Percent - part of 100     $40\% = \frac{40}{100} = 0.4$
↑ hundredths

Eg. equivelent fractions                $= 0.40$
$\frac{40}{100} = \frac{4}{10} = \frac{2}{5} = \frac{8}{20} = \frac{360}{900}$          ↑ tenths place

## Example 1

243 people out of 400 state that they like dogs. What percent is this?

**Method 1**          $\frac{243}{400} = 0.6075$          **Method 2**     $400 \overline{)243.00}$     $0.6075$

**Method 3.** $\frac{243 \times 100}{400}$ ← multiply by 100 $= 60.75\%$

Go to decimal
move 2 places right

or multiply by
100 & divide

## Example 2

Write each as a percent:  a) $\frac{1}{4}$  b) 0.02  c) 2.35

a) $\frac{1}{4} = .25 = 25\%$

$.25\% \neq 25\%$

$0.25\% = 0.0025\%$

b) $.02 = 2\%$

c) $2.35 = 235\%$

**Percents**
If we have a *part* that is some *percent* of a *whole*, then

$\text{percent} = \dfrac{\text{part}}{\text{whole}}$, or equivalently, $\text{part} = \text{percent} \cdot \text{whole}$

To do the calculations, we write the percent as a decimal.

## Example 3

The sales tax in a town is 9.4%. How much tax will you pay on a $140 purchase?

tax – additional value = ?

tax rate: percent of original value = 9.4%
that is added on.

9.4% of $140

converted to decimal

$$\frac{9.4 \ (\$140)}{100}$$

$$\boxed{\$13.16}$$
tax

$$.094 (\$140) =$$

$$\boxed{\$13.16}$$
-tax

## Example 4

In the news, you hear "tuition is expected to increase by 7% next year." If tuition this year was $1200 per quarter, what will it be next year?

→tuition?

tuition per quarter?

**Method 1**

$$.07 (\$1200) = \$84$$

↗
7%

$$\$1200 + \$84 = \$1284$$

↑
add onto
original value

next years
tuition per quarter

$$1200 + 84 = 1284$$

$$1200(1) + 1200(.07) = 1284$$

$$1200(1 + .07)$$

$$1200(1.07)$$

↓

*original price*(1 + r)
rate as a decimal

A TV originally priced at $799 is on sale for 30% off. There is then a 9.2% sales tax. Find the price after including the discount and sales tax.
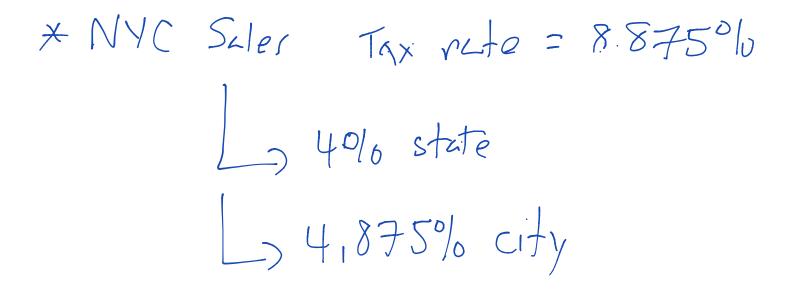
0.3

0.092

$-.3(799)$

$.3(799) = \$239.70$

$\$799 - \$239.70 = \$559.30$

Multiply  $\$559.30 (0.092) \approx \$51.455...$
$\approx \$51.46$

Add  $\$559.30 + \$51.46 = \$610.76$

Option 2:  30% off = 70% remaining

$(1-.3)$

$\$799 (.7)(1 + .092) \approx \$610.76$

final price = original price $(1 - r_d)(1 + r_t)$

$r_d$ = discount rate

$r_t$ = tax rate

\* NYC Sales Tax rate = 8.875%

$\quad\quad\quad\quad$ ⌐→ 4% state

$\quad\quad\quad\quad$ ⌐→ 4.875% city

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**Example 5**

The value of a car dropped from $7400 to $6800 over the last year. What percent decrease is this?

$\$7400 - \$6800 = \$600$ absolute difference

$\dfrac{\$600}{\$7400} = 0.081$ ← relative change

$\quad\quad\quad$ ↖ original value

$0.081 = 8.1\%$ percent change

\* $\dfrac{|new - old|}{old} \times 100\%$ $\quad\quad$ percent change

$| \cdots |$ ← absolute value

$\quad\quad\quad\quad$ "any number becomes positive"

new − old > 0    increase
new − old < 0    decrease    ⎤ types of change

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**Absolute and Relative Change**

Given two quantities,

Absolute change = |ending quantity − starting quantity|

Relative change: $\dfrac{\text{absolute change}}{\text{starting quantity}}$

Absolute change has the same units as the original quantity.
Relative change gives a percent change.
The starting quantity is called the **base** of the percent change.

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The base of a percent is very important. For example, while Nixon was president, it was argued that marijuana was a "gateway" drug, claiming that 80% of marijuana smokers went on to use harder drugs like cocaine. The problem is, this isn't true. The true claim is that 80% of harder drug users first smoked marijuana. The difference is one of base: 80% of marijuana smokers using hard drugs, vs. 80% of hard drug users having smoked marijuana. These numbers are not equivalent. As it turns out, only one in 2,400 marijuana users actually go on to use harder drugs[2].

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\* $\dfrac{|\text{actual} - \text{observed}|}{\text{actual}}$   ⟵ error