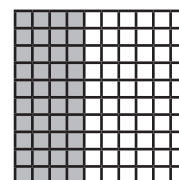


NS8-82 Percents

The words “per cent” mean “out of 100.” A percent is a ratio that compares a number or amount to 100.
 The symbol for a percent is %. Example: $45\% = 45 : 100 = \frac{45}{100}$

1. a) 40 out of 100 squares are shaded. The ratio of shaded squares to all squares is ___ : 100.
 So, ___% of the grid is shaded.



- b) 49 out of 100 letters are Bs. The ratio of Bs to all letters in the set is ___ : 100.
 So, ___% of the letters are Bs.

**BBBBCCBBAABBCABBCCB
 AAABBBCCBBAABAAABBC
 CBCABBBCCBBBCCBBAAB
 BAAABBABCBBAAABCCBBAB
 BCCBAABBAAAABCCABAB**

2. Write the ratio as a percent.
 a) $50 : 100 = \underline{\quad}\%$ b) $72 : 100 = \underline{\quad}\%$ c) $7 : 100 = \underline{\quad}\%$ d) $43 : 100 = \underline{\quad}\%$
3. Write the percent as a ratio.
 a) $70\% = \underline{\quad} : \underline{100}$ b) $13\% = \underline{\quad} : \underline{\quad}$ c) $38\% = \underline{\quad} : \underline{\quad}$ d) $8\% = \underline{\quad} : \underline{\quad}$
4. Write the ratio as a fraction and as a percent.
 a) $60 : 100 = \frac{\quad}{100} = \underline{\quad}\%$ b) $10 : 100 = \frac{\quad}{100} = \underline{\quad}\%$
5. Write the fraction as a percent.
 a) $\frac{52}{100} = \underline{\quad}\%$ b) $\frac{39}{100} = \underline{\quad}\%$ c) $\frac{18}{100} = \underline{\quad}\%$ d) $\frac{2}{100} = \underline{\quad}\%$ e) $\frac{6}{100} = \underline{\quad}\%$
6. Write the percent as a fraction.
 a) $12\% = \frac{\quad}{100}$ b) $7\% = \frac{\quad}{100}$ c) $49\% = \frac{\quad}{100}$ d) $3\% = \frac{\quad}{100}$ e) $100\% = \frac{\quad}{100}$

7. Complete the chart.

Drawing				
Fraction	$\frac{34}{100}$	$\frac{\quad}{100}$	$\frac{67}{100}$	$\frac{\quad}{100}$
Percent	34%	52%	___%	___%

NS8-85 Fractions and Percents

1. Write the fraction as a percent by changing it to a fraction over 100.

a) $\frac{3 \times 20}{5 \times 20} = \frac{60}{100} = 60\%$

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

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

d) $\frac{8}{25}$

2. Two out of five friends, or $\frac{2}{5}$, ordered pizza. What percent ordered pizza? _____

3. Change the fraction to a percent. Reduce the fraction to lowest terms if necessary.

a) $\frac{9}{15} = \frac{3}{5} = \frac{60}{100} = 60\%$

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

c) $\frac{9}{18} =$

d) $\frac{6}{24} =$

e) $\frac{2}{5}$

f) $\frac{7}{10}$

g) $\frac{6}{15}$

h) $\frac{17}{20}$

i) $\frac{12}{48}$

4. Divide to change the fraction to a decimal. Then write the decimal as a percent.

a) $\frac{3}{4} = 3 \div 4 = 0.\underline{\quad}\underline{\quad} = \underline{\quad}\underline{\quad}\%$

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

c) $\frac{6}{15}$

d) $\frac{15}{25}$

e) $\frac{65}{500}$

5. Write the percent as a decimal, then as a fraction, then in lowest terms.

a) 30%

b) 84%

c) 55%

d) 4%

e) 90%

6. Is the fraction closest to 10%, 25%, 50%, 75%, or 100%?

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

b) $\frac{2}{10}$

c) $\frac{2}{5}$

d) $\frac{9}{10}$

e) $\frac{11}{20}$

f) $\frac{16}{20}$

g) $\frac{4}{25}$

7. Estimate what percent the fraction is. Say what fraction you used to make your estimate. Then divide to change the fraction to a decimal. Was your estimate close?

a) $\frac{11}{40}$

b) $\frac{23}{49}$

c) $\frac{60}{84}$

d) $\frac{14}{24}$

e) $\frac{4}{42}$

f) $\frac{21}{31}$

8. Write the fraction as a decimal. Round to two decimal places. Write the approximate percent.

a) $\frac{5}{12} = 5 \div 12 = 0.41\bar{6} \approx 0.42 = \underline{\quad}\underline{\quad}\%$

b) $\frac{1}{3}$

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

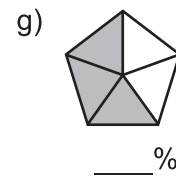
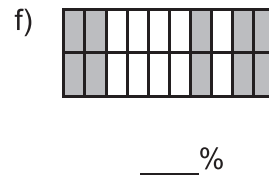
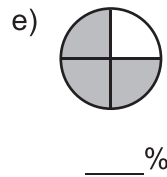
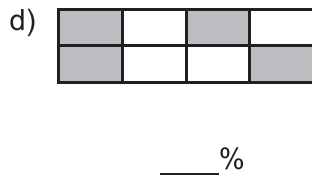
d) $\frac{2}{9}$

e) $\frac{5}{6}$

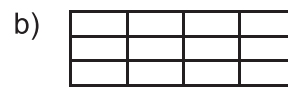
f) $\frac{1}{7}$

NS8-86 Visual Representations of Percents

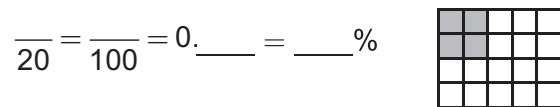
1. What percent of the figure is shaded?



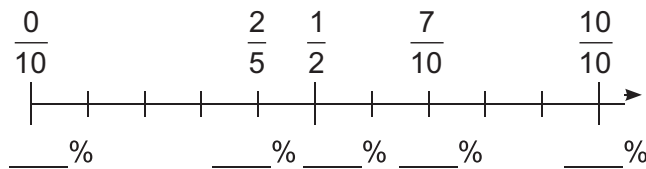
2. Shade 50% of each figure.



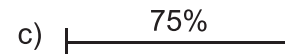
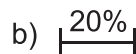
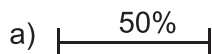
3. Write different expressions for the shaded area.



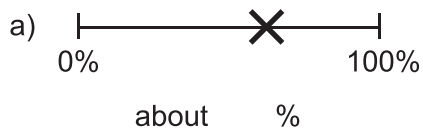
4. Write the percents that are equivalent to the fractions.



5. Measure the line segment. Extend the segment to show 100%.



6. Estimate the percent of the line segment to the left of the mark.



7. 25 out of 50 squares in a grid are shaded. What fraction and percent of the squares are shaded?

8. Alice must do 40 hours of community service. She has completed 10 hours. What fraction and percent of the hours has she completed? What percent of the hours must still be completed?

9. When would you use the measurement to describe the amount, and when would you use the percent (if ever)? Write a sentence using each expression.

- a) 3 h of the school day or 50% of the school day b) 12 kg of berries or 40% of the berries

NS8-87 Comparing Fractions, Decimals, and Percents

1. Complete the chart.

Fraction	$\frac{1}{4}$		$\frac{3}{20}$			$\frac{6}{15}$	$\frac{23}{25}$		
Decimal		0.35			0.60				0.55
Percent				40%				75%	

2. Write < or > or = between each pair of numbers. First change the numbers to a pair of decimal fractions with the same denominator.

a) $\frac{1}{2}$ 47% b) $\frac{1}{2}$ 57% c) $\frac{1}{5}$ 22% d) $\frac{3}{5}$ 80%

$$\frac{1 \times 50}{2 \times 50} \quad \frac{47}{100}$$

$$\frac{50}{100} > \frac{47}{100}$$

e) $\frac{3}{4}$ 67% f) 0.26 42% g) 0.05 7% h) $\frac{3}{10}$ 30%

i) $\frac{21}{25}$ 18% j) $\frac{39}{50}$ 76% k) 0.8 15% l) $\frac{16}{20}$ 32%

3. Change the numbers in each set to decimals. Then order the decimals from least to greatest.

a) $\frac{3}{5}$, 42%, 0.73

b) $\frac{1}{2}$, 0.73, 80%

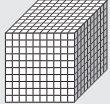





c) $\frac{1}{4}$, 0.09, 15%

4. a) In Abeed's school, $\frac{3}{5}$ of students like gym and 65% like drama. Which class is more popular?

b) In Rachel's class, 0.45 of the students like pepperoni pizza best, 35% like cheese, and $\frac{1}{5}$ like vegetarian. Which type of pizza do the most students like best?

NS8-88 Finding Percents

If you use a thousands cube to represent 1 whole, you can see that taking $\frac{1}{10}$ of a number is the same as dividing by 10 (the decimal shifts one place left):

$\frac{1}{10}$ of 	=		$\frac{1}{10}$ of 	=		$\frac{1}{10}$ of 	=	
$\frac{1}{10}$ of 1 = 0.1		$\frac{1}{10}$ of 0.1 = 0.01		$\frac{1}{10}$ of 0.01 = 0.001				

1. Find $\frac{1}{10}$ of each number by shifting the decimal. Write your answers in the boxes provided.

a) 7	b) 10	c) 35	d) 210	e) 6.4	f) 50.6
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

2. 10% is short for $\frac{10}{100}$ or $\frac{1}{10}$. Find 10% of each number.

a) 1	b) 3.9	c) 4.05	d) 6.74	e) 0.09	f) 60.08
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

How to Find Percents That Are Multiples of 10

Step 1: Find 10% of the number.

Example: Find 30% of 21.

$$10\% \text{ of } 21 = \boxed{2.1}$$

There are 3 tens in 30 ($30 = 3 \times 10$).

$$3 \times \boxed{2.1} = 6.3$$

So 30% of 21 = 6.3.

Step 2: Multiply the result by the number of tens in the percent.

3. Find the percent using the method above.

a) 30% of 15	b) 40% of 35	c) 20% of 2.7
10% of 15 = <input type="text"/>	10% of ___ = <input type="text"/>	10% of ___ = <input type="text"/>
3 × <input type="text"/> = ___	___ × <input type="text"/> = ___	___ × <input type="text"/> = ___
d) 50% of 62	e) 80% of 17	f) 30% of 0.7
10% of ___ = <input type="text"/>	10% of ___ = <input type="text"/>	10% of ___ = <input type="text"/>
___ × <input type="text"/> = ___	___ × <input type="text"/> = ___	___ × <input type="text"/> = ___

4. If you know 10% of a number n , then 5% of n is 10% divided by 2. Complete the chart.

5%	3			
10%	6	20	42	1
100%	60			

Use these steps to find 1% of a number:

Step 1: Change the percent to a decimal and replace “of” with “ \times .”

Step 2: Multiply by 0.01 by shifting the decimal two places left.

5. Fill in the blanks.

a) 1% of 300 = $0.01 \times 300 =$ _____ b) 1% of 2000 = _____ \times _____ = _____
 c) 1% of 15 = _____ \times _____ = _____ d) 1% of 60 = _____ \times _____ = _____

6. Find 1% of 200 and use your answer to calculate each percent.

a) 2% of 200 = _____ b) 3% of 200 = _____ c) 12% of 200 = _____

7. Use the method of Question 6 to calculate...

a) 4% of 800 b) 2% of 50 c) 11% of 60 d) 2% of 4 e) 7% of 45

8. Fill in the missing numbers. (Hint: $8\% = 4\% + 4\%$.)

2%	4%	8%	10%	20%	50%	25%	100%
	20						
	30						
					60		
			50				

9. a) If 45% is 9, what is 90%? b) If 3% is 12, what is 1%?
 c) If 40% is 64, what is 100%? d) If 20% is 13, what is 100%?

10. Arti wants to leave a 15% tip on a meal that cost \$60. How much tip should she leave? (Hint: $15\% = 10\% + 5\%$.)

11. a) A shirt that usually costs \$40 is on sale for 25% off. What is 25% of \$40? What is $\$40 - (25\% \text{ of } \$40)$? What is the sale price of the shirt?
 b) How would you estimate the price if a shirt that usually costs \$32.99 is on sale for 25% off?

NS8-90 Writing Equivalent Statements for Proportions

These are equivalent statements:



$\frac{6}{9}$ of the circles are shaded.



$\frac{2}{3}$ of the circles are shaded.



6 is $\frac{2}{3}$ of 9.



$6 : 9 = 2 : 3$
 part whole

1. Write four equivalent statements for each picture.



$\frac{4}{6}$ are shaded

$\frac{2}{3}$ are shaded

4 is $\frac{2}{3}$ of 6

$4 : 6 = 2 : 3$







2. For each picture, write a pair of equivalent ratios.



4 is $\frac{1}{2}$ of 8

$\frac{4}{8} = \frac{1}{2}$
 part whole = 1 : 2



6 is $\frac{3}{5}$ of 10

$\frac{6}{10} = \frac{3}{5}$
 part whole = ____ : ____



2 is $\frac{1}{4}$ of 8

$\frac{2}{8} = \frac{1}{4}$
 part whole = ____ : ____

3. For each statement, write a pair of equivalent ratios and equivalent fractions.

a) 15 is $\frac{3}{4}$ of 20 $\frac{\text{part}}{\text{whole}} = \frac{\text{part}}{\text{whole}}$ = ____ : ____

b) 18 is $\frac{9}{10}$ of 20 $\frac{\text{part}}{\text{whole}} = \frac{\text{part}}{\text{whole}}$ = ____ : ____

4. Write a question mark where you are missing a piece of information.

a) 12 is $\frac{4}{5}$ of what number? $\frac{12}{\text{part}} : \frac{?}{\text{whole}} = \frac{4}{5} : \frac{5}{5}$ $\frac{\text{part}}{\text{whole}} \frac{12}{?} = \frac{4}{5}$

b) 6 is how many quarters of 8? $\frac{6}{\text{part}} : \frac{8}{\text{whole}} = \frac{?}{5} : \frac{4}{5}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

c) What is $\frac{3}{4}$ of 16? $\frac{\text{---}}{\text{part}} : \frac{\text{---}}{\text{whole}} = \text{---} : \text{---}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

d) 20 is how many thirds of 30? $\frac{\text{---}}{\text{part}} : \frac{\text{---}}{\text{whole}} = \text{---} : \text{---}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

5. For each statement, write a pair of equivalent ratios and a pair of equivalent fractions.

a) 15 is what percent of 20? $\frac{15}{\text{part}} : \frac{20}{\text{whole}} = \frac{?}{100} : \frac{100}{100}$ $\frac{\text{part}}{\text{whole}} \frac{15}{20} = \frac{?}{100}$

b) What is 25% of 80? $\frac{\text{---}}{\text{part}} : \frac{\text{---}}{\text{whole}} = \text{---} : \text{---}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

c) 9 is what percent of 12? $\frac{\text{---}}{\text{part}} : \frac{\text{---}}{\text{whole}} = \text{---} : \text{---}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

d) 18 is 3% of what number? $\frac{\text{---}}{\text{part}} : \frac{\text{---}}{\text{whole}} = \text{---} : \text{---}$ $\frac{\text{part}}{\text{whole}} \text{---} = \text{---}$

6. Write the two pieces of information you are given and what you need to find (?). Then write an equation for the problem.

a) What percent of 30 is 5? part 5 whole 30 percent ? $\frac{5}{30} = \frac{?}{100}$

b) If 7 is 20%, what is 100%? part whole ? percent $\frac{\text{---}}{?} = \frac{\text{---}}{100}$

c) What is 6% of 24? part ? whole percent $\frac{?}{\text{---}} = \frac{\text{---}}{100}$

d) If 3 is 12%, what is 100%? part whole percent $\text{---} = \frac{\text{---}}{100}$

e) What percent of 90 is 4? part whole percent $\text{---} = \frac{\text{---}}{100}$

f) What is 52% of 18? part whole percent $\text{---} = \frac{\text{---}}{100}$

g) 7 is what percent of 25? part whole percent $\text{---} = \frac{\text{---}}{100}$

NS8-91 Using Proportions to Solve Percent Problems

If 5 subway tickets cost \$4, how much do 20 tickets cost? Write the ratio of tickets to dollars as a fraction, then find an equivalent fraction by multiplying.

Step 1:

$$\frac{4}{5} = \frac{?}{20}$$

Step 2:

$$\frac{4}{5} \begin{array}{c} \xrightarrow{\times 4} \\ \xrightarrow{=} \\ \xrightarrow{\times 4} \end{array} \frac{\quad}{20}$$

Step 3:

$$\frac{4}{5} \begin{array}{c} \xrightarrow{\times 4} \\ \xrightarrow{=} \\ \xrightarrow{\times 4} \end{array} \frac{16}{20}$$

1. Solve the ratio. Draw arrows and show what you multiply by.

a) $\frac{3}{4} = \frac{\quad}{20}$

b) $\frac{1}{5} = \frac{\quad}{15}$

c) $\frac{3}{5} = \frac{\quad}{35}$

d) $\frac{4}{7} = \frac{\quad}{49}$

e) $\frac{3}{8} = \frac{\quad}{24}$

f) $\frac{2}{3} = \frac{\quad}{18}$

g) $\frac{13}{20} = \frac{\quad}{100}$

h) $\frac{5}{9} = \frac{\quad}{72}$

2. Solve the ratio as you did in Question 1. Note: The arrows will point from right to left.

a) $\frac{15}{8} = \frac{3}{4}$

b) $\frac{12}{5} = \frac{2}{5}$

c) $\frac{15}{5} = \frac{3}{7}$

d) $\frac{12}{18} = \frac{\quad}{3}$

3. For each question, you will have to reduce the fraction given before you can find the equivalent fraction. The first one has been started for you.

a) $\frac{8}{10} = \frac{4}{5} = \frac{\quad}{15}$

b) $\frac{4}{6} = \frac{\quad}{\quad} = \frac{\quad}{15}$

c) $\frac{40}{100} = \frac{\quad}{\quad} = \frac{\quad}{45}$

d) $\frac{15}{18} = \frac{\quad}{\quad} = \frac{\quad}{30}$

e) $\frac{70}{100} = \frac{\quad}{\quad} = \frac{\quad}{90}$

f) $\frac{50}{75} = \frac{\quad}{\quad} = \frac{\quad}{36}$

4. Write a proportion to represent the percent problem. Solve the proportion.

a) What percent of 20 is 4? part $\frac{\quad}{\quad}$ whole $\frac{\quad}{\quad}$ percent $\frac{\quad}{\quad}$ $\frac{\quad}{\quad} = \frac{\quad}{100}$

b) If 6 is 25%, what is 100%? part $\frac{\quad}{\quad}$ whole $\frac{\quad}{\quad}$ percent $\frac{\quad}{\quad}$ $\frac{\quad}{\quad} = \frac{\quad}{100}$

c) What is 17% of 10? part $\frac{\quad}{\quad}$ whole $\frac{\quad}{\quad}$ percent $\frac{\quad}{\quad}$ $\frac{\quad}{\quad} = \frac{\quad}{100}$

d) What is 17% of 50? part $\frac{\quad}{\quad}$ whole $\frac{\quad}{\quad}$ percent $\frac{\quad}{\quad}$ $\frac{\quad}{\quad} = \frac{\quad}{100}$

e) 4 is what percent of 5?

f) 6 is 25% of what number?

g) 24 is 80% of what number?

5. Explain why the proportion $\frac{3}{25} = \frac{x}{100}$ will be easy to solve.

6. Write a proportion $\frac{a}{b} = \frac{x}{100}$ to represent each problem. Solve by first writing $\frac{a}{b}$ in lowest terms.

- a) What percent of 15 is 3? b) What percent of 24 is 6? c) What percent of 30 is 12?

7. Write a proportion to represent the percent problem. Find an equivalent ratio to rewrite the proportion.

a) If 6 is 40%, what is 100%? part 6 whole ? percent 40 $\frac{6}{?} = \frac{40}{100}$ $\frac{6}{?} = \frac{2}{5}$

Hint: Start by writing $\frac{40}{100}$ as an equivalent ratio with numerator 2.

b) What is 75% of 48? part whole percent $\frac{\quad}{\quad} = \frac{\quad}{100}$ $\frac{\quad}{\quad} = \frac{\quad}{\quad}$

Hint: Start by writing 75% as an equivalent ratio with denominator 4.

c) What percent of 60 is 45? part whole percent $\frac{\quad}{\quad} = \frac{\quad}{100}$ $\frac{\quad}{\quad} = \frac{\quad}{\quad}$

Hint: Start by writing $\frac{45}{60}$ as an equivalent ratio with denominator 20.

d) What is 64% of 15? part whole percent $\frac{\quad}{\quad} = \frac{\quad}{100}$ $\frac{\quad}{\quad} = \frac{\quad}{\quad}$

Hint: Start by writing $\frac{64}{100}$ as an equivalent ratio with denominator 5.

8. Solve the proportions in Question 7. Explain why the proportions in Question 7 were more challenging to solve than those in Question 4.

9. Solve.

- a) 8 is 40% of what number? b) What is 60% of 30?
c) 15 is 75% of what number? d) What percent of 240 is 60?

10. If 4 of 25 fish are blue, what percent of the fish are blue? What percent are not blue?

11. If 45% of 180 students voted for Kendra for student council, how many of the students voted for Kendra?

12. 12 students in a class (60% of the class) are fluent in French. How many students are in the class?

NS8-92 Solving Percent Problems — Advanced

$\frac{3}{4} = 0.75$ means the same thing as $3 \div 4 = 0.75$.

1. a) Write $\frac{a}{b} = c$ as a division statement. $\underline{\hspace{1cm}} \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
 b) Use the information from part a) to write a as a product. $a = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$

2. Change the equation to a multiplication statement.

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

$\underline{\hspace{1cm}} \quad 9 = 2x$

b) $7 = \frac{x}{5}$

$\underline{\hspace{1cm}} \quad 7 \times 5 = x$

c) $\frac{x}{3} = 11$

$\underline{\hspace{1cm}}$

d) $3 = \frac{21}{x}$

$\underline{\hspace{1cm}}$

e) $\frac{12}{x} = 11$

f) $\frac{x}{9} = 7$

g) $\frac{24}{x} = 8$

h) $6 = \frac{x}{7}$

3. Write the equation as a multiplication statement. Then solve for x .

a) $\frac{7}{x} = 3$

$7 = 3x$

$\frac{7}{3} = \frac{3x}{3}$

$\frac{7}{3} = x$

b) $8 = \frac{x}{5}$

c) $2 = \frac{5}{x}$

d) $\frac{x}{3} = 10$

e) $5 = \frac{20}{x}$

f) $9 = \frac{x}{8}$

g) $\frac{x}{5} = 11$

h) $\frac{36}{x} = 4$

$\frac{3}{4} = \frac{9}{12}$

so

$3 \div 4 = 9 \div 12$

$12 \times 3 \div 4 = 12 \times 9 \div 12$ Multiply both sides by 12.

$12 \times 3 \div 4 = 9$ Rewrite the right side.

$12 \times 3 \div 4 \times 4 = 9 \times 4$ Multiply both sides by 4.

$12 \times 3 = 9 \times 4$ Rewrite the left side.

To rewrite $\frac{3}{4} = \frac{9}{12}$ as $12 \times 3 = 9 \times 4$ is called **cross-multiplying** because the products can be obtained from an "X":

$\frac{3}{4} = \frac{9}{12}$

4. Check that cross-multiplying works for these equivalent fractions.

a) $\frac{2}{5} = \frac{6}{15}$

b) $\frac{3}{4} = \frac{6}{8}$

c) $\frac{1}{2} = \frac{5}{10}$

d) $\frac{2}{3} = \frac{8}{12}$

e) make your own

$2 \times 15 = 5 \times 6$

$30 = 30 \checkmark$

5. Cross-multiply and write = (equal) or \neq (not equal) in the box. Then decide if the fractions are equivalent.

a) $\frac{3}{4}$ and $\frac{10}{13}$

$\underline{\quad 3 \quad} \times \underline{\quad 13 \quad} \square \underline{\quad 4 \quad} \times \underline{\quad 10 \quad}$

Are $\frac{3}{4}$ and $\frac{10}{13}$ equivalent? $\underline{\hspace{2cm}}$

b) $\frac{2}{5}$ and $\frac{10}{25}$

$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \square \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

Are $\frac{2}{5}$ and $\frac{10}{25}$ equivalent? $\underline{\hspace{2cm}}$

c) $\frac{9}{10}$ and $\frac{81}{100}$

$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \square \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

Are $\frac{9}{10}$ and $\frac{81}{100}$ equivalent? $\underline{\hspace{2cm}}$

d) $\frac{5}{7}$ and $\frac{28}{35}$

$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \square \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$

Are $\frac{5}{7}$ and $\frac{28}{35}$ equivalent? $\underline{\hspace{2cm}}$

e) $\frac{3}{4}$ and $\frac{15}{20}$

f) $\frac{5}{6}$ and $\frac{35}{42}$

g) $\frac{91}{105}$ and $\frac{104}{120}$

h) $\frac{14}{21}$ and $\frac{30}{48}$

6. Cross-multiply to write an equation for x. (Do not solve.)

a) $\frac{7}{x} = \frac{3}{5}$

$\underline{\quad 7 \times 5 = 3x \quad}$

b) $\frac{x}{9} = \frac{2}{5}$

$\underline{\quad 5x = 2 \times 9 \quad}$

c) $\frac{11}{x} = \frac{5}{2}$

$\underline{\hspace{2cm}}$

d) $\frac{4}{9} = \frac{x}{3}$

e) $\frac{5}{21} = \frac{3}{x}$

f) $\frac{x}{52} = \frac{4}{8}$

g) $\frac{20}{x} = \frac{12}{25}$

h) $\frac{12}{x} = \frac{3}{10}$

7. Solve for x.

a) $\frac{9}{6} = \frac{x}{3}$

b) $\frac{4}{x} = \frac{2}{3}$

c) $\frac{3}{4} = \frac{6}{x}$

d) $\frac{100}{7} = \frac{9}{x}$

e) $\frac{2}{x} = \frac{10}{4}$

You can solve percent problems by first writing a proportion and then cross-multiplying.

Example: What is 70% of 9?

$$\begin{aligned} \frac{x}{9} &= \frac{70}{100} \quad \text{so} \quad 100x = 70 \times 9 \\ 100x &= 630 \\ \frac{100x}{100} &= \frac{630}{100} \\ x &= 6.3 \end{aligned}$$


8. Solve the problem by first writing a proportion.

a) What is 90% of 6?

b) 9 is 2% of what number?

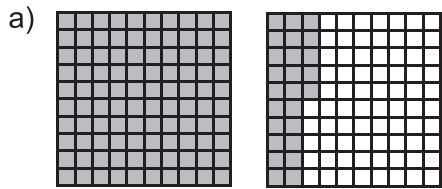
c) 5 is what percent of 8?

Write an equation for each of the problems below and solve the equation. Use a calculator.

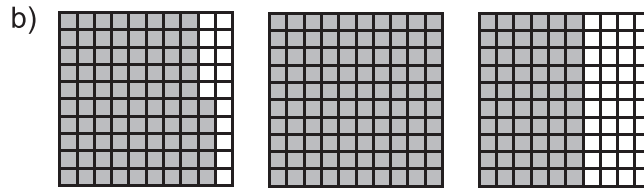
- 9.** a) What percent of 32 is 8?
c) What percent of 128 is 32?
- b) What percent of 125 is 5?
d) What percent of 15 is 0.6?
- 10.** Round the solution to the nearest one.
- a) 5 is about what percent of 24?
c) 4 is about what percent of 9?
e) 1.3 is about what percent of 27?
- b) About what percent of 17 is 9?
d) About what percent of 7 560 is 3 000?
- 11.** If Yvonne has read 54 of the 297 pages in her library book, about what percent of the book has she read so far?
- 12.** Find the amounts. Include units in your answers.
- a) 26% of 130 g
c) 32% of 11 mL
e) 40% of 2 222 min
- b) 11% of 407 m
d) 99% of 8 m²
- 13.** About 3% of 592 students are vegans. About how many of the students are vegans?
- 14.** A basketball team won 60% of the 25 games it played this year.
- a) What percent of the games played did the team lose?
b) How many games did the team lose?
- 
- 15.** Find 100% if...
- a) 25% is 30
b) 15% is 30
c) 3% is 12
- 16.** Round the solution to the nearest one.
- a) 10 is 7%. About what is 100%?
c) 2 is 9%. About what is 100%?
- b) 74 is 32%. About what is 100%?
- 17.** In a Grade 8 class, 6 students, or about 27%, were on the honour roll. How many students were in the class?
- 18.** Kai bought a new computer at a 15% discount. He paid \$1 020.
- a) What percent of the original price did he pay?
b) What was the original price?
c) How many dollars did Kai save by buying the computer at a discount?
- 19.** A computer costs \$1 000 plus 15% tax. Which of these is the best deal?
- A: The store offers a 15% discount on the \$1 000 purchase price, then adds the tax onto the sale price.
B: The store will pay the tax.
C: The store offers a 15% discount, calculated after the tax is added.

NS8-94 Percents Greater Than 100%

1. Determine the total percent of the grids that is shaded as a fraction, decimal, and percent.

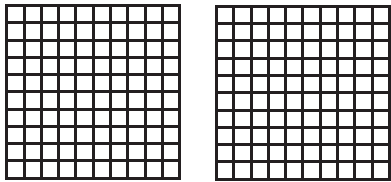


Fraction: $\frac{100}{100} + \frac{100}{100} = 1\frac{0}{100}$
 Decimal: _____ + 0. _____ = _____
 Percent: _____% + _____% = _____%

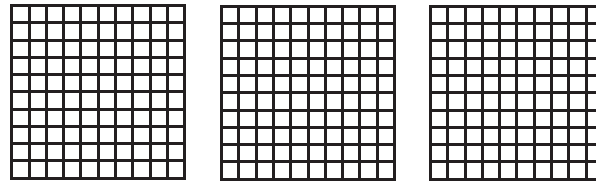


Fraction: _____ + _____ + _____ = _____
 Decimal: _____ + _____ + _____ = _____
 Percent: _____% + _____% + _____% = _____%

2. a) Shade the grids to represent 134%.



b) Shade the grids to represent 273%.



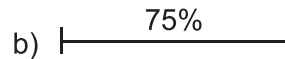
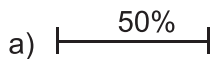
3. Add the percents.

a) $125\% + 240\% = \underline{\hspace{2cm}}\%$ b) $80\% + 60\% = \underline{\hspace{2cm}}\%$ c) $150\% + 75\% = \underline{\hspace{2cm}}\%$

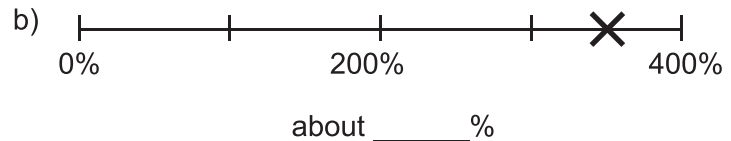
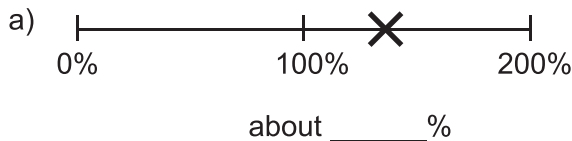
4. Subtract the percents.

a) $117\% - 17\% = \underline{\hspace{2cm}}\%$ b) $125\% - 40\% = \underline{\hspace{2cm}}\%$ c) $675\% - 50\% = \underline{\hspace{2cm}}\%$

5. Measure the line segment. Extend the segment to show 150%.



6. Estimate the percent of the line segment to the left of the mark.



7. Write the ratio as an improper fraction and as a percent.

a) $110 : 100 = \frac{\hspace{1cm}}{100} = \underline{\hspace{1cm}}\%$ b) $350 : 100 = \frac{\hspace{1cm}}{100} = \underline{\hspace{1cm}}\%$ c) $261 : 100 = \frac{\hspace{1cm}}{100} = \underline{\hspace{1cm}}\%$

8. Write the percent as a mixed number with the fractional part in lowest terms.

a) 130% b) 275% c) 308% d) 1505% e) 785%

9. Complete the chart. Hint: If a decimal with one decimal place is given, add a zero to make two decimal places.

Percent			190%	535%			
Mixed Number						$1\frac{76}{100}$	$1\frac{8}{100}$
Decimal	9.2 = <u>9.20</u>	2.32			3.4 = _____		

10. About what percent does the decimal represent? Example: $4.715 \approx 4.72 = 472\%$

a) $4.382 \approx$ _____% b) $5.925 \approx$ _____% c) $5.007 \approx$ _____% d) $2.999 \approx$ _____%

11. Write the percent as a decimal, then as a mixed number, then in lowest terms.

a) 350% b) 540% c) 275% d) 360% e) 515%

12. Write the mixed number as a percent.

a) $2\frac{1}{2}$ b) $3\frac{3}{4}$ c) $8\frac{3}{10}$ d) $1\frac{1}{5}$ e) $20\frac{3}{20}$ f) $17\frac{9}{25}$

13. Write the mixed number as a decimal. Round the decimal to two places. Then write the approximate percent.

a) $3\frac{5}{12} = 3 + 0.41\bar{6} \approx 3.42 =$ _____% b) $3\frac{1}{3}$ c) $4\frac{2}{3}$ d) $1\frac{2}{9}$ e) $2\frac{1}{7}$

14. Change the numbers in each set to decimals. Then order the numbers from greatest to least.

a) $1\frac{1}{2}$ 1.73 180% b) $1\frac{6}{10}$ 157% 1.62 c) $6\frac{1}{4}$ 6.09 615%

15. Determine the amount mentally.

a) 300% of 20 = _____ b) 250% of 50 = _____ c) 110% of 6 = _____ d) 330% of 2 = _____

16. If $30\% = 150$, what is 10% ? _____ What is 100% ? _____

17. Determine 100% mentally.

a) If $40\% = 200$, then $100\% =$ _____ . b) If $5\% = 20$, then $100\% =$ _____ .
 c) If $150\% = 12$, then $100\% =$ _____ . d) If $300\% = 18$, then $100\% =$ _____ .

18. Estimate the solution. Use a calculator to check your estimate. Was your estimate close?

a) What percent of 20 is 30? b) What percent of 45 is 87? c) What percent of 2 is 17?
 d) What percent of 7 is 13? e) What percent of 1.5 is 4.4? f) What percent of 1.1 is 59.3?

NS8-96 Relating Fractions, Ratios, and Percents

1. Write the number of boys (**b**), girls (**g**), and children (**c**) in each class.

- a) There are 7 boys and 6 girls in a class. **b** _____ **g** _____ **c** _____
- b) There are 5 boys and 9 girls in a class. **b** _____ **g** _____ **c** _____
- c) There are 18 boys and 22 girls in a class. **b** _____ **g** _____ **c** _____
- d) There are 15 girls in a class of 27 children. **b** _____ **g** _____ **c** _____

2. Write the number of boys, girls, and children in each class. Then write the fraction of children who are boys and the fraction who are girls in the boxes provided.

- a) There are 6 boys and 9 girls in a class. **b** _____ **g** _____ **c** _____
- b) There are 17 children in the class and 9 are boys. **b** _____ **g** _____ **c** _____

3. Fill in the missing numbers for each classroom.

	Ratio of boys to girls	Fraction of boys	Fraction of girls	Percentage of boys	Percentage of girls
a)	3 : 2	$\frac{3}{5}$	$\frac{2}{5}$	$\frac{3}{5} = \frac{60}{100} = 60\%$	40%
b)	1 : 5				
c)		$\frac{11}{20}$			
d)				30%	
e)		$\frac{12}{25}$			
f)	32 : 18				
g)			$\frac{27}{50}$		
h)					45%
i)				19%	

4. Fill in the missing numbers for each classroom.

	Number of students	Fraction of boys	Fraction of girls	Number of boys	Number of girls
a)	20	$\frac{4}{5}$	$\frac{1}{5}$	$\frac{4}{5} \times 20 = 16$	4
b)	40	$\frac{1}{5}$			
c)	24		$\frac{1}{4}$		
d)	38	$\frac{5}{19}$			

5. Determine the number of girls and boys in each class.

- a) There are 20 children and $\frac{2}{5}$ are boys. b) There are 42 children and $\frac{3}{7}$ are girls.
 c) There are 15 children. d) There are 24 children.
 The ratio of girls to boys is 3 : 2. The ratio of girls to boys is 3 : 5.
 e) There are 25 children and 60% are girls. f) There are 28 children and 25% are boys.

6. For each question, say which classroom has more girls.

- a) In classroom A, there are 40 children and 60% are girls.
 In classroom B, there are 36 children. The ratio of boys to girls is 5 : 4.
 b) In classroom A, there are 28 children. The ratio of boys to girls is 5 : 2.
 In classroom B, there are 30 children and $\frac{3}{5}$ of the children are boys.

7. Ron and Ella shared \$35 in the ratio 4 : 3. What fraction of the money did each person receive? What amount of money did each person receive?

8. Students in a class each chose one sport to participate in for a sports day. Complete the chart. How did you find the number of students who chose swimming?

Chosen sport	Fraction of the class that chose the sport	Percent	Decimal	Number of students who chose the sport
Soccer	$\frac{1}{5}$			4
Swimming		40%		
Baseball				
Gymnastics			.15	

NS8-97 Finding the Whole from the Part

$\frac{2}{3}$ of a number is 100. What is the number?

$$\frac{2}{3} = \frac{100}{?} \quad \begin{array}{l} \text{part} \\ \text{whole} \end{array}$$

$$\frac{2}{3} \xrightarrow{\times 50} \frac{100}{?}$$

$$\frac{2}{3} = \frac{100}{150}$$

The number is 150.

1. Find the number.
 - a) $\frac{2}{5}$ of a number is 4.
 - b) $\frac{3}{7}$ of a number is 9.
 - c) $\frac{5}{11}$ of a number is 25.

2. A box holds red and blue beads. Find the total number of beads in the box.
 - a) $\frac{3}{4}$ of the beads are red. Six beads are red.
 - b) $\frac{3}{5}$ of the beads are blue. Twelve beads are blue.
 - c) 60% of the beads are red. Fifteen beads are red.
 - d) The ratio of red to blue beads is 4 : 5. There are 20 red beads.

3. Ron and Lisa share a sum of money. Ron receives $\frac{2}{5}$ of the money. Lisa receives \$24.
 - a) What fraction of the sum does Lisa receive?
 - b) How much money do Ron and Lisa share?

4. At Franklin Middle School, $\frac{3}{8}$ of the students take a bus to school, $\frac{3}{5}$ walk, and the rest bike. There are 20 students who bike to school. How many students are in the school?

5. In a fish tank, $\frac{2}{3}$ of the fish are red, $\frac{1}{4}$ are yellow, and the rest are green. There are 42 more red fish than green fish.
 - a) What fraction of the fish are green?
 - b) What fraction of the total number of fish does 42 represent? Hint: 42 is the difference between the number of red and green fish.
 - c) How many fish are in the tank?

6. In Tina's stamp collection, 70% of the stamps are Canadian and the rest are international. Tina has 500 more Canadian stamps than international stamps. How many stamps does she have?

7. On a neon sign, $\frac{1}{5}$ of the lights are yellow and the rest are blue and red. There are twice as many blue lights as yellow lights, and there are 200 red lights on the sign. How many lights of all colours are on the sign?

NS8-98 Further Percent Problems

1. A pair of jeans costs \$80. Now the jeans are 20% off. Find the new cost of the jeans in two ways:
- a) Find 20% of 80. Then subtract this amount from 80.
 b) $100\% - 20\% = 80\%$. Find 80% of 80.
2. A daily planner cost \$12.50 last year. The price has increased 20%. What is the new price?
3. A game sells for \$25 plus 14% tax. Is \$28 enough to buy the game?
4. a) $115\% = 46$. What is 100%?
 $\frac{115\%}{115} = \frac{46}{115}$
 $\frac{1\%}{115} = \frac{46}{115} \div 115 = 0.4$
 $\frac{100\%}{1} = 0.4 \times 100$
 $= 40$
- b) $120\% = 80$. What is 100%?

- c) $150\% = 45$. What is 100%?

5. The total cost of a T-shirt, including 14% tax, is \$23.00. The total cost is 114% of the price before taxes. What is the price of the T-shirt before taxes?
6. A grocery buys organic apples at 80 cents each and sells them for \$1 each. What percent does the store mark up the price of each apple?
7. This year, 20 more students joined the band than last year. That is a 10% increase.
 a) How many students were in the band last year?
 b) How many students are in the band this year?
8. The tax on a purchase of \$20 is \$2.80. How much tax will there be on a purchase of \$45.50?
9. Suppose you bought something that was priced at \$6.95, and the total bill was \$7.61. What is the sales tax rate in this city? (Round your answer to one decimal place.)
10. Calculate the percent. Round to one decimal place if necessary.
 a) 25% of 50% $= 0.25 \times 0.50$
 $= 0.125$
 $= 12.5\%$
- b) 10% of 60% = _____

- c) 80% of 30% = _____

11. Ravi gave 60% of his stamp collection to his brother. He sold 20% of the remaining amount. What percent of his collection did he sell?

NS8-99 Word Problems

1. An 8-slice pizza is shared among 3 people.ayah eats 2 pieces, Tegan eats 3 pieces, and Matias eats 3 pieces. The pizza costs \$12.99 plus 14% tax. How much should each person pay?
2. Two hockey goalies, Dillon and Melissa, are comparing their records. Dillon saved 53 out of 60 shots in 3 games. Melissa saved 65 out of 70 shots in 2 games. Find...
 - a) the percentage of shots each person saved (to one decimal place).
 - b) the average number of goals allowed per game by each person (to one decimal place).
 - c) Who do you think is the better goalie? Why?
3. Philip gave away 45% of his hockey cards.
 - a) What fraction of his cards did Philip keep?
 - b) Philip put his remaining cards in a scrapbook. Each page held 18 cards and he filled $23\frac{5}{6}$ pages. How many cards did he put in the book?
 - c) How many cards did Philip have before he gave part of his collection away?
4. Pure gold is 24 karat, so 12-karat gold is 50% pure and 18-karat gold is 75% pure.
 - a) What percentage of pure gold is in 15-karat gold?
 - b) Rita has a gold bracelet weighing 50 g. It is 15-karat gold. If pure gold costs \$23.64/g, what is a fair price for the bracelet?
5. Kevin gave $\frac{2}{7}$ of his savings to charity and spent $\frac{3}{5}$ of the remainder on holiday gifts.
 - a) What fraction of Kevin's money was left?
 - b) If Kevin had \$300 left, how much money did he have to start with?
6. A book costs \$17.50. The salesperson tells you that the total price, including taxes, is \$21.43. How can you tell if the total price is reasonable without using a calculator?
7. You invest \$4 000 in a fund that earns 10% interest each year. If you leave the money in the fund and do not touch it, how much money will you have after two years?
8. Two years ago, a calculator cost \$120. The price increased by 10% last year. This year, last year's price increased by 12%. What is this year's price? What percent did the price increase over the two years?
9. A population increased by 10% one year and then increased by 15% the next year. Explain why there was not a 25% increase in population over the two years.

NS8-101 Rates

A **rate** is a ratio of two quantities measured in different units. Rates are written with a slash instead of a colon or as a fraction. Example: \$2 / 3 min (we read this as “\$2 **per** 3 minutes”)

1. Find the equivalent rate.

a) $\frac{10 \text{ km}}{2 \text{ h}} = \frac{5 \text{ km}}{1 \text{ h}}$ b) $\frac{18 \text{ km}}{3 \text{ h}} = \frac{\text{km}}{1 \text{ h}}$ c) $\frac{20 \text{ km}}{8 \text{ s}} = \frac{\text{km}}{2 \text{ s}}$ d) $\frac{42 \text{ km}}{3 \text{ L}} = \frac{\text{km}}{1 \text{ L}}$
e) $\frac{\$35}{7 \text{ kg}} = \frac{\$5}{\text{kg}}$ f) $\frac{\$96}{6 \text{ h}} = \frac{\$32}{\text{h}}$ g) $\frac{\$1.05}{10 \text{ min}} = \frac{\$}{2 \text{ min}}$ h) $\frac{8 \text{ m}^2}{0.5 \text{ L}} = \frac{\text{m}^2}{1 \text{ L}}$

In a **unit rate**, the second term is equal to 1. The 1 is often left out. Example: 60 km / 1 h = 60 km/h

2. Find the unit rate for each rate (include the units).

a) 20 km / 5 h = $\frac{4 \text{ km}}{1 \text{ h}}$ b) \$12 / 2 boxes = $\frac{\text{ }}{1 \text{ box}}$ c) \$70 / 2 h = $\frac{\text{ }}{1 \text{ h}}$
d) 96 m / 12 s = $\frac{\text{ }}{1 \text{ s}}$ e) \$45 / 9 jars = $\frac{\text{ }}{1 \text{ jar}}$ f) \$32 / 4 kg = $\frac{\text{ }}{1 \text{ kg}}$

3. Change both prices to a unit rate to find out which offer is a better buy.

- a) 6 golf balls for \$10 or 12 golf balls for \$24?
b) \$112 for 7 CDs or \$68 for 4 CDs?
c) \$36.52 for 2 cans of paint or \$46.20 for 3 cans?

4. Density is the ratio of mass to volume measured in grams per cubic centimetre (g/cm³).

- a) 500 cm³ of human blood weigh 612 g. What is the density of human blood?
b) One litre of milk weighs 1.003 kg. Is milk denser than human blood?
c) The density of gasoline is 0.737 g/cm³. Which is heavier: 500 mL of gasoline or 400 mL of milk?

5. Anne donates blood at a rate of 200 mL in 3 minutes. How long will it take Anne to donate 500 mL of blood?

6. A space shuttle flies at a speed of 11 km/s. The Moon is 380 000 km from Earth. How long will it take for the space shuttle to get from Earth to the Moon?

7. Jade is sick. She needs to take 0.5 mL of antibiotic per kilogram of her body weight each day. Jade weighs 42 kg.

- a) How much antibiotic does she need each day?
b) Jade takes the antibiotic 3 times per day. How much antibiotic does she need to take each time?
c) Jade will take the antibiotic for 10 days. How much antibiotic will she get in total?

8. Estimate to the nearest half hour how long it would take to drive each distance at 100 km/h.

- a) 254 km b) 723 km c) 1 425 km