PERCENT COMPETENCY PACKET

Student
Support
Center

NORTH SHORE
COMMUNITY COLLEGE

Developed by: Nancy Tufo
Revised 2001: Sharyn Sweeney
Student Support Center
North Shore Community College

In this booklet the relationship between percents, fractions and decimals will be explained. If you have not already reviewed the Fraction and Decimal booklets, please do so before working through this one. If you are using these booklets to study for the Placement Test, do not use a calculator. Calculator use is not permitted during the test.

To use this booklet, review the glossary, study the examples, then complete the exercises. The answers are at the end of the booklet. When you find an unfamiliar word, check the glossary for a definition or explanation.

If you have difficulty understanding any of the concepts, come to the tutoring centers. Hours are available at (978) 762-4000 x 5410.

During the Fall and Winter/Spring semesters, tutoring is available daily at the Lynn Campus in LW222, at the Beverly Campus at SR108, and at the Hathorne Campus at Berry Hall 104. Evening hours are available on Monday and Wednesday in Lynn and on Tuesday and Thursday in Beverly.

The Labs are closed when school is not in session, and Summer hours are limited.

General Information about Percent

- Percent is another way of writing fractions with a denominator of 100.
- Percent refers to a value compared to a whole expressed as 100, rather than compared to a whole expressed as 1.
- Percents are always expressed with a percent sign: %. 100% represents the whole amount, any value less than 100 is less than the whole, and any value greater than 100 is more than the whole.

Glossary

Base
Numerical value to which the part is compared. It is the denominator of a fraction equal to a percent fraction.

Decimal
or
Decimal Number
A fractional number may be expressed in decimal form. For example, seven-tenths maybe $\dfrac{7}{10}$ or 0.7, (See Decimal booklet for more information.)

Decimal Point
A dot or point that separates the decimal value from the integral value of a number. (See Decimal booklet for more information.)

Denominator
The bottom number of a fraction. It represents the number of pieces needed to make one whole. (See Fraction booklet for more information.)

Fraction
Any numerical expression with a numerator and a denominator. (See fraction booklet for more information.)

Numerator
The top number of a fraction. It represents the number of pieces of a certain size considered for the expression. (See fraction booklet for more information)

Part
Numerical value compare to the base. It is the numerator of a fraction equal to a percent fraction. It can be greater than or less than the base value.

Percent
"PER" means "out of" or "divided by" and "CENT" means 100 (i.e. 100 **cent**s in a dollar), therefore, PERCENT means "out of 100" or "divided by 100"

Percent Sign
The symbol: %, denoting a percent value.

Quotient
The name given to the result when one number is divided by another.

Ratio
The quotient of two numbers written as $\dfrac{a}{b}$, where $b \neq 0$.

Writing a Percent as a Decimal

To convert a Decimal to a Fraction, Divide by 100%.	
Write 15% as a decimal.	
15% ÷ 100%	To divide by 100, move the decimal point two places to the left. (hint: where is the decimal in a whole number?)
= 0.15	Note: The % symbols cancel each other.
Write 0.4% as a decimal	
0.4% ÷ 100%	To divide by 100, move the decimal point two places to the left.
= 0.004	Note: The % symbols cancel each other.

Write as a decimal.

1)   8.5%

2)   3%

3)   65%

4)   3.75%

5)   42.5%

6)   903%

7)   2.07%

8)   50.5%

9)   125%

10)   100%

(3)

Writing a Percent as a Fraction

To convert a Percent to a Fraction, divide by 100%.	
Write 15% as a fraction. $$15\% \div 100\% =$$ $$\frac{15\%}{100\%} = \frac{3}{20} \quad 125\% = \frac{125}{100}$$	To divide by 100%, write with a fraction bar. Always reduce fractions. Note: the percent signs cancel
Write 125% as a fraction. $$125\% \div 100\%$$ $$\frac{125\%}{100\%} = \frac{125}{100}$$ $$\frac{125}{100} = 1\frac{25}{100}$$ $$1\frac{25}{100} = 1\frac{1}{4}$$	Divide by 100% Write division with a fraction bar. Change to a mixed number. Reduce the fraction.

Write each percent as a fraction.

1)   25%   6)   130%

2)   40%   7) 150%

3)   83%   8) 625%

4)   45%   9) 70%

5)   100%   10) 66%

(4)

Writing a Decimal as a Percent

To write a decimal as a percent, multiply by 100%
Write 0.45 as a percent.
0.45 x 100% = 45%   To multiply by 100%, move the decimal point two places to the right. Note: The percent sign is included in the answer.
Write 0.06 as a percent.
0.06 x 100% = 6%   To multiply by 100%, move the decimal point two places to the right. Note the percent sign.

Write as a percent.

1)   0.16

2)   0.93

3)   0.05

4)   0.75

5)   1.75

6)   3.09

7)   0.8

8)   0.006

9)   5.5

10)   0.45

(5)

Writing a Fraction as a Percent

To write a fraction as a percent, multiply by 100%

Write $\frac{3}{5}$ as a percent.

$\frac{3}{5}$ x 100% = $\frac{3}{5}$ x $\frac{100\%}{1}$

To multiply by 100%, write it as a fraction.

$\frac{3}{\overset{}{\underset{1}{\cancel{5}}}}$ x $\frac{\overset{20\ \%}{\cancel{100\%}}}{1}$ = 60%

Reduce before you multiply.
Recall that the denominator of 1 need not be written.

Write $\frac{5}{9}$ as a percent.

$\frac{5}{9}$ x $\frac{100}{1}$ %= $\frac{500}{9}$ %

There is nothing to reduce first.

$\frac{500}{9}$ = $55\frac{5}{9}$ %

Change to a mixed number.

Write as a percent.

1) $\frac{35}{50}$

2) $\frac{3}{25}$

3) $\frac{7}{20}$

4) $\frac{3}{5}$

5) $\frac{3}{8}$

6) $1\frac{9}{40}$ Hint: Change to a mixed number first

7) $5\frac{2}{3}$

8) $4\frac{3}{11}$

(6)

Complete the Chart

	Percent	Decimal	Fraction
1			$\dfrac{1}{3}$
2		5.30	
3			$3\dfrac{7}{8}$
4	$66\dfrac{2}{3}\%$		
5			$\dfrac{3}{4}$
6		0.06	
7		0.25	
8	5%		
9			$\dfrac{2}{5}$
10	100%		

(7)

Finding a Percent of a Number

Translate the problem to Mathematical symbols:

"of" means multiply

"%" means per hundred (use decimal number)

Find 6% of 200.   Translate and write the percent as a decimal number.

$$0.06 \times 200 = 12$$ Multiply

What is 8.4% of $120

$$\frac{84}{100} \times \$120 = \frac{42 \times \$12}{5}$$ Write the percent as a fraction.

Reduce before multiplying

$$\frac{\$504}{5} = \$100.80$$

Solve:

1)   Find 150 % of 82?

6)   8.2% of 300 is what?

2)   What is 6% of 2500?

7)   16% of 50 is what?

3)   Find 0.05% of 200.

8)   400% of 52.7 is what?

4)   What is 55% of 900?

9)   What is 80% of 18.4?

5)   52% of 95 is what?

Hint: Think of this as: What is 52% of 95?

10)   Find 90% of 12.75.

(8)

Solving Percent Application Problems

Strategy:
Read the Problem
Recognize the three elements of the percent equation:
    Percent, **Base**, and **Part**
        Percent has percent sign %, **Base** follows the word "of" ("of" means
          multiply), **Part** is compared to the base. ("Part" is not always less than
          "Base" value)
Put into the equation:
                Percent x Base = Part

An electrician's hourly wage is $14.50 before and 8% raise. How much will the raise be? (Hint: The raise is a percent of the wage: 8% of $14.50)

8% of $14.50 = Raise	Recognize the elements
8% x $14.50 = ?	Form the equation
0.08 x $14.50 = $1.1600	Write the percent as a decimal and multiply
The raise will be $1.16	

Solve:

1)   You buy a television which costs $550 and pay a 5% sales tax. What is the tax?

2)   A quality control inspector found that 1.3% of 1500 computers inspected were defective. How many computers were defective?

3)   In a college election, the winning candidate got 58% of the 368 votes that were cast. How many votes did the winner receive?

4)   A business was given an income tax credit of 8% on the cost of its computer. If the (9) computer cost $2200, how much was the tax credit?

5)   A solution of a battery is 14% sulfuric acid. If we have 9 gallons of the solution, how much of it is acid?

6)   A one-year-old baby often weighs 400% of its birth weight. What should a one year old baby weigh if it was 8 pounds at birth?

7)   A seller pays a real estate commission of 7.5% of the sales price. How much commission would be on a $130,000 house?

8)   Ordinary brass contains 61.6% copper, 2.9% lead, 0.2% tin and 35.3% zinc. How many pounds of each metal would be in 160 lb. of brass?

Finding a Percent

What percent of 8 is 6?   Translate to mathematics. Note: "is" means =.

$$n\% \times 8 = 6$$ Use "n" to indicate the unknown percent

$$n\% \times \frac{8}{8} = \frac{6}{8}$$ Using a fraction bar, divide both sides of equation by 8.

$$n\% = \frac{6}{8}$$ Recall: dividing a number by itself equals one.

$$n\% = \frac{3}{4}$$ Reduce the fraction

$$n\% = 75\%$$ Write the fraction as a percent

$225 is what percent of $120?   Translate

$$\$225 = n\% \times \$120$$ Using a fraction bar divide both sides of equation by $120 (note: the base is not the largest number)

$$\overset{15}{\underset{8}{\frac{\cancel{\$225}}{\cancel{\$120}}}} = n\% \times \frac{\$120}{\$120}$$ Reduce the fraction

$$\frac{15}{8} = n\%$$ Write the fraction as a percent

$$187.5\% = n\%$$

Solve: (Recall the rules for rounding)

1) What percent of 12 is 8?

2) 16 is what percent of 48?

3) What percent of 15 is 3000?

4) What percent of 22 is 5?

5) 14 is what percent of 280?

6) 56 is what percent of 72?

7) What percent of 18 is 27?

8) What percent of 18 is 4.5?

9) 3.2 is what percent of 80?

10) What percent of 60 is 88?

(11)

Application Problems for Finding a Percent

Strategy:
Read the Problem
Recognize the three elements of the percent equation:
Percent, **Base**, and **Part**
Percent has percent sign %, **Base** follows the word "of" ("of" means multiply), **Part** is compared to the base. ("Part" is not always less than "Base" value)
Put into the equation: Percent x Base = Part

A student correctly answered 32 out of 40 questions on a test. What percent of the questions did the student answer correctly?

What percent of 40 is 32?	Translate to math
n% x 40 = 32	Using the fraction bar, divide both sides of equation by 40
$n\% = \dfrac{32}{40}$	Reduce the fraction
$n\% = \dfrac{4}{5}$	Write the fraction as a percent
n% = 80%	The student correctly answered 80% of the questions.

Solve:

1)   A survey of 250 people showed that 220 people favored a candidate for re-election. What percent of the people surveyed favored the candidate?

2)   A salesperson at a dress shop sold $1,200 worth of clothes and earned a commission of $210. What is his commission percent?

3)   There were 13,426 eligible voters for a certain election. On election day 8,206 people cast their vote. What was the percent of voter turn-out?

4)   A merchant sold 3,500 hats in one month. If she purchased 4000 hats, what percent of the hats purchased were sold?

5)   A house painter has an annual income of $35,000 and paid $2,500 in income tax. What percent of her income is the income tax?

6)   An investor received a dividend of $550 on an investment of $4000. What percent of the investment is the dividend?

7)   Bernie was earning $12.60 an hour. He received a raise of $1.07. What percent was his raise?

8)   A family with a monthly income of $2200 spends $850 for rent $225 for utilities and $325 for food. What percent of the family income is spent for each?

Mixed percent problems

Read each problem carefully. Identify which part of the percent equation is missing, and solve each problem.

1)   15% of what number is 60?

2)   4% of 625 is what number?

3)   What percent of 50 is 11?

4)   A spring coat that cost the retailer $60.00 was marked up 20% of the cost. What was the price increase?

5)   The list price of a car at Ira's is $12, 600.00. Since Liza works there, she receives a 12% discount on the list price. How much is the discount?

6)   Mr. Winkleman, a professional wine taster, made $32,800 last year. This year he had a raise of $2,132. What was the percent of the raise?

7)   A television that usually sells for $499 is on sale for 10% off. What is the discount of the television?

(14)

8)   This summer the number of tourists in Salem increased 4.5% from last year's total of 426,000. How many more tourists came to Salem this summer?

9)   At the Liberty Tree Mall 1,300 people took the Coke/Pepsi challenge. 55% of those challenged preferred Coke. How many people selected Coke?

10)   Mercy marks up all goods she sells by 30%. What is the mark up of a hat that cost her $42?

11)   You correctly answered 15 out of 20 problems on your test. What is your percent score?

12)   Martha finished 20 teddy bears of the 21 she was expecting to complete on Tuesday. What percent of her work did she complete? (Round to the nearest whole percent)

Common Percents

Some common percents are related to common fractions for example: 25% = ¼ 50% ½
Find 50% of 280   50% = ½

280 x ½ = 140   50% is one half of the given number. The correct answer is found
or 280 ÷ 2 = 140   by multiplying by ½ or dividing by 2.
50% of 280 = 140

Some common percents are related to decimals, for example: 10% = 0.1
Find 10% of 280   10% = 0.1
280 x 0.1 = 28   See decimal booklet for more on multiplying of decimal numbers.
10% of 280 = 28

Some common percents are multiples of whole numbers, for example: 100% = 1, 200% = 2
Find 200% of 280   200% = 2
280 x 2 = 560
200% of 280 = 560.

	Number	10%	50%	100%	200%
	280	280 x 0.1 = 28	280 x ½ = 140	280 x 1 = 280	280 x 2 = 560
1.	360				
2.	3427				
3.	48				
4.	52.7				
5	2.87				
6.	27.54				
7.	3829				
8.	0.78				
9.	0.04				
10.	583.7				

(16)

Figuring Tips and Sales Tax

A tip is usually 15% to 20% of a restaurant bill.

Find a 15% tip for a bill of $12.80   15% = 10% + 5% and 10% x ½ = 5%
$12.80 x 0.1 = $1.28   Find 10%
$1.28 x ½ = $0.64   Find one half of 10%
$1.28 + $0.64 = $1.92   Add the two results for a 15% tip.

Find a 20% tip of a bill of $12.80   20% = 10% x 2
$12.80 x 0.1 = $1.28   Find 10%
$1.28 x 2 = $2.56   Multiply by 2 to find 20%

In Massachusetts the sales tax is 5%.
Find the sales tax on $12.80   5% = 10% x ½
$12.80 x 0.1 = $1.28   Find 10%
$1.28 x ½ = $0.64   Find one half of 10%
The sales tax is $0.64

	Bill	10%	5% (sale tax)	15%	20%
1.	$28.30				
2.	$14.83				
3.	$52.48				
4.	$ 8.74				
5.	$66.98				
6.	$ 4.93				
7.	$82.95				
8.	$ 1.52				
9.	$72.84				
10.	$30.65				

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Estimating Using Common Percents

In a multiple-choice test, estimation can be used to select the correct answer.
Strategy: Use numerical judgment and common percent values to narrow the selection.
78% of 200 is: a) 1560 b) 156 c) 15.6   Note that the part is missing
50% of 200 is 100   78% is between 50% and 100%.
The correct answer is: b) 156   The answer must also be between 100 and 200.

45% of a) 82   b) 820   c) 8200   is 369.   Note that the base is missing.
45% is close to 50%   Find 50% of each of the given choices.
50% of 82 is 41   41 is much less than 369
50% of 820 is 410   410 is greater than 369, but close, (just as 50% is
                                    greater than 45% but close)
50% of 8200 is 4100   4100 is much greater.
The correct answer is: b) 820   Check the answer: 45% of 810 = 369

Use estimation and judgment to select the correct answer:

1)   30% of 600 is: a) 1800   b) 180   c) 18

2)   43% of 7000 is: a) 3,010   b) 30,100   c) 301,000

3)   43% of 200 is: a) 68   b) 680   c) 6800

4)   90% of 30 is   a) 2700   b) 270   c) 27

5)   79% of 500 is   a) 39,000   b) 3,950   c) 395

6)   65% of 70 is   a) 455   b) 45.5   c) 4.55

7)   80 is a) 5%   b) 50%   c) 500%   of 160.   (18)

8)   48 is   a) 6%   b) 60%   c) 600%   of 80.

9)   56 is   a) 8%   b) 80%   c) 800%   of 70.

10)   1500 is   a) 2%   b) 20%   c) 200%   of 750.

11)   60 is   a) 60%   b) 6%   c) 600%   of 100.

12)   210 is   a) 7%   b) 70%   c) 700%   of 30.

13)   360 is 50% of   a) 7.2   b) 72   c) 720

14)   240 is 6% of   a) 40   b) 400   c) 4000

15)   40 is 80% of   a) 50   b) 500   c) 5000

16)   75 is 30% of   a) 25   b) 250   c) 2500

Percent Answers

Page 3	Page 4	Page 5	Page 6	Page 8
1) 0.085	1) $\dfrac{1}{4}$	1) 16%	1) 70%	1) 123
2) 0.03	2) $\dfrac{2}{5}$	2) 93%	2) 12%	2) 150
3) 0.65	3) $\dfrac{83}{100}$	3) 5%	3) 35%	3) 0.1
4) 0.0375	4) $\dfrac{9}{20}$	4) 75%	4) 60%	4) 495
5) 0.425	5) 1	5) 175%	5) $37\dfrac{1}{2}\%$	5) 49.4
6) 9.03	6) $1\dfrac{3}{10}$	6) 309%	6) $122\dfrac{1}{2}\%$	6) 24.6
7) 0.0207	7) $1\dfrac{1}{2}$	7) 80%	7) $566\dfrac{2}{3}\%$	7) 8
8) 0.505	8) $6\dfrac{1}{4}$	8) 0.60%	8) $427\dfrac{3}{11}\%$	8) 210.8
9) 1.25	9) $\dfrac{7}{10}$	9) 550%		9) 14.72
10) 1	10) $\dfrac{33}{50}$	10) 45%		10) 11.475

Pages 9-10	Page 11	Pages 12-13	Pages 14-15
1) $27.50	1) $66\dfrac{2}{3}\%$	1) 88% people surveyed	1) 400
2) 20 computers	2) $33\dfrac{1}{3}\%$	2) 17.5% commission	2) 25
3) 213 votes	3) 200%	3) 61% voters	3) 22%
4) $176	4) 22.7%	4) 87.5% hats	4) $12 markup
5) 1.26 gallons	5) 5%	5) 7% tax rate	5) $1,512 discount
6) 32 pounds	6) 78%	6) 13.75% dividend	6) 6.5% raise
7) $9,750	7) 150%	7) 8.5% raise	7) $49.90 discount
8) 98.56 lbs copper	8) 25%	8) Rent: 39%	8) 19,170 tourists
4.64 lbs lead	9) 4%	Utilities: 10%	9) 715 coke lovers
0.32 lbs tin	10) 147%	Food: 15%	10) $12.60 markup
56.48 lbs zinc			11) 75% grade
			12) 95% finished

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1)	b) 180	9)	b) 80%
2)	a) 3,010	10)	c) 200%
3)	a) 68	11)	a) 60%
4)	c) 7	12)	c) 700%
5)	c) 395	13)	c) 720
6)	b) 45.5	14)	c) 4000
7)	b) 50%	15)	a) 50
8)	b) 60%	16)	b) 250

Answers to:
Page7, Page 16, and Page 17
On following page

Page 7

	Percent	Decimal	Fraction
1	33.3% $33\frac{1}{3}\%$	0.33	$\frac{1}{3}$
2	530%	5.3	$5\frac{3}{10}$
3	387.5% $387\frac{1}{2}\%$	3.875	$3\frac{7}{8}$
4	$66\frac{2}{3}\%$	0.667	$\frac{2}{3}$
5	75%	0.75	$\frac{3}{4}$
6	6%	0.06	$\frac{3}{50}$
7	25%	0.25	$\frac{1}{4}$
8	5%	0.05	$\frac{1}{20}$
9	40%	0.4	$\frac{2}{5}$
10	100%	1.00	1

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	Num	10%	50%	100%	200%
1	360	36	130	360	720
2	3427	342.7	1713.5	3427	6854
3	48	4.8	24	48	96
4	52.7	5.27	26.35	52.7	105.4
5	2.87	0.287	1.435	2.87	5.74
6	27.54	2.754	13.77	27.54	55.08
7	3829	382.9	1914.5	3829	7658
8	0.78	0.078	0.39	0.78	1.56
9	0.04	0.004	0.02	0.04	0.08
10	583.7	58.37	291.85	583.7	1167.4

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	Bill	10%	5%	15%	20%
1.	$28.30	$ 2.83	$ 1.42	$ 4.25	$ 5.66
2.	$14.83	$ 1.48	$ 0.74	$ 2.22	$ 2.96
3.	$52.48	$ 5.25	$ 2.63	$ 7.88	$10.50
4.	$ 8.74	$ 0.87	$ 0.44	$ 1.31	$ 1.74
5.	$66.98	$ 6.70	$ 3.35	$10.05	$13.40
6.	$ 4.93	$ 0.49	$ 0.25	$ 0.74	$ 0.98
7.	$82.95	$ 8.30	$ 4.15	$12.45	$16.60
8.	$ 1.52	$ 0.15	$ 0.08	$ 0.23	$ 0.30
9.	$72.84	$ 7.28	$ 3.64	$10.92	$14.56
10.	$30.65	$ 3.07	$ 1.54	$ 4.61	$ 6.14