MA 0090 Section 06 - Percentages and Expressions
Friday, February 3, 2017

Objectives: Review percentages and evaluating expressions.

**PERCENTS**

When we write 12%, we read this as “12 percent.” This means, roughly, “12 per 100,” or “12 for every 100.” This is a ratio or fraction. Mathematically, the following are the same.

\[12\% = \frac{12}{100} = 0.12\]

If you want, you can interpret the %-sign as meaning \( \cdot \frac{1}{100} \), so

\[12\% = 12 \cdot \frac{1}{100}\]

Along with this, percents are almost always used in the context of a percentage of something, like “12% of $50.” This will always be interpreted as a multiplication, so 12% of $50 would be

\[12\% \cdot 50 = 0.12 \cdot 50 = 6\]
using your calculator.

If we wanted 40% of 35, that would be\( \frac{40}{100} \cdot 35 = 14\).

If we wanted 150% of 75, that would be \(1.50 \cdot 75 = 112.5\).

**FINDING PERCENTS**

In the last example, we saw that

\[1.50 \cdot 75 = 112.5,\]

and we would say that 150% of 75 is 112.5. If we divide both sides of this equation by 75, we get

\[1.50 = \frac{112.5}{75}.\]

That is, if we divide 112.5 by 75, then we get that 112.5 is 150% of 75.

As another example, 52 is going to be a certain percentage of 75. Then (rounded to four decimal places)

\[\frac{52}{75} = 0.6933 = 69.33\%.\]

The thing we’re figuring the percentage *out of* goes on the bottom.

What percentage is 37 of 50?

\[\frac{37}{50} = 0.74 = 74\%\]

What percentage is 80 of 40?

\[\frac{80}{40} = 2.00 = 200\%.\]
1. Quiz 06, Part I

Don’t Round.

1. What is 45% of 70?
2. What is 30% of 55?
3. What is 120% of 60?
4. What is 10% of 45?

For problem 5-8, round percentages to two decimal places, if needed. Enter into D2L as 27.68%.

5. What percentage is 22 of 50?
6. What percentage is 60 of 40?
7. What percentage is 15 of 80?
8. What percentage is 40 of 40?

2. Evaluating Expressions

We will very frequently be working with expressions that include unknown or variable quantities represented by letters. For example, we might have something like

(9) \[ \frac{5a + 2b}{c} \]

The letters \(a\), \(b\), and \(c\) represent numbers. These numbers may be fixed numbers that we don’t know yet, or they may be numbers that can change from one situation to another. In either case, these letters significantly increase the power and usefulness of mathematics.

One thing that we’ll need to do often, is to substitute specific numbers into an expression. In the expression above, we might want to put in the values \(a = -1\), \(b = 2\), and \(c = 5\). It is always a good idea to substitute these numbers in parentheses. It will look like this.

(10) \[ \frac{5(-1) + 2(2)}{5} = \frac{-5 + 4}{5} = \frac{-1}{5}. \]

Substituting inside of parentheses will help you to keep track of minus signs, and help you not to confuse multiplications with additions. Also note that simplifying the expression after substituting is done by following the order of operations.

Here’s another example. Substitute the values \(x = -3\) and \(y = 2\) into the expression

(11) \[ x^2 + 2y - 1. \]

We get

(12) \[ (-3)^2 + 2(2) - 1 = 9 + 4 - 1 = 12. \]

Note how the \((-3)^2 = (-3)(-3) = 9.\)
3. Quiz 06, Part II

9. Substitute \( x = 3 \) into the expression \( 2x - 5x \) and simplify.

10. In the previous problem, substitute \( x = -1 \).

11. Substitute \( a = 1 \) and \( b = 3 \) into the expression \( -4a + b \) and simplify.

12. Substitute \( a = -2 \) and \( b = -1 \) into the expression in problem 11.

13. Substitute \( a = 0 \) and \( b = -2 \) into the expression in problem 11.

14. Substitute \( x = 3 \) and \( y = 2 \) into the expression \( x^2 - y \).

15. Substitute \( x = 0 \) and \( y = 0 \) into the expression from problem 14.

16. Substitute \( x = -1 \) and \( y = -1 \) into the expression from problem 14.

17. Substitute \( x = 1 \) and \( y = 3 \) into the expression \((x + 1)(y - 1)\).

18. Substitute \( x = -1 \) and \( y = 0 \) into the expression of problem 17.

19. Substitute \( x = 2 \) and \( y = 1 \) into the expression of problem 17.

20. Substitute \( x = -1 \) and \( y = -1 \) into the expression of problem 17.
4. Homework 06

Don’t round.

1. What is 55% of 70?
2. What is 30% of 110?
3. What is 170% of 20?
4. What is 100% of 45?

For problem 5-8, round percentages to two decimal places, if needed. Enter into D2L like 26.67%.

5. What percentage is 28 of 100?
6. What percentage is 65 of 80?
7. What percentage is 25 of 160?
8. What percentage is 80 of 40?

For problems 9-20, do the given substitution and simplify.

9. Substitute $x = 2$ into the expression $3x + x^2$ and simplify.
10. In the previous problem, substitute $x = -1$.
11. Substitute $a = 2$ and $b = 5$ into the expression $2a - b$ and simplify.
12. Substitute $a = -2$ and $b = -1$ into the expression in problem 11.
13. Substitute $a = 0$ and $b = -2$ into the expression in problem 11.
14. Substitute $x = 3$ and $y = 2$ into the expression $x - 3y^2$.
15. Substitute $x = 0$ and $y = 0$ into the expression from problem 14.
16. Substitute $x = -1$ and $y = -1$ into the expression from problem 14.
17. Substitute $x = 1$ and $y = 3$ into the expression $(x + 2)(y - 3)$.
18. Substitute $x = -1$ and $y = 0$ into the expression of problem 17.
19. Substitute $x = 2$ and $y = 1$ into the expression of problem 17.
20. Substitute $x = -1$ and $y = -1$ into the expression of problem 17.