

3-3-3 Simple Percentage Equations

Percent is per hundred. Imagine 15 red marbles in a pile of 40 marbles. If the ratio is the same, how many red marbles would there be in a pile of 100 marbles?

A percentage is a portion of the whole amount. Think of a 50% off sale on a \$24 shirt. To figure this divide by 2 or multiply by .5. Review topic 2 showed that to change a percentage to a decimal, divide by 100. This is easily done by moving the decimal to the left two places. 50% is .5.

In an equation write = for "is" and multiply for "of." Keep the numbers the same. Write the percent as a decimal. Put an x for the "what"

50% **of** \$24 can be written .5(24). The result is 12. **Of** means times in math.

Review solving one step equations by rewriting a percent question sentence as an equation.

What	is	20%	of	15?	Solve this equation by multiplying .2 and 15.
↓	↓	↓	↓	↓	$x = .20(15)$
x	=	.20	•	15	$x = 3$

14%	of	what	is	70?	$.14x = 70$
↓	↓	↓	↓	↓	$\frac{.14x}{.14} = \frac{70}{.14}$
.14	•	x	=	70	$x = 500$

12	is	15%	of	what?	$12 = .15x$
↓	↓	↓	↓	↓	$\frac{12}{.15} = \frac{.15x}{.15}$
12	=	.15	•	x	$80 = x$

2/3%	of	what	is	7 1/2?	Because there are fractions in the problem, change the percent to a fraction instead of a decimal.	$\frac{2}{300}x = 7\frac{1}{2}$
↓	↓	↓	↓	↓		$\left(\frac{300}{2}\right)\frac{2}{300}x = 7\frac{1}{2}\left(\frac{300}{2}\right)$
2/300	•	x	=	7 1/2		$x = \frac{15}{2}\left(\frac{300}{2}\right) = \frac{15}{2}\left(\frac{300^{75}}{2_1}\right) = 1125$

What	is	33 1/3 %	of	1 1/2?	Change 33 1/3 to a fraction.
↓	↓	↓	↓	↓	$33\frac{1}{3} \div 100 = \frac{100}{3} \div \frac{100}{1} = \frac{100}{3} \cdot \frac{1}{100} = \frac{1}{3}$
x	=	$\frac{33\frac{1}{3}}{100}$	•	1 1/2	$x = \frac{1}{3} \cdot 1\frac{1}{2} = \frac{1}{3} \cdot \frac{3}{2} = \frac{1}{2}$

1 2/3	is	2/5 %	of	what?	$1\frac{2}{3} = \frac{1}{250}x$
↓	↓	↓	↓	↓	$\frac{1\frac{2}{3}}{\frac{1}{250}} = \frac{\frac{1}{250}x}{\frac{1}{250}}$
1 2/3	=	(2/5)100	•	x	$1\frac{2}{3} \div \frac{1}{250} = \frac{5}{3} \cdot \frac{250}{1} = 83\frac{1}{3} = x$

Practice: Write the percentage question as a one step equation, then solve. Divide each percent by 100 before writing the equation.

a) 34% of what is 16?

↓ ↓ ↓ ↓ ↓

$\frac{3}{4}\%$ of what is 65?

↓ ↓ ↓ ↓ ↓

b) 21 is 15% of what?

↓ ↓ ↓ ↓ ↓

2.1 is .5% of what?

↓ ↓ ↓ ↓ ↓

c) What is 15% of 32?

↓ ↓ ↓ ↓ ↓

Do the long division to review decimal division.
What is $2\frac{1}{5}\%$ of 3.2?

↓ ↓ ↓ ↓ ↓

Either change the fraction to a decimal or the decimal to a fraction.

More examples:

12 is what percent of 90?

↓ ↓ ↓ ↓ ↓

12 = x • 90

$$12 = x(90)$$

$$\frac{12}{90} = \frac{90x}{90} \text{ Cancel.}$$

$$\frac{2}{15} = x$$

When a percent is put **into** an equation, it is changed into a fraction or a decimal by **dividing by 100**.
To get a percent **out** of an equation, **multiply by 100**.
 $\frac{2}{15} \cdot 100 = \frac{2}{15} \cdot \frac{100}{1} = \frac{40}{3}\%$

What percent of 30 is 10?

↓ ↓ ↓ ↓ ↓

x • 30 = 10

$$30x = 10$$

$$\frac{30x}{30} = \frac{10}{30} = \frac{1}{3}$$

$$\frac{1}{3} \cdot 100 = \frac{100}{3} = 33\frac{1}{3}\%$$

Practice:

d) 3 is what percent of 16?

↓ ↓ ↓ ↓ ↓

$\frac{3}{4}$ is what percent of 16?

↓ ↓ ↓ ↓ ↓

e) What percent of 40 is 600?

↓ ↓ ↓ ↓ ↓

What percent of $\frac{3}{4}$ is 6?

↓ ↓ ↓ ↓ ↓

Remember to multiply the result from the equation by 100 and add the percent symbol.

- f) What is 20% of 32? 14 is what percent of 84? 32 is 55% of what?
- g) What percent of 15 is 300? 350% of 22 is what? 17% of what is 22?
- h) 20% of what is 36? What percent of $\frac{2}{3}$ is 16? 10% of 15 is what?
- i) 54 is what percent of 100? $3\frac{1}{4}$ is 25% of what? What is $2\frac{1}{2}\%$ of 25?

Reword word problems to mimic the easier questions already done. Then solve the problem.

- | | | |
|---|--|---|
| a) Three hundred entered Saturday's jog-a-thon. 5 didn't finish. What percent didn't finish?
Reword: What percent of 300 is 5? | 24% of the runners wrapped their bad knee. Out of the 575 runners, how many had a wrapped knee? | 96% of the runners finished last year. 575 runners finished. How many entered? |
| b) A local library has 150,000 books. An average of 7% are checked out. About how many are checked out? | Little Johnny has 50 books in his little library. He loaned Sally 12 books. What percent did Sally borrow? | If 2.9% of the books in another library are checked out and records show 12,350 are currently out, how many books does the library have total? |
| c) I spend 5.5 out of 8 hours working with others and 2.5 hours independently. What percent do I spend on my own? | Out of a typical month Jonathan spends 85% of his time with customers. When he works 125 hours in a month, How much time was spent with customers? | Tony worked 14 hours one week with customers. The rest of his time was spent filling orders. If he spends 28% of his time with customers, how many hours did he work that week? |
| d) 2.5% of the what-cha-ma –call-its produced an Saturday were defective. There were 325 defective what-cha-ma –call-its. How many useable what-cha-ma –call-its were produced? | A week later the same company made 5,090 what-cha-ma –call-its. 35 were defective. What percent were bad? Which week was better? | Across town a rival company has a 0.3% defective rate. They produce 3402 per day. How many are defective? |
| e) Jill missed 4 and got a 72% on a test. How many were on the test? | Jack earned an 85% on a test with 30 questions How many did he get wrong? | Janet missed 3 on a test with 45 questions. What is her percent correct? |
| f) Tammy spent \$52 on a dress that had been marked down 35%. What was the original price of the dress? | A matching scarf is \$12. If Tammy waits until it goes on sale next week it will be 20% off. How much will she save? | Tammy's husband wants a new tool set originally priced at \$45, on sale for \$30. What percent off is the tool set? He says it will go well with the dress too. |

