Chapter 3

of

FRACTIONS, DECIMALS, & PERCENTS

PERCENTS

In This Chapter . . .

- Percents as Decimals: Multiplication Shortcut
- Percents as Fractions: The Percent Table
- Benchmark Values: 10%
- Percent Increase and Decrease
- Successive Percents
- Smart Numbers: Pick 100
- Interest Formulas
- Chemical Mixtures

PERCENTS

One final way of expressing a part-whole relationship (in addition to decimals and fractions) is by using percents. Percent literally means per 100. One can conceive of percent as simply a special type of fraction or decimal that involves the number 100.

75% of the students like chocolate ice cream.

This means that, for every 100 students, 75 like chocolate ice cream.

In fraction form, we write this as $\frac{75}{100}$, which simplifies to $\frac{3}{4}$.

In decimal form, we write this as 0.75 or seventy-five hundredths. Note that the last digit of the percent is in the hundredths place value.

A percent is simply a fraction with a denominator of 100.

One common mistake is the belief that 100% equals 100. This is not correct. In fact, 100% means $\frac{100}{100}$, or one hundred hundredths. Therefore, 100% = 1.

Percent problems occur frequently on the GMAT. The key to these percent problems is to make them concrete by picking real numbers with which to work.

Percents as Decimals: Multiplication Shortcut

One way of working with percents is by converting them into decimals. Percents can be converted into decimals by moving the decimal point 2 spaces to the left.

70.7% = .707	75% = .75	70% =.70 =.7	7% =.07	0.7% =.007
80.8% = .808	88% = .88	80% =.80 =.8	8% =.08	0.08% = .0008

A decimal can be converted into a percentage by moving the decimal point two spaces to the right. For example:

.6 = 60%	.28 = 28%	.459 = 45.9%	.3041 = 30.41%

Note that there are numbers greater than 100%. If 100% = 1, consider the following:

2 = 200%	3 = 300%	4.1 = 410%	5.68 = 568%

Changing percents into decimals is one way to solve "percent of" problems.

What is 65% of 500?

The phrase "percent of" (% of) signals multiplication.
Therefore, 65% of 500 is .65(500) = 325.00 = 325.

Easy "percent of" problems can be solved in this manner—by simply changing the percentage into a decimal and then multiplying by the number in question.

Percents as Fractions: The Percent Table

Perhaps the most useful way of structuring percent problems on the GMAT is by relating percents to fractions through a percent table as shown below.

	Numbers	Percentage Fraction
PART		
WHOLE		100

This percent table can be useful for the following types of basic percent problems:

Be careful that you have correctly identified the part and the whole when setting up your percent table.

a) What is 30% of 80?
b) 75% of what number is 21?
c) 12 is what percent of 48?

In example a), we are given the whole and the percent, and we are looking for the part. Thus, we fill in the percent table as follows:

PART	x	30
WHOLE	80	100

Using the percent table, we set up a proportion, cross-multiply, and solve:

$$\frac{x}{80} = \frac{30}{100}$$

$$100x = 2{,}400$$
$$x = 24$$

In example b), we are given the part and the percent, and we are looking for the whole. Thus, we fill in the percent table as follows:

PART	21	75
WHOLE	x	100

Using the percent table, we set up a proportion, cross-multiply, and solve:

$$x = 28$$

In example c), we are given the part and the whole, and we are looking for the percent. Thus, we fill in the percent table as follows:

PART	12	x
WHOLE	48	100

Using the percent table, we set up a proportion, cross-multiply, and solve:

$$x = 25$$

Benchmark Values: 10%

To find 10% of any number, just move the decimal point to the left one place.

10% of 500 is 50 10% of 34.99 = 3.499 10% of .978 is .0978

You can use the Benchmark Value of 10% to estimate percents. For example:

Karen bought a new television, originally priced at $690. However, she had a coupon that saved her $67. For what percent discount was Karen's coupon?

You know that 10% of 690 would be 69. Therefore, 67 is slightly less than 10% of 690.

The whole is the original value. It is not necessarily the largest number in the problem.

Percent Increase and Decrease

Some percent problems involve the concept of percent change. For example:

The price of a cup of coffee increased from 80 cents to 84 cents. By what percentage did the price change?

Percent change problems can be solved using our handy percent table. The price change (4 cents) is considered the part, while the ***original*** price (80 cents) is considered the whole. We are trying to solve for the percent change.

PART	4	x
WHOLE	80	100

Using the percent table, we set up a proportion, cross-multiply and solve.

$$\frac{4}{80} = \frac{x}{100}$$
$$400 = 80x$$
$$5 = x$$

Therefore, the price of a cup of coffee increased by 5%.

Alternatively, a question might be phrased as follows:

If a $30 shirt decreased in price by 20%, what was the final price of the shirt?

The whole is the original price of the shirt. The percent change is 20%. In order to find the answer, we must first find the part, which is the amount of the decrease:

PART	x	20
WHOLE	30	100

Using the percent table, we set up a proportion, cross-multiply, and solve:

$$\frac{x}{30} = \frac{20}{100}$$
$$x = 6$$

Therefore, the shirt decreased by $6. The final price of the shirt was $30 − $6 = $24.

Successive Percents

One of the GMAT's favorite tricks involves successive percents.

If a ticket increased in price by 20%, and then increased again by 5%, by what percent did the ticket price increase in total?

Although it may seem counter-intuitive, the answer is NOT 25%!

To understand why, consider a concrete example. Let's say that the ticket initially cost \$100. After increasing by 20%, the ticket price went up to \$120 (\$20 is 20% of \$100).

Here is where it gets tricky. The ticket price goes up again by 5%. However, it increases by 5% of the NEW PRICE of \$120 (not 5% of the original \$100 price). 5% of \$120 is .05(120) = \$6. Therefore, the final price of the ticket is \$120 + \$6 = \$126.

Pick real numbers to solve successive percent problems.

You can now see that two successive percent increases, the first of 20% and the second of 5%, DO NOT result in a combined 25% increase. In fact, they result in a combined 26% increase (because the ticket price increased from \$100 to \$126).

Successive percents MAY NOT simply be added together! This holds for successive increases, successive decreases, and for combinations of increases and decreases (e.g. If a ticket goes up in price by 30% and then goes down by 10%, this does NOT mean that it has gone up a net of 20%).

The best way to solve successive percent problems is to choose real numbers and see what happens. The preceding example used the real value of \$100 for the initial price of the ticket, making it easy to see exactly what happened to the ticket price with each increase. Usually, 100 will be the easiest real number to choose for percent problems.

Note that when you do pick numbers for successive percent problems, be sure you are very careful about which quantities each percentage refers to. Often, the different percentages will refer to different things. For example:

A boy eats 80% of his candy and then eats another 5% of what's left. What percentage of his original candy remains?

Assume there are 100 pieces of candy. The boy eats 80% of them (80 pieces of candy).

Now the boy eats 5% of the *remaining* 20 pieces. (5% of 20 is 1 piece.)

Therefore, the boy has eaten 81 out of the 100 original pieces. 19% of the original candy remains.

Note that the percentages in this problem refer to different quantities. The first percentage (80%) is calculated from the original amount of candy. The second percentage (5%) is calculated from the remaining candy after the boy devours his first portion.

Smart Numbers: Pick 100

More often than not, percent problems on the GMAT include unspecified numerical amounts; often these unspecified amounts are described by variables.

A shirt that initially cost *d* dollars was on sale for 20% off. If *s* represents the sale price of the shirt, *d* is what percentage of *s*?

This is an easy problem that might look confusing. To solve percent problems such as this one, simply pick 100 for the unspecified amount (just as we did when solving successive percents).

In a percent problem with unspecified amounts, pick 100 to represent the original value.

If the shirt initially cost \$100, then $d = 100$. If the shirt was on sale for 20% off, then the new price of the shirt is \$80. Thus, $s = 80$.

The question asks: *d* is what percentage of *s*, or 100 is what percentage of 80? Using a percent table, we fill in 80 as the whole and 100 as the part (even though the part happens to be larger than the whole in this case). We are looking for the percent:

PART	100	x
WHOLE	80	100

Using the percent table, we set up a proportion, cross-multiply, and solve:

$$\frac{100}{80} = \frac{x}{100}$$
$$x = 125$$

Therefore, *d* is 125% of *s*.

The important point here is that, like successive percent problems and other percent problems that include unspecified amounts, this example is most easily solved by plugging in a real value. For percent problems, the easiest value to plug in is 100. The fastest way to success with GMAT percent problems is to constantly pick 100!

Interest Formulas

Certain GMAT percent problems require a working knowledge of basic interest formulas. Although the compound interest formula is very rare on the GMAT, it does occasionally appear.

SIMPLE INTEREST	Principal × Rate × Time	\$5,000 invested for 6 months at an annual rate of 7% will earn \$175 in simple interest. Principal = \$5,000, Rate = 7% or .07, Time = 6 months or .5 years. ***Prt* = \$5,000(.07)(.5) = \$175.00**
COMPOUND INTEREST	$P(1 + \frac{r}{n})^{nt}$, where P = principal, r = rate, n = number of times per year, t = number of years	\$5,000 invested for 1 year at a rate of 8% compounded quarterly will earn approximately \$412: $\$5{,}000\left(1 + \frac{.08}{4}\right)^{4(1)} = \$5{,}412$

Chemical Mixtures

One final type of GMAT percent problem bears mention: the chemical mixture problem.

A 500 ml solution is 20% alcohol by volume. If 100 ml of water is added, what is the new concentration of alcohol?

Chemical mixture problems can be solved systematically by using a mixture chart. Just by reading the problem, we can fill in the following for the original chemical solution:

SUBSTANCES	AMOUNT	PERCENTAGE
Alcohol		20%
Water		
TOTAL	500 ml	100%

Charts are a helpful way to organize information.

Before continuing, we must fill in this chart completely. If the solution is 20% alcohol, then there are .20(500) = 100 ml of alcohol. This leaves 400 ml of water, which is 80% of the solution:

SUBSTANCES	AMOUNT	PERCENTAGE
Alcohol	100 ml	20%
Water	400 ml	80%
TOTAL	500 ml	100%

Now we create a mixture chart for the altered solution. Since 100 ml of water was added, the water amount will change to 500 ml and the total amount will change to 600 ml, while the alcohol amount remains the same:

SUBSTANCES	AMOUNT	PERCENTAGE
Alcohol	100 ml	
Water	500 ml	
TOTAL	600 ml	100%

Finally, we can solve for the new alcohol percentage: $\frac{\text{alcohol}}{\text{total}} = \frac{100}{600} = .1\overline{66} = 16.\overline{6}\%$.

The key to solving these problems is creating TWO MIXTURE CHARTS—one for BEFORE (the original solution) and one for AFTER (the altered solution).

Problem Set

Solve the following problems. Use a percent table to organize percent problems, and pick 100 when dealing with unspecified amounts.

1. x% of y is 10. y% of 120 is 48. What is x?

2. A stereo was marked down by 30% and sold for $84. What was the presale price of the stereo?

3. From 1980-1990, the population of Kumar increased by 6%. From 1991-2000, it decreased by 3%. What was the overall percentage change in the population of Kumar from 1980-2000?

4. If y is decreased by 20% and then increased by 60%, what is the new number, expressed in terms of y?

5. A 7% car loan, which is compounded annually, has an interest payment of $210 after the first year. What is the principal on the loan?

6. A bowl was half full of water. 4 cups of water were then added to the bowl, filling the bowl to 70% of its capacity. How many cups of water are now in the bowl?

7. A tide pool is filled with 920 units of sodium chloride and 1,800 units of water. 40% of the water evaporates. What percentage of the liquid in the pool remains water?

8. x is 40% of y. 50% of y is 40. 16 is what percent of x?

9. 800, increased by 50% and then decreased by 30%, yields what number?

10. Lori deposits $100 in a savings account at 2% interest, compounded annually. After 3 years, what is the balance on the account? (Assume Lori makes no withdrawals or deposits.)

11. A full bottle contains 40% oil, 20% vinegar, and 40% water. The bottle is poured into a larger bottle, four times as big as the original. The remaining space in the larger bottle is then filled with water. If there were 8 ml of oil in the original bottle, how much water is in the final mixture?

12. A professional gambler has won 40% of his 25 poker games for the week so far. If, all of a sudden, his luck changes and he begins winning 80% of the time, how many more games must he play to end up winning 60% of all his games for the week?

13. If 1,600 is increased by 20%, and then reduced by y%, yielding 1,536, what is y?

14. A certain copy machine is set to reduce an image by 13%. If Steve photocopies a document on this machine, and then photocopies the copy on the same machine, what percent of the original will his final image size be?

15. A bottle is 80% full. The liquid in the bottle consists of 60% guava juice and 40% pineapple juice. The remainder of the bottle is then filled with 70 mL of rum. How much guava juice is in the bottle?

1. **25:** Use two percent tables to solve this problem. Begin with the fact that y% of 120 is 48:

PART	48	y
WHOLE	120	100

$4,800 = 120y$
$y = 40$

Then, set up a percent table for the fact that x% of 40 is 10.

PART	10	x
WHOLE	40	100

$1,000 = 40x$
$x = 25$

2. **$120:** Use a percent table to solve this problem. Remember that, if the stereo was marked down by 30%, the sale price represents 70% of the original price.

PART	84	70
WHOLE	x	100

$8,400 = 70x$
$x = 120$

3. **2.82% increase:** For percent problems, the Smart Number is 100. Therefore, assume that the population of Kumar in 1980 was 100. Then, apply the successive percents to find the overall percent change:

From 1980-1990, there was a 6% increase: $100 + 100(.06) = 100 + 6 = 106$
From 1991-2000, there was a 3% decrease: $106 - 106(.03) = 106 - 3.18 = 102.82$
Overall, the population increased from 100 to 102.82, representing a 2.82% increase.

4. **1.28y:** For percent problems, the Smart Number is 100. Therefore, assign y a value of 100. Then, apply the successive percent to find the overall percentage change:

(1) y is decreased by 20%: $100 - 100(.20) = 100 - 20 = 80$
(2) Then, it is increased by 60%: $80 + 80(.60) = 80 + 48 = 128$
Overall, there was a 28% increase. If the original value of y is 100, the new value is 1.28y.

5. **$3,000:** Use a percent table to solve this problem.

PART	210	7
WHOLE	x	100

$21,000 = 7x$
$x = 3,000$

6. **14:** There are some problems for which you cannot use Smart Numbers, since the total amount (though technically unspecified) is actually calculable. This is one of those problems. Instead, use a percent table:

PART	$.5x + 4$	70
WHOLE	x	100

$50x + 400 = 70x$
$400 = 20x$
$x = 20$

The capacity of the bowl is 20 cups. There are 14 cups in the bowl [70% of 20, or .5(20) + 4].

PART	4	20
WHOLE	x	100

Alternately, the 4 cups added to the bowl represent 20% of the total capacity. Use a percent table to solve for x, the whole. Since $x = 20$, there are 14 (half of 20 + 4) cups in the bowl.

7. **54%:** For this chemical mixture problem, set up a table with two columns: one for the original mixture and one for the mixture after the water evaporates from the tide pool.

	Original	After Evaporation
NaCl	920	920
Water	1,800	.60(1800) = 1,080
TOTAL	2,720	2,000

The percentage of the liquid in the pool that remains water is $\frac{1,080}{2,000}$, or 54%.

8. **50%:** Use two percent tables to solve this problem. Begin with the fact that 50% of y is 40:

PART	40	50
WHOLE	y	100

$4,000 = 50y$
$y = 80$

Then, set up a percent table for the fact that x is 40% of y.

PART	x	40
WHOLE	80	100

$3.200 = 100x$
$x = 32$

Finally, 16 is 50% of 32.

9. **840:** Apply the successive percent to find the overall percentage change:
(1) 800 is increased by 50%: $800 \times 1.5 = 1,200$
(2) Then, the result is decreased by 30%: $1,200 \times .7 = 840$

10. **$106.12:** Interest compounded annually is just a series of successive percents:
(1) 100.00 is increased by 2%: $100(1.02) = 102$
(2) 102.00 is increased by 2%: $102(1.02) = 104.04$
(3) 104.04 is increased by 2%: $104.04(1.02) \approx 106.12$

11. **68 mL:** First, organize the information for the original situation:
8 mL = 40% oil x mL = 20% vinegar y mL = 40% water

There is the same amount of water in the original as there is oil. So, y = 8 mL. If you know that 8 mL is 40% of the total, then 20%, or x, must be half as much, or 4 mL. The original solution contains 20 mL of liquid all together.

	mL	%
Oil	8	40
Vinegar	4	20
Water	8	40
TOTAL	20	100

Then, the solution is poured into a new bottle with a capacity of 80 mL (4 × 20). The remaining space, 60 mL, is filled with water. Therefore, there are 68 mL of water in the final solution (8 from the original mixture and 60 added into the larger bottle).

	mL
Oil	8
Vinegar	4
Water	68
TOTAL	80

12. **25 more games:** Make a percent table to find out how many games the gambler has won so far.

PART	x	40
WHOLE	25	100

$1{,}000 = 100x$
$x = 10$
The gambler has won 10 games.

Then, make a new percent table, using a variable to represent the unknown number of additional times the gambler must play.

PART	$10 + .8n$	60
WHOLE	$25 + n$	100

$1{,}500 + 60n = 1{,}000 + 80n$
$500 = 20n$
$n = 25$
The gambler must play 25 more times.

13. **20:** Apply the percents in succession with two percent tables.

PART	x	120
WHOLE	1,600	100

$192{,}000 = 100x$
$x = 1{,}920$

Then, fill in the "change" for the part (1920 − 1536 = 384) and the original for the whole (1,920).

PART	384	y
WHOLE	1,920	100

$1{,}920y = 38{,}400$
$y = 20$

14. **75.69%:** This is a series of successive percents. Use Smart Numbers to assign the original document an area of 100 square units.

87% of 100 = .87 × 100 = 87
87% of 87 = .87 × 87 = 75.69

15. **168 mL:** If the bottle is 80% full, then the 70 mL of rum represents the empty 20%. Use your knowledge of percents to figure out that 80% is four times as big as 20%. Therefore, there must be 4 × 70 (280) mL of the guava-pineapple mixture in the bottle. Use a percent table to find the amount of guava juice.

PART	x	60
WHOLE	280	100

$16{,}800 = 100x$
$x = 168$

Chapter 4

of

FRACTIONS, DECIMALS, & PERCENTS

FDP's

In This Chapter . . .

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- The FDP Connection
- Converting Among Fractions, Decimals, and Percents
- Common FDP Equivalents

FDP CONNECTION

GMAT problems usually do not test fractions, decimals, and percents in isolation. Instead, most problems that test your understanding of non-integer numbers involve some kind of combination of fractions, decimals, and percents.

For this reason, we refer to these problems as FDP's (an abbreviation for fraction-decimal-percent). In order to achieve success with FDP problems on the GMAT, you must understand the connections between fractions, decimals, and percents; you should be able to comfortably and quickly shift amongst the three. In a very real sense, fractions, decimals, and percents are three different ways of expressing the exact same thing: a part-whole relationship.

Fractions, decimals, and percents are all different ways of expressing the same thing.

> A **fraction** expresses a part-whole relationship in terms of a numerator (the part) and a denominator (the whole).
>
> A **decimal** expresses a part-whole relationship in terms of place value (a tenth, a hundredth, a thousandth, etc.).
>
> A **percent** expresses the special part-whole relationship between a number (the part) and one hundred (the whole).

Converting Among Fractions, Decimals, and Percents

The following chart reviews the ways to convert from fractions to decimals, from decimals to fractions, from fractions to percents, from percents to fractions, from decimals to percents, and from percents to decimals.

TO → FROM ↓	FRACTION $\frac{3}{8}$	DECIMAL .375	PERCENT 37.5%
FRACTION $\frac{3}{8}$		Divide the numerator by the denominator: $3 \div 8 = .375$	Divide the numerator by the denominator and move the decimal two places to the right: $3 \div 8 = .375 \rightarrow 37.5\%$
DECIMAL .375	Use the place value of the last digit in the decimal as the denominator, and put the decimal's digits in the numerator. Then simplify: $\frac{375}{1000} = \frac{3}{8}$		Move the decimal point two places to the right: $.375 \rightarrow 37.5\%$
PERCENT 37.5%	Use the digits of the percent for the numerator and 100 for the denominator. Then simplify: $\frac{37.5}{100} = \frac{3}{8}$	Find the percent's decimal point and move it two places to the left: $37.5\% \rightarrow .375$	

Common FDP Equivalents

You should memorize the following common equivalents:

Memorize these equivalents so you will recognize them quickly on the test.

Fraction	Decimal	Percent
$\frac{1}{100}$	.01	1%
$\frac{1}{50}$	.02	2%
$\frac{1}{25}$	.04	4%
$\frac{1}{20}$	.05	5%
$\frac{1}{10}$	.1	10%
$\frac{1}{8}$	.125	12.5%
$\frac{1}{6}$	$.1\overline{6}$	≈ 16.6%
$\frac{1}{5}$	.2	20%
$\frac{1}{4}$	.25	25%
$\frac{3}{10}$	.3	30%
$\frac{1}{3}$	$.\overline{3}$	≈ 33.3%
$\frac{2}{5}$	.4	40%

Fraction	Decimal	Percent
$\frac{1}{2}$	.5	50%
$\frac{3}{5}$	.6	60%
$\frac{2}{3}$	$.\overline{6}$	≈ 66.6%
$\frac{7}{10}$	.7	70%
$\frac{3}{4}$	.75	75%
$\frac{4}{5}$	.8	80%
$\frac{9}{10}$	.9	90%
$\frac{1}{1}$	1	100%
$\frac{5}{4}$	1.25	125%
$\frac{4}{3}$	$1.\overline{3}$	≈ 133%
$\frac{3}{2}$	1.5	150%

Problem Set

1. Express the following as fractions: 2.45 .008

2. Express the following as fractions: 420% 8%

3. Express the following as fractions: .15% 9.6%

4. Express the following as decimals: $\frac{9}{2}$ $\frac{3000}{10{,}000}$

5. Express the following as decimals: $1\frac{27}{3}$ $12\frac{8}{3}$

6. Express the following as decimals: 2,000% .030%

7. Express the following as percents: $\frac{1000}{10}$ $\frac{25}{9}$

8. Express the following as percents: 80.4 .0007

9. Express the following as percents: 36.1456 1

10. Order from least to greatest: $\frac{8}{18}$ .8 40%

11. Order from least to greatest: 1.19 $\frac{120}{84}$ 131.44%

12. Order from least to greatest: $2\frac{4}{7}$ 2400% 2.401

13. Order from least to greatest ($x \neq 0$): $\frac{50}{17}x^2$ $2.9x^2$ $(x^2)(3.10\%)$

14. Order from least to greatest: $\frac{500}{199}$ 248,000% 2.9002003

15. Order from least to greatest: $\frac{\frac{3}{5}}{\frac{8}{10}}$ $\frac{.00751}{.01}$ $\frac{200}{3} \times 10^{-2}$

1. To convert a decimal to a fraction, write it over the appropriate power of ten and simplify.

$$2.45 = 2\frac{45}{100} = \mathbf{2\frac{9}{20}}$$

$$.008 = \frac{8}{1000} = \mathbf{\frac{1}{125}}$$

2. To convert a percent to a fraction, write it over a denominator of 100 and simplify.

$$420\% = \frac{420}{100} = \frac{21}{5} = \mathbf{4\frac{1}{5}}$$

$$8\% = \frac{8}{100} = \mathbf{\frac{2}{25}}$$

3. To convert a percent that contains a decimal to a fraction, write it over a denominator of 100. Shift the decimal points in the numerator and denominator to eliminate the decimal point in the numerator. Then simplify.

$$.15\% = \frac{.15}{100} = \frac{15}{10000} = \mathbf{\frac{3}{2000}}$$

$$9.6\% = \frac{9.6}{100} = \frac{96}{1000} = \mathbf{\frac{12}{125}}$$

4. To convert a fraction to a decimal, divide the numerator by the denominator.

$$\frac{9}{2} = 9 \div 2 = \mathbf{4.5}$$

It often helps to simplify the fraction BEFORE you divide:

$$\frac{3000}{10{,}000} = \frac{3}{10} = \mathbf{.3}$$

5. To convert a mixed number to a decimal, simplify the mixed number first, if needed.

$$1\frac{27}{3} = 1 + 9 = \mathbf{10}$$

$$12\frac{8}{3} = 12 + 2\frac{2}{3} = 14\frac{2}{3} = \mathbf{14.\overline{6}}$$

6. To convert a percent to a decimal, drop the percent sign and shift the decimal point two places to the left.

2,000% = **20**
.030% = **.00030**

7. To convert a fraction to a percent, rewrite the fraction with a denominator of 100.

$$\frac{1000}{10} = \frac{10000}{100} = \mathbf{10{,}000\%}$$

Or convert the fraction to a decimal and shift the decimal point two places to the right.

$$\frac{25}{9} = 25 \div 9 = 2.\overline{7} = \mathbf{277.\overline{7}\%}$$

8. To convert a decimal to a percent, shift the decimal point two places to the right.

80.4 = **8040%**
.0007 = **.07%**

9. To convert a decimal to a percent, shift the decimal point two places to the right.

36.1456 = **3614.56%**
1 = **100%**

10. **40% < 8/18 < .8:** To order from least to greatest, express all the terms in the same form.

$8/18 = .\overline{4}$
.8 = .8
40% = .4
$.4 < .\overline{4} < .8$

Alternately, you can use FDP logic and Benchmark Values to solve this problem: 8/18 is 1/18 less than 1/2. 40% is 10% (or 1/10) less than 1/2. Since 8/18 is a smaller piece away from 1/2, it is closer to 1/2 and therefore larger than 40%. .8 is clearly greater than 1/2. Therefore, 40% < 8/18 < .8.

11. **1.19 < 131.44% < 120/84:** To order from least to greatest, express all the terms in the same form.

1.19 = 1.19
120/84 ≈ 1.4286
131.44% = 1.3144
1.19 < 1.3144 < 1.4286

12. **2.401 < 2 4/7 < 2400%:** To order from least to greatest, express all the terms in the same form.

$$2\frac{4}{7} \approx 2.57$$

2400% = 24
2.401 = 2.401

Alternately, you can use FDP logic and Benchmark Values to solve this problem: 2400% is 24, which is clearly the largest value. Then, use Benchmark Values to compare 2 4/7 and 2.401. Since the whole number portion, 2, is the same, just compare the fraction parts. 4/7 is greater than 1/2. .401 is less than 1/2. Therefore, 2 4/7 must be greater than 2.401. So, 2.401 < 2 4/7 < 2400%.

13. **3.10% < 2.9 < 50/17:** To order from least to greatest, express all the terms in the same form. (Note that, since x^2 is a positive term common to all the terms you are comparing, you can ignore its presence completely.)

$$\frac{50}{17} = 2\frac{16}{17} \approx 2.94$$

2.9 = 2.9
3.10% = .0310
.0310 < 2.9 < 2.94

Alternately, you can use FDP logic and Benchmark Values to solve this problem: 3.10% is .0310, which is clearly the smallest value. Then, compare 2.9 and 2 16/17 to see which one is closer to 3. 2.9 is 1/10 away from 3. 2 16/17 is 1/17 away from 3. Since 1/17 is a smaller piece than 1/10, 2 16/17 is closest to 3; therefore, it is larger. So, 3.10% < 2.9 < 50/17.

14. **500/199 < 2.9002003 < 248,000%:** To order from least to greatest, express all the terms in the same form.

$$\frac{500}{199} \approx 2.51$$

248,000% = 2,480
2.9002003 = 2.9002003

Alternately, you can use FDP logic and Benchmark Values to solve this problem: 248,000% = 2,480, which is clearly the largest value. 500/199 is approximately 500/200, or 5/2, which is 2.5. This is clearly less than 2.9002003. Therefore, 500/199 < 2.9002003 < 248,000%.

15. $\mathbf{\frac{200}{3} \times 10^{-2} < \frac{3}{5} \div \frac{8}{10} < \frac{.0751}{.01}}$

First, simplify all terms and express them in decimal form:

$$\frac{3}{5} \div \frac{8}{10} = \frac{3}{5} \times \frac{10}{8} = \frac{3}{4} = .75$$

$$\frac{.00751}{.01} = \frac{.751}{1} = .751$$

$$\frac{200}{3} \times 10^{-2} = 66.\overline{6} \times 10^{-2} = .\overline{6}$$

$.\overline{6} < .75 < .751$