step of making a fraction.

If you are dividing with a calculator, you always key in the numbers so that the dividend is keyed in first, then the division sign and then the divisor. To divide 175 by 25 using a calculator, key in the dividend 175 first and then the divisor 25.

Next you change the answer of the division question to a percent by multiplying it by 100 and adding the percent sign. (The quick way to multiply by 100 is to move the decimal point two places to the right.)

Example: 620 is what percent of 1000?

$$\frac{620}{1000}$$

= 620 ÷ 1000 = .62

.62 x 100
= 32%

Example: what percent is 25 is 15?

15/25
= 15 ÷ 25 = .6

.6 x 100
= 60 %

Sometimes the division answer doesn't come out evenly or is a repeating decimal, or the decimal part of the answer is very long. For example, 1 ÷ 3 = .3333... You have to round off the answer. To make the answer into a percent, round off to four places so you have two decimal places in the percent.

Example: 1 is what percent of 3?

1 ÷ 3 = .3333...

.3333 x 100 = 33.33 %

Example: 200 is what percent of 300?

200 ÷ 300 = .6666...
.6666... rounded to four places is .6667
.6667 x 100 = 66.67 %

TO FIND WHAT PERCENT ONE NUMBER IS OF ANOTHER:
1. Make a fraction, using the number representing the total or the number following "of" as the denominator and the other number as the numerator.
2. Change the fraction to a decimal number by dividing the numerator by the denominator.
3. Multiply this division answer by 100 and add the percent sign.

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

7. a) 3 is what percent of 12? b) 28 is what % of 32? c) What percent of 36 is 9?

   d) What % of 40 is 15? e) What % of 1 is 1? f) 250 is what % of 200?

   g) 25 is what % of 75? h) What % of $3.99 is $1.10?

8. If a wine cellar has 225 bottles of white wine and 205 bottles of red wine, what is the percent of white wine in the cellar? (Find the total number of bottles first.)

9. If you buy a set of knives that normally sells for $150 for only $90, what % saving do you get? (Your savings are the amount you don't have to pay.)

FINDING A NUMBER WHEN A PERCENT OF IT IS KNOWN

You might know that 10% of an unknown number is 25. You want to find out what the unknown number is. Here is what you do:

1. Change the percent, to a decimal number by dropping the percent sign and moving the decimal point two places to the left. 10% = .1
2. Divide the given number 25 by the decimal number found above.
   25 ÷ .1 = 250
   So, if 10% of an unknown number is 25, that unknown number is 250.

These types of questions can be worded in these two different ways but they are solved in the same way:

I. 45% of what number is 90?
   Change 45% to .45
   90 ÷ .45 = 200

II. 12 is 24% of what number?
   Change 24% to .24
   12 ÷ .24 = 50

TO FIND AN UNKNOWN NUMBER WHEN A PERCENT OF IT IS KNOWN:
1. Change the percent to a decimal number by moving the decimal point two places to the left.
2. Divide the given number by the decimal number to get the number you are looking for.

Answer the following questions. **The answers are at the end of this skills manual.**

10. a) 2% of what number is 10?

    b) 18 is 36% of what number?

    c) 44 is 55% of what number?

    d) 25% of what number is 6?

    e) 100% of what number is 70?

    f) 40% of what number is 12.6?

11. 30% of the student in a class drove to school. How many students were in the class if 15 drove to school?

12. If a cook prepared a beef stock that required 5 pounds of beef and the meat makes up 45% of the stock, what is the total weight?

WORD PROBLEMS

To solve problems dealing with percent, the first thing you have to decide is what kind of question you are being asked. There are basically three types of problems:

- Finding a percent of a number. These questions are worded:
  "find 20% of 66" or "what is 45% of 50?"
- Finding what percent one number is of another. These questions are worded:
  "15 is what percent of 25?" or "what percent of 40 is 10?
- Finding an unknown number when a percent of it is known. These questions are worded:
  "20% of what number is 80?" or "24 is 35% of what number?"

When you know what kind of question you have to solve, you follow the steps listed for that type of question to get your answer. Ask what the problem requires you to find and decide what method to use to find it.

Often in percent problems, you are given a percent of one part and required to find the other part. For example, if a pot that regularly sells for $90. is on sale at a savings of 25%, what is the sale price? In these cases, you have to calculate the 25 percent that you saved and then subtract that from the regular price.

Example: If you know that 55% of an order for wine glasses has been filled and you have received 220 glasses, how do you find out how many items you are still waiting for?

- First, find the amount of the total order using the steps for finding an unknown number when a percent of it is known.
- Then, subtract the amount you have from the total to get the amount you are waiting for.

Example: 55% is .55 as a decimal

220 ÷ .55 = 400
400 - 220 = 180
180 wine glasses are still on order

Example: A special deal might offer 25% off parts and labour on four gas burner replacements. If the normal price is $449.00, what do you have to pay? The percent taken off tells what you save, not what you have to pay.

You can use either one of two methods:

a. You can subtract 25% from 100% to get 75% and then find 75% of the original price.
b. Or you can find 25% of the original price to find the savings and subtract that amount from the original price to get the amount you pay.

Example: 100% - 25% = 75%

a) 75% = .75
.75 x $449. = $336.75

Or

b) 25% = .25
.25 x $449. = $112.25
$449.00 - $112.25 = $336.75
You have to pay $336.75

To answer the following problems, you will have to decide what method to use.

13. A cook earning $37.00 an hour receives a 4% increase in pay. What is his new hourly rate? (Find his increase and add it to what he is making now.)

14. A recipe for chocolate ice cream contains 25 % fat. A recipe for vanilla ice cream has 15 grams of fat for every 90 grams made. Which recipe has the higher % of fat?

15. A roast shrinks by 5% larger when it is cooked. If a roast weighs 10.8 kilograms uncooked, what is the cooked weight?

16. A pound of frozen shrimp costs $10.85. The discount on buying 200 pounds at a time is 25%. What would be the cost of buying 200 pounds?

ANSWER PAGE

TO WRITE A NUMBER AS A PERCENT

1 . a) 10% b) 20% c) 100% d) 200% e) 85% f) 275%

CHANGING PERCENT TO A DECIMAL

2. 2. a) .28 b) .567 c) .07 d) 1 e) .085 f) 2.5
g) .15 h) .002 i) .625

FINDING A PERCENT OF A NUMBER

3. 3. a) 100 b) 49.95 c) 1.275 d) $5.82 e) $.30 f) .03
g) 75 h) 102 i) $.97

4. Since 32 students passed the test, 8 students failed.
5. $6.90
6. 21

FINDING WHAT PERCENT ONE NUMBER IS OF ANOTHER

7. a) 25% b) 87.5% c) 25% d) 37.5% e) 100% f) 125%
g) 33.33% h) 27.57

8. 52.33%
9. 40%

FINDING A NUMBER WHEN A PERCENT OF IT IS KNOWN

10. a) 500 b) 50 c) 80 d) 24 e) 70 f) 31.5

11. 50 students
12. 500 lb.

WORD PROBLEMS

13. $38.48 (his increase is $1.48 an hour)

14. % fat in vanilla recipe: 15 ÷ 90 = .1667 x 100 = 16.67%
The chocolate ice cream has a higher fat content.

15. 10.8 kg x .05 = .54 kg
    10.8 - .54 = 10.26 kg

16. $1627.50 (find the cost of 200, then find 75% of that cost)