

$$.75 = \frac{3}{4} \Rightarrow 75\%$$

$$100\% \Leftarrow 1 = \frac{4}{4}$$

BUSN 135

chapter 3

Percentages

Handwritten Notes

$$\frac{1}{2} = .5 \Rightarrow 50\%$$

$$25\% \Leftarrow .25 = \frac{1}{4}$$

① Rules for Percents

- ① Percents are NOT numbers!!
- ② Percents are formatted—symbolic-representations of numbers!!!
- ③ To convert a number to a percent:

① multiply number by 100
or
slide decimal two places
to right

② Add the symbol for
percentage: "%" to
end of number

example 1: convert .06 to a percentage.

① $.06 * 100 = 6$ OR $.06 \Rightarrow 6$

② 6%

②

Decimal to %

example 1 : convert .005 to %

① $.005 \Rightarrow .5$

② $.5\%$

example 2 : convert .062 to %

① $.062 \Rightarrow 6.2$

② 6.2%

% to Decimal (Reverse Rules)

example 3 : convert .75% to number

① Drop symbol $.75\% \Rightarrow .75$

② Divide by 100
or
Slide decimal
Two places to
Left!
(Add zeroes if
needed)

$.75 \Rightarrow .0075$

③

example 4: convert 25% to number

① $25\% \Rightarrow 25.$

② $25. \Rightarrow .25$

Fraction to Percent

example 5: convert $\frac{1}{2}$ to %

① Do Division

$$\begin{array}{r} 0.5 \\ 2 \overline{) 1.0} \\ \underline{-10} \\ 0 \end{array}$$

$$\frac{1}{2} = .5$$

② Slide decimal
two places to
Right!

(Add zeroes
if needed)

$.50 \Rightarrow 50.$

③ Add symbol

50%

example 6: convert $\frac{1}{3}$ to %

①

$$\begin{array}{r} 0.333 R1 \\ 3 \overline{) 1.0} \\ \underline{-9} \\ 10 \\ \underline{-9} \\ 10 \\ \underline{-9} \end{array}$$

②

$.333 \Rightarrow 33.3$

③

33.3% or $33\frac{1}{3}\%$

(4)

example 7: Convert $2\frac{1}{2}$ to %

$$\textcircled{1} \quad 2\frac{1}{2} = \frac{2*2+1}{2} = \frac{5}{2} \Rightarrow 2\overline{)5.5}$$

$$\begin{array}{r} 2\overline{)5.5} \\ \underline{-4} \\ 10 \end{array}$$

$$\textcircled{2} \quad 2.50 \Rightarrow 250$$

$$\textcircled{3} \quad \textcircled{250\%}$$

Percent to Fraction

example 8: convert 12% to fraction

$$\textcircled{1} \text{ Drop symbol} \quad 12\% \Rightarrow 12.$$

$$\textcircled{2} \text{ Slide decimal to Left} \quad \begin{array}{c} \uparrow \uparrow \\ 12. \end{array} \Rightarrow .12$$

$$\textcircled{3} \text{ Twelve Hundredths} \Rightarrow .12 = \frac{12}{100} = \frac{2*2*3}{2*2*5*5}$$

$$= \frac{3}{25} = \textcircled{\frac{3}{25}}$$

⑤ example 9: ~~convert~~ $\frac{3}{4}\%$ to fraction and then convert to number

① Drop symbol

$$\frac{3}{4}\% \Rightarrow \frac{3}{4}$$

② Do Division

$$\begin{array}{r} 0.75 \\ 4 \overline{) 3.0} \\ \underline{28} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

$$\frac{3}{4} = .75$$

③ Slide Decimal
two places to
Left
(Add zeroes
if needed)

$$0.075 \Rightarrow .0075$$

④ (to fraction) $.0075 = \frac{75}{10,000} = \frac{75}{10,000}$

⑤ (Back to number)

$$\begin{array}{r} .0075 \\ 10000 \overline{) 75.000} \\ \underline{70000} \\ 50000 \\ \underline{50000} \\ 0 \end{array}$$

$$\frac{75}{10,000} = .0075$$

⑥

Percent Formula

$$\text{Rate} * \text{Base} = \text{Part}$$

(Remember: $\text{Base} * \text{Rate} = \text{Part}$ is same formula because $3 * 2 = 2 * 3$)

words
→

"% of something is something"
↓ ↓ ↓ ↓ ↓
Rate * Base = Part

Define:

Base

The "whole" or "total" or "starting point" or "Begin point" or "Beg." or that to which something is being compared

Rate

A Percent (also could be decimal) or fraction

Part

$\text{Rate} * \text{Base}$. The part is a part of the base, as sales tax is a part of the total sales, or as # of units sold is a part of the total # of units, or as this years total sales is a part of last years total sales (sometimes called: End Amount)

7

$$\text{Rate} * \text{Base} = \text{Part}$$

Note:
1:

$$\text{Part} = \text{Rate} * \text{Base}$$

$$\text{Base} * \text{Rate} = \text{Part}$$

$$\text{Part} = \text{Base} * \text{Rate}$$

all
are
equivalent

Note:
2:

There are really
3 different formulas

①

$$\text{Part} = \text{Rate} * \text{Base}$$

②

$$\text{Base} = \frac{\text{Part}}{\text{Rate}}$$

③

$$\text{Rate} = \frac{\text{Part}}{\text{Base}}$$

This
means
we can
solve
for any
one of the
3 things
(Rate, Base, Part)

Why the 3 Formulas?

$$\text{Part} = \text{Rate} * \text{Base}$$

Divided both sides of
equation by same thing
and equation remains
true!

$$\frac{\text{Part}}{\text{Base}} = \frac{\text{Rate} * \text{Base}}{\text{Base}}$$

cancel Base

$$\frac{\text{Rate} * \cancel{\text{Base}}}{\cancel{\text{Base}}} = \frac{\text{Rate}}{1} = \text{Rate} = \frac{\text{Part}}{\text{Base}}$$

$$\text{Part} = \text{Rate} * \text{Base}$$

⇓

$$\frac{\text{Part}}{\text{Rate}} = \frac{\text{Rate} * \text{Base}}{\text{Rate}}$$

$$\frac{\text{Part}}{\text{Rate}} = \frac{\cancel{\text{Rate}} * \text{Base}}{\cancel{\text{Rate}}}$$

$$\frac{\text{Part}}{\text{Rate}} = \frac{\text{Base}}{1} = \text{Base}$$

$$\text{Base} = \frac{\text{Part}}{\text{Base}}$$

⑧

example 1: The Pop Advertising

Institute says that 55% of all supermarket shoppers have a written list of their needs. If there are 3,680 shoppers entering the supermarket that you managed in one day, what number of shoppers would you expect to have a written shopping list?

Step 1

List variables

Rate = 55% = Shoppers with list

Base = 3,680 = All the shoppers in one day

Part = # of shoppers you expect to have a list

Step 2

set up & solve

Formula

$$\text{Part} = \text{Rate} * \text{Base}$$

Find number

$$\text{Rate} = 55\% \Rightarrow .55$$

Plug in numbers

$$\text{Part} = .55 * 3680 = 2,024$$

Step 3

say in words

Assuming that 55% of shoppers have lists, if 3,680 shoppers come in to my store, I would expect that 2,024 shoppers would have list.

(9)

Example 2: $18\frac{1}{2}\%$ of ? circuits is 370 circuits.

$$\begin{array}{ccccccc} & \downarrow & & \downarrow & & \downarrow & & \downarrow & & \downarrow \\ & .185 & * & ? \text{ circuits} & = & 370 \text{ circuits} \end{array}$$

$$.185 * ? \text{ circuits} = 370 \text{ circuits}$$

$$\begin{array}{ccc} \downarrow & & \downarrow \\ \text{Rate} * & \text{Base} & = \text{Part} \end{array}$$

$$\text{Base} = \frac{\text{Part}}{\text{Rate}} = \frac{370 \text{ circuits}}{.185} = 2000$$

check

$$2000 * .185 = 370 \checkmark$$

$18\frac{1}{2}\%$ of 2000 circuits is 370 circuits

Example 3: Ren Hoke earns a monthly interest rate of $\frac{1}{2}\%$. If he earned \$251⁰⁰ in interest for the month, what was the amount invested for the month?

step 1

$$\left\{ \begin{array}{l} \text{Interest} \\ \text{Earned} \\ \text{for month} \end{array} \right\} = \$251 = \text{Part}$$

$$\text{Interest Rate per month} = \frac{1}{2}\% \Rightarrow \frac{1}{2} = .5 \Rightarrow \overset{\text{because}}{\text{move decimal 2 places}} \Rightarrow .005$$

Base = The amount invested for the month

$$\text{step 2} \quad \text{Base} = \frac{\text{Part}}{\text{Rate}} = \frac{\$251}{.005} = \$50,200$$

$$\text{check} \Rightarrow \$50,200 * .005 = \$251 \checkmark$$

step 3

If Ren earned \$251 for the month at a rate of $\frac{1}{2}\%$, he had \$50,200 invested for month.

10 Example 4: If Suix Radcoolinator earned \$27.25 in interest for the quarter and she had \$1,362.50 invested for the quarter, what was the quarterly interest rate?

Step 1
Part = interest earned for the quarter = \$27.25
Base = Amount invested for the quarter = \$1,362.50
Rate = the quarterly interest rate

Step 2
$$\text{Rate} = \frac{\text{Part}}{\text{Base}} = \frac{\$27.25}{\$1,362.50} = \frac{27.25}{1,362.50} = .02 \Rightarrow 2\%$$

Step 3
If Suix earned \$27.25 for the quarter in interest and she had \$1,362.50 invested for the quarter, her quarterly rate was 2%.

Example 5: Barbara's Antiquery says that of its 3800 items in inventory, 3344 are just plain junk, while the rest are antiques. What percent of the total inventory is antiques?

Step 1
Base = total items in inventory = 3800
Part = inventory that is just plain junk = 3344
Rate = percent of the total inventory that is antiques
other Part = Antiques = $3800 - 3344 = 456$

Step 2
$$\text{Rate} = \frac{\text{Part}}{\text{Base}} = \frac{456}{3800} = .12 \Rightarrow 12\%$$

Step 3
The percentage of total inventory that is antiques is equal to 12%



"percent of change" or "Rate of change"

Increase Problem
Decrease Problem

10.25

Variables & Formulas:

Beg = Begin Amount = Starting Point = Base

End = End Amount = End Point = Part

$$\text{Rate} = \frac{\text{Part}}{\text{Base}} \Rightarrow \text{"New Terms"} \Rightarrow \frac{\text{End}}{\text{Beg}}$$

$$\text{AOC} = \left\{ \begin{array}{c} \text{Amount} \\ \text{of} \\ \text{change} \end{array} \right\} = \text{End} - \text{Beg}$$

$$\text{ROC} = \left\{ \begin{array}{c} \text{Rate} \\ \text{of} \\ \text{change} \end{array} \right\} = \frac{\text{End} - \text{Beg}}{\text{Beg}} = \frac{\text{End}}{\text{Beg}} - \frac{\text{Beg}}{\text{Beg}} = \frac{\text{End}}{\text{Beg}} - 1$$

* ROC = Rate - 1

Example 1:

$$\text{Beg} = \left\{ \begin{array}{c} \text{stock \$} \\ \text{Year 1} \end{array} \right\} = \$10$$

$$\text{End} = \left\{ \begin{array}{c} \text{stock \$} \\ \text{Year 2} \end{array} \right\} = \$12.50$$

$$\text{Rate} = \frac{\text{End}}{\text{Beg}}$$

$$\text{Rate} = \frac{12.5}{10} = 1.25 \Rightarrow 125\%$$

$$\text{AOC} = \text{End} - \text{Beg}$$

$$\text{AOC} = 12.5 - 10 = 2.50$$

This is increase because it is positive

$$\text{ROC} = \frac{\text{End}}{\text{Beg}} - 1$$

$$\text{ROC} = \frac{12.5}{10} - 1 = 1.25 - 1 = .25 \Rightarrow 25\%$$

Example 2:

$$\text{Beg} = \left\{ \begin{array}{c} \text{stock \$} \\ \text{Year 1} \end{array} \right\} = \$10$$

$$\text{End} = \left\{ \begin{array}{c} \text{stock \$} \\ \text{Year 2} \end{array} \right\} = \$7.50$$

$$\text{Rate} = \frac{\text{End}}{\text{Beg}}$$

$$\text{Rate} = \frac{7.5}{10} = .75 \Rightarrow 75\%$$

$$\text{AOC} = \text{End} - \text{Beg}$$

$$\text{AOC} = 7.5 - 10 = -2.50$$

This is Decrease because it is Negative

$$\text{ROC} = \frac{\text{End}}{\text{Beg}} - 1$$

$$\text{ROC} = \frac{7.5}{10} - 1 = .75 - 1 = -.25 \Rightarrow -25\%$$

Note: Book says

"percent of change"

in these Notes
we use:

"Rate of change"

Remember:

$$\text{Part} = \text{Base} * \text{Rate}$$

could also be called

$$\text{Part} = \text{Base} * \text{Percent}$$

example:

$$25 = 100 * .25$$

could also use:

$$25 * 100 * 25\%$$

① Rate of change

new Formula = $Roc = \frac{End}{Beg} - 1$ ①

② Increase Problem

(same formulas from Before)
 $B \times R = P$; $P_R = B$; $R = P/B$

Last years sales = \$125,000 = Base = Beg

This years sales = \$190,000 = Part = End

$$1.52\% \leftarrow 1.52 = \frac{38}{25} = \frac{2 \times 5 \times 19}{5 \times 5 \times 5} = \frac{190000}{125000} =$$

$$Rate = \frac{Part}{Base} = \frac{End}{Beg}$$

$$ROC = \left\{ \begin{array}{l} \text{Rate of} \\ \text{change} \end{array} \right\} = \frac{End - Beg}{Beg} = \frac{End}{Beg} - \frac{Beg}{Beg} = \frac{End}{Beg} - 1$$

* Remember you can cancel zeroes

$$\left\{ \begin{array}{l} \text{Rate of} \\ \text{change} \end{array} \right\} = \frac{190}{125} - 1 = 1.52 - 1 = .52 \Rightarrow 52\%$$

IF Roc comes out positive,
it is increase problem

$$\left\{ \begin{array}{l} \text{Amount} \\ \text{of} \\ \text{change} \end{array} \right\} = \frac{End - Beg}{}$$

$$\frac{190,000 - 125,000}{}$$

$$65,000$$

IF Amount of change is positive, it is an increase problem

Increase or Positive Rate of change

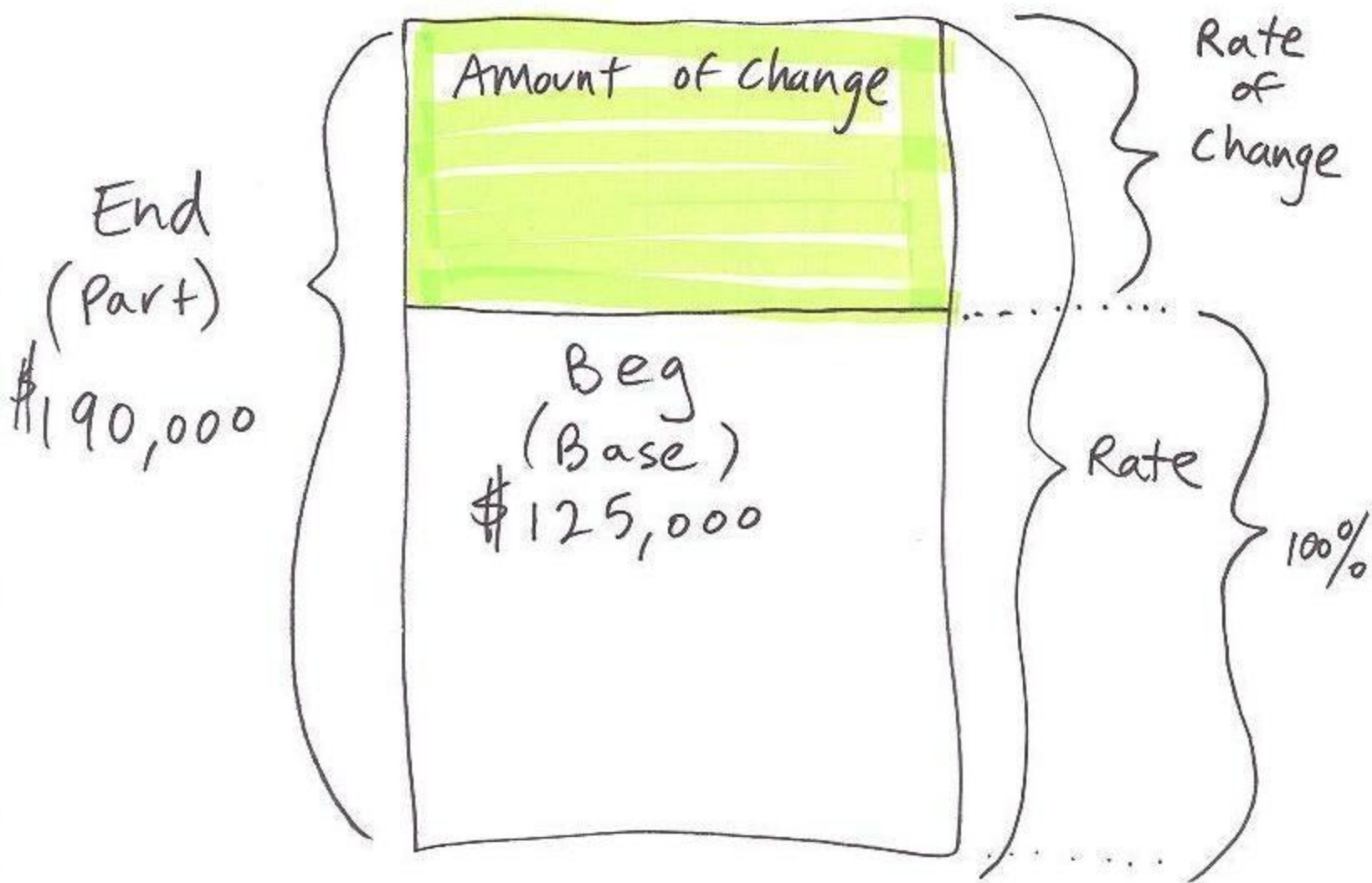
End
or
Part
190,000

Amount of
change
65,000

125,000
Beg
or
Base

Rate of
change
52%

Rate
1.52% } 100%



End
(Part)
\$190,000

Amount of change \$65,000
Beg (Base) \$125,000

.52

Rate
of
change
52%

Rate
1.52
152%

100%

① Rate of Change

$$Roc = \frac{End}{Beg} - 1$$

② Decrease Problem

$$(P = B * R; B = \frac{P}{R}; R = \frac{P}{B})$$

Last Years Sales = \$125,000 = Base = Beg

This Years Sales = \$110,000 = Part = End

$$Rate = \frac{Part}{Base} = \frac{End}{Beg} = \frac{110000}{125000} = \frac{110}{125} = \frac{11 * 2 * 5}{5 * 5 * 5} \frac{22}{25} = .88 \Rightarrow 88\%$$

$$AOC = \left\{ \begin{array}{l} \text{Amount} \\ \text{of} \\ \text{change} \end{array} \right\} = End - Beg = Base - Part = 110,000 - 125,000 = -15,000$$

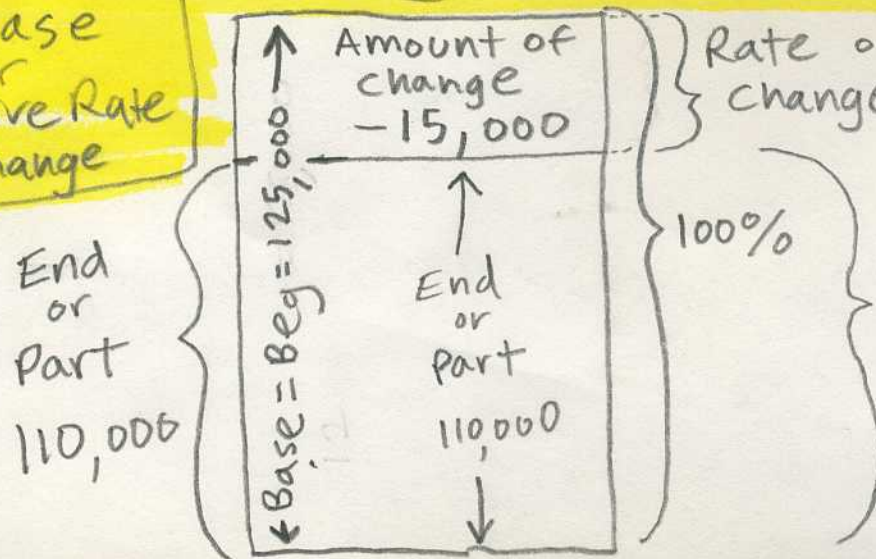
$$Roc = \left\{ \begin{array}{l} \text{Rate} \\ \text{of} \\ \text{change} \end{array} \right\} = \frac{End - Beg}{Beg} = \frac{End}{Beg} - 1$$

* Remember you can cancel zeroes

$$Roc = \frac{110}{125} - 1 = .88 - 1 = -.12 \Rightarrow -12\%$$

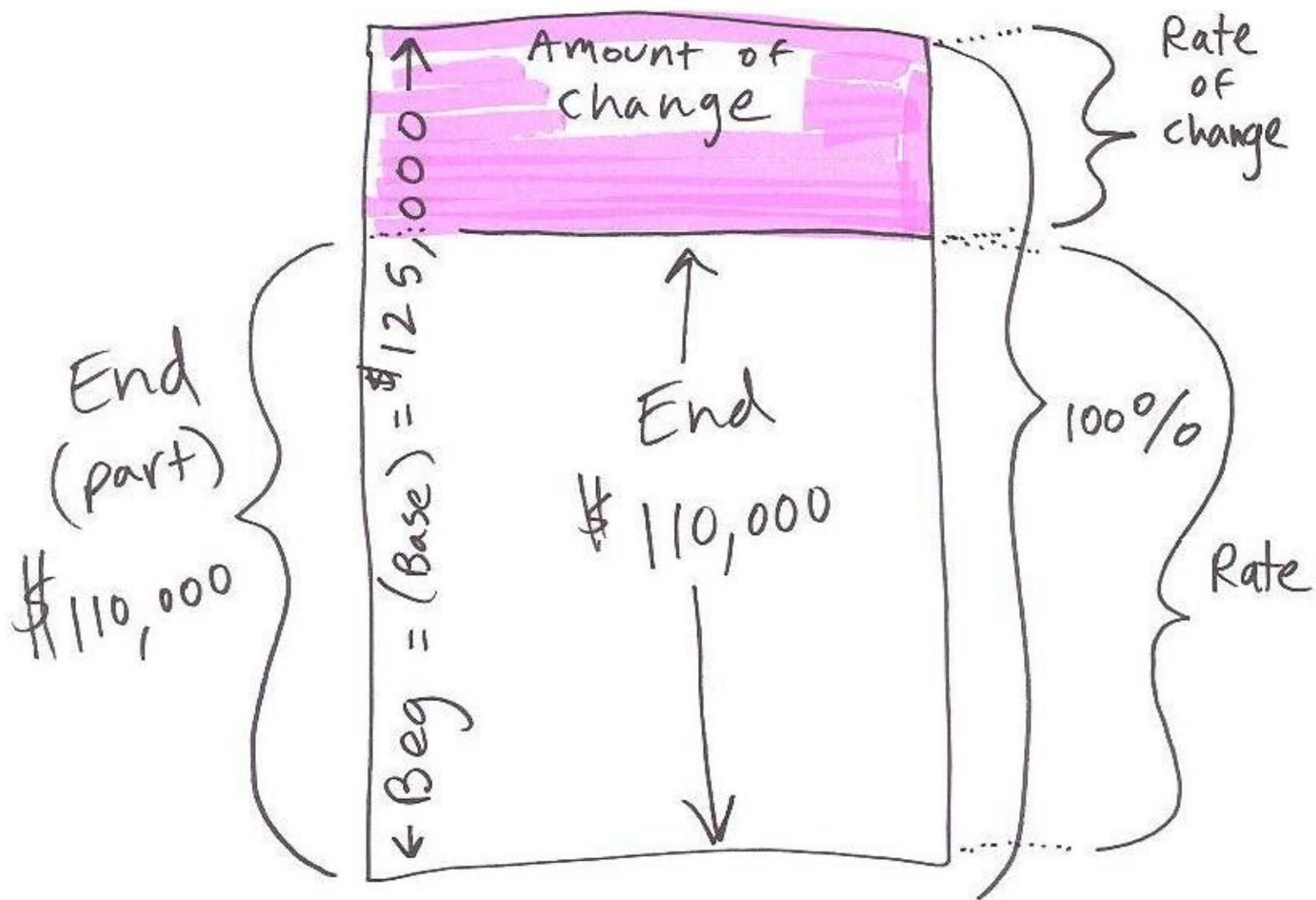
If AOC or ROC come out negative you have a decrease problem

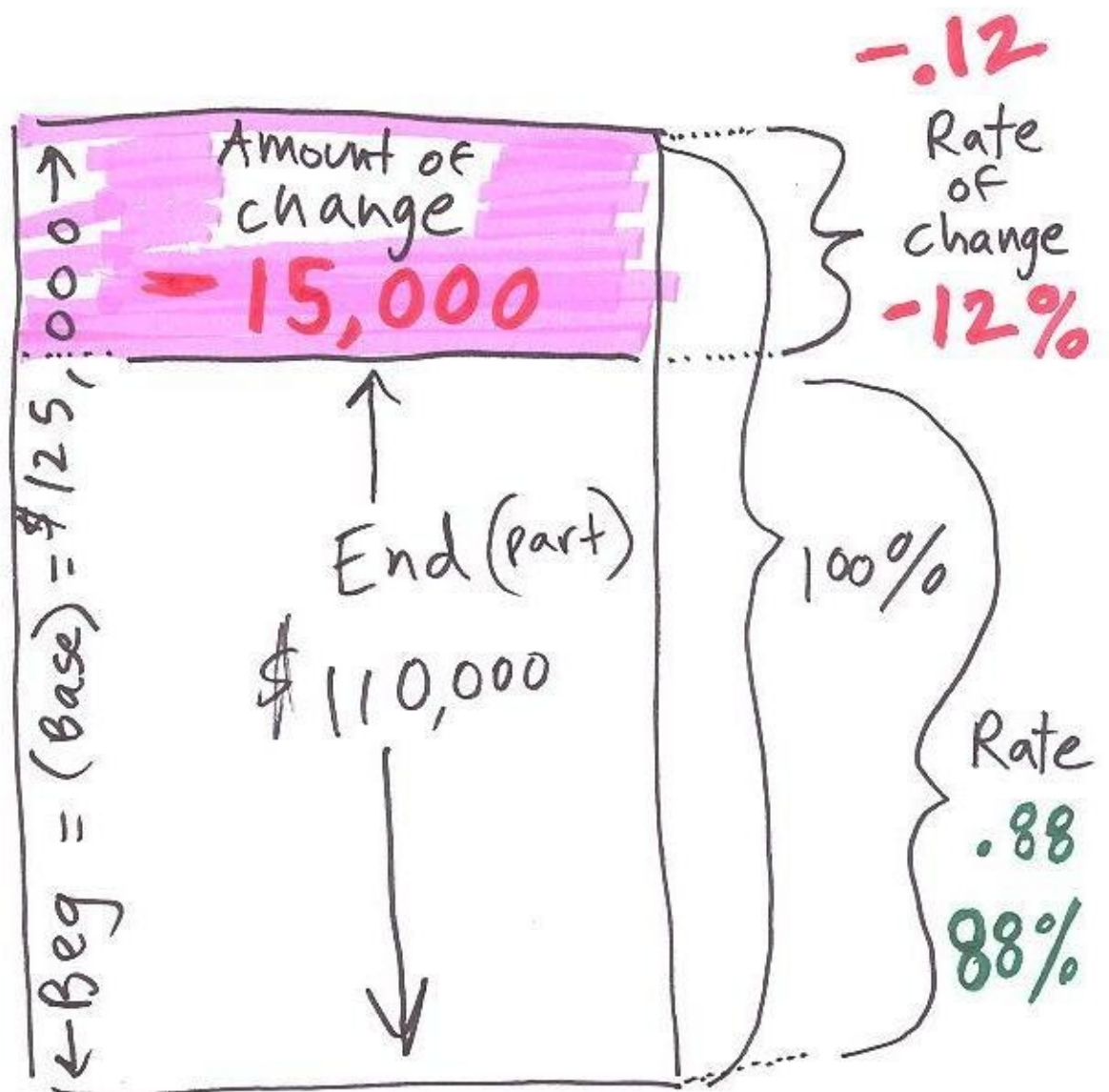
Decrease or Negative Rate of change



$$Rate \text{ of change} = -12\% \text{ or } -.12$$

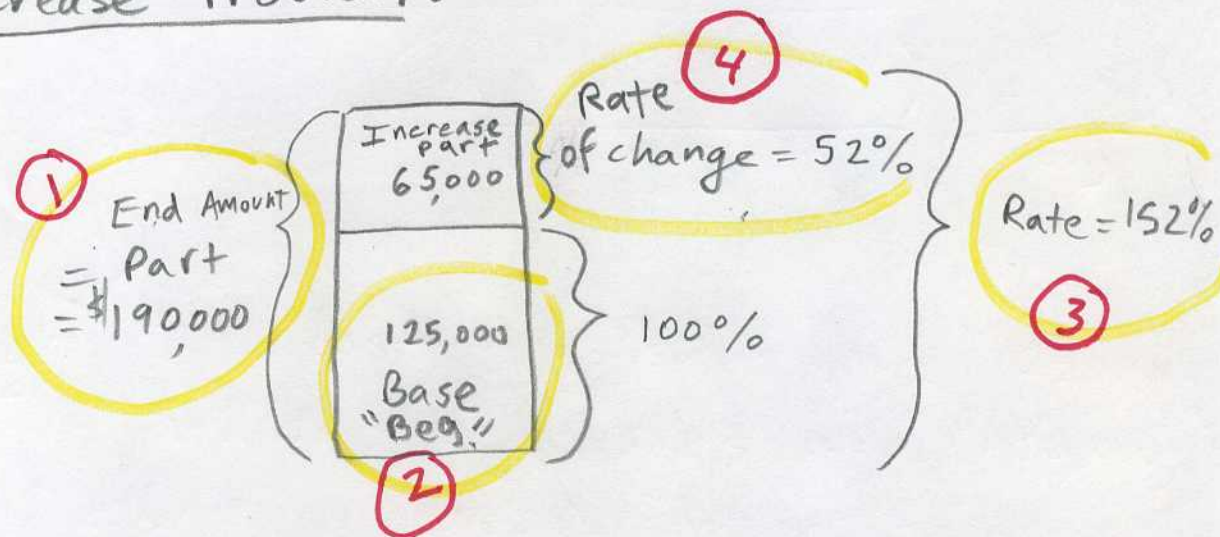
$$Rate = 88\%$$



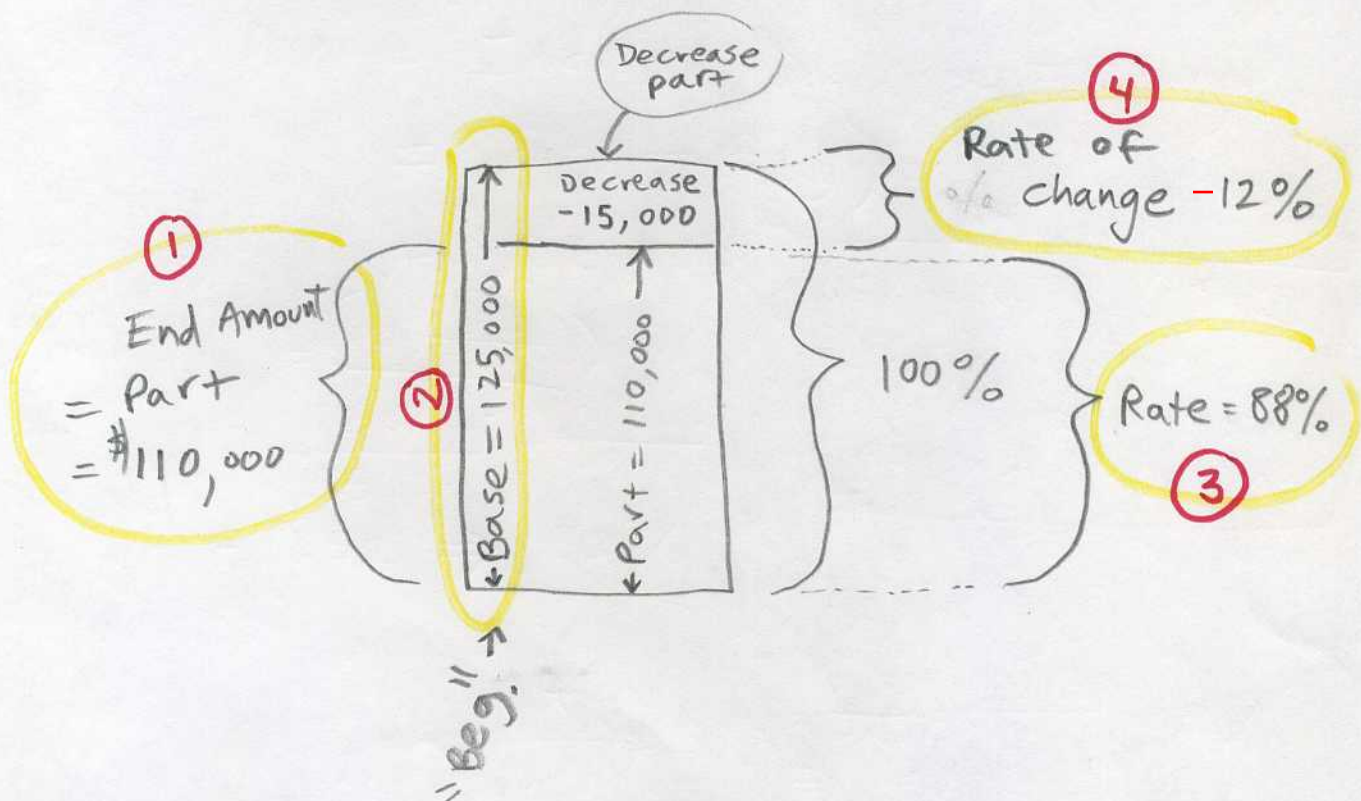


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Increase Problem:



Decrease Problem:



Example 3:

After spending \$3,450 for tuition and \$4,350 for dorm fees, Edgar finds that 35% of his original savings remains.

Step 1:

Find the amount of his savings that remain.

$$\left\{ \begin{array}{l} \text{Amount} \\ \text{of} \\ \text{Change} \end{array} \right\} = \left\{ \begin{array}{l} \text{Amount spent} \\ \text{+ this year} \end{array} \right\} = \text{Decrease Amount} = \text{Part} = 3450 + 4350 = 7800$$
$$\text{Base} = 7800 + \text{savings that remain} = \left\{ \begin{array}{l} \text{original} \\ \text{savings} \end{array} \right\}$$

$$\text{Rate} = \frac{\text{Part}}{\text{Base}} = .35$$

$$\text{Rate of change (Decrease)} = \boxed{} = .65 \Rightarrow -65\%$$

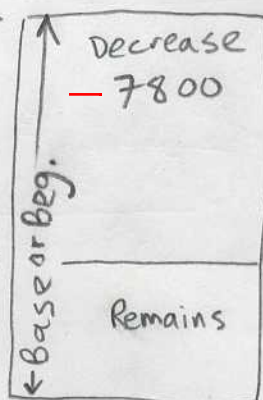
$$\text{Rate of original savings that remain} = 35\% \Rightarrow .35$$

$$\text{End Amount Part} = \text{savings that remain}$$

This is what we are trying to find

Amount of change Decrease

End Amount Part



Rate of change Decrease

Base = 100%

original savings is Base or Beg.

Step 2:

$$\text{Base} = \frac{\text{Part}}{\text{Rate}} = \frac{\text{Amount Decrease}}{\text{Rate change Decrease}} = \frac{-7800}{-.65} = 12,000$$

$$\text{End Amount} = \text{savings that remain} = 12,000 * .35 = 4,200$$

check

$$7800 + 4200 = 12,000 \text{ also } 12000 * .65 = 7800 \checkmark$$

Step 3:

After Edgar spent \$7,800 for the year he had \$4,200 remaining in the savings account. (The original amount was \$12,000).

15) example 4: The value of Iowa farmland increased 4.3% this year to a statewide average value of \$1857 per acre. How much per acre did Iowa farmland increase this year (round to dollar)?

Step 1:

$$\text{Rate of change (Increase)} = 4.3\% \Rightarrow .043$$

$$\text{End Amount} = \text{Part} = \$1857 \text{ per acre} = \frac{\$1857}{1 \text{ acre}}$$

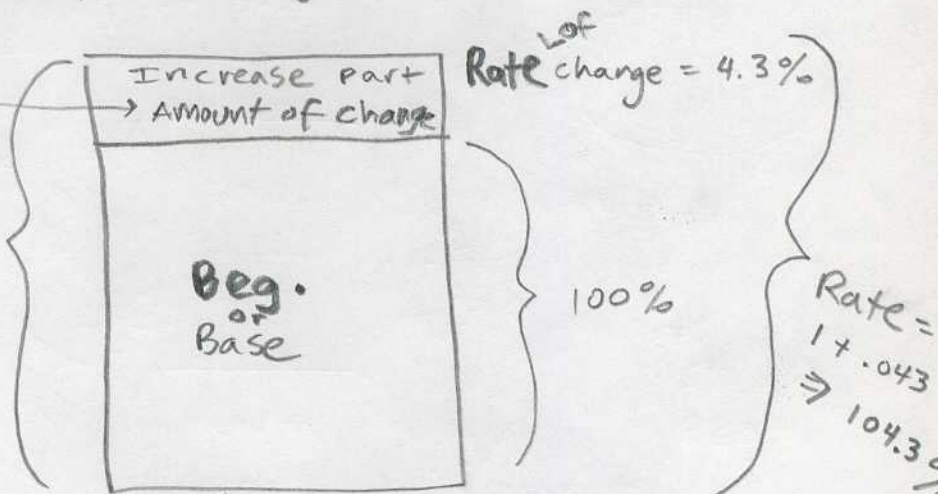
$$\text{Rate} = 1 + .043 = 1.043 \Rightarrow 104.3\%$$

$$\text{Base} = \text{Begin Amount}$$

$$\text{Amount of change} \Rightarrow \text{Increase Part} = \text{Average Amount that 1 acre increase}$$

This is what we are trying to find

$$\begin{aligned} \text{End Amount} \\ = \text{Part} \\ = 1857 \end{aligned}$$



Step 2:

$$\text{Base} = \frac{\text{Part}}{\text{Rate}} = \frac{\text{End Amount Part}}{\text{Rate}} = \frac{1857}{1.043} = 1,780.44103547$$

Round to dollar

1,780.44

↑
Round
to
Here

less than 5

Step 3: The amount of increase in value this year over last year in Iowa farmland was \$77

Amount of change

\$1,780.00

$$\{\text{Increase Part}\} = 1857 - 1780 = 77$$

check

$$1780 * .043 = 76.54 \Rightarrow 77$$

↑
Round > 5

(16)

Example 5:

The original price of the Lego set was \$10.50. If the markdown was 10%, what was the reduced price?

Step 1:

Base = \$10.50 = original price

$$\{ROC\} = \left\{ \begin{array}{l} \% \text{ change} \\ (\text{Decrease}) \end{array} \right\} = -10\% \Rightarrow -.10$$

$$\text{Rate} = 1 - .1 = .9 \Rightarrow 90\%$$

End Amount = reduced price = Part

Step 2:

$$\text{part} = \text{Rate} * \text{Base} = .9 * 10.50 = 9.45$$

Step 3:

The reduced price is \$9.45 (10% markdown from 10.50).

Example 6:

The original price for the generator before the Seattle storm was \$600. After the storm a 20% markup was added. What is the new price?

Step 1:

Base = \$600 = original price

$$\left\{ \begin{array}{l} \% \text{ change} \\ (\text{Increase}) \end{array} \right\} = 20\% \Rightarrow .20 = \{ROC\}$$

$$\text{Rate} = 1 + .2 = 1.2 \Rightarrow 120\%$$

End Amount = New Price = Part

Step 2:

$$\text{part} = \text{Rate} * \text{Base} = 1.2 * 600 = \$720$$

Step 3:

After the Seattle storm, the new price for the generator was \$720.

(20.5)

convert the percentages

(17)

1.45% and .8% to decimals

~~1.45%~~
~~.8%~~

convert percentages
to decimals

① Remove percentage
symbol

0 1.45
0 0.8

② slide decimal
2 positions
to left (if
need be, write
zeroes)

.0145
.008

Answer .0145 and .008

.0145 and .008 are numbers. 1.45% and
.8% are formatted presentations
of the numbers .0145 and .008.
1.45% and .8% are not numbers!!!
.0145 and .008 are numbers!!

20

Express $\frac{3}{8}$ as a percent

18

$$\begin{array}{r} .375 \\ 8 \overline{) 3.0} \\ \underline{- 24} \\ 60 \\ \underline{- 56} \\ 40 \end{array}$$

.375

37.5%

Answer 37.5%

convert number to % format

① Divide

② Slide decimal
2 to the right

③ Add %
symbol

37.5% is formatted presentation
of the number .375 or $\frac{3}{8}$.

37.5% IS NOT A NUMBER!!!
.375 and $\frac{3}{8}$ ARE NUMBERS!!

- 21) Net world spent 1.7% of its sales on insurance premiums. If sales amounted to \$292,560, what amount was spent on insurance premiums?

1st List variables & details

1) Business name = Net world

2) Sales = \$292,560

3) Insurance premiums = 1.7% of sales

4) How much spent on Insurance Premiums

↑ ↑
Convert to number word "of" means multiply

2nd set up & solve

$$1.7\% \Rightarrow \overset{0}{\underset{w}{1.7}} \Rightarrow .017$$

Insurance Premiums = 1.7% of Sales

$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$\text{Insurance Premiums} = .017 * \$292,560$$

3rd) write your answer in words (use words from original statement)

\$4973.52 was spent on
Answer Insurance Premiums.

$$\begin{array}{r} \overset{6}{2} \overset{5}{9} \overset{2}{5} \overset{6}{0} \\ * \quad .017 \quad \text{3 decimals} \\ \hline 2047920 \\ + 2925609 \\ \hline 4973.520 \\ \hline \$4973.52 \end{array}$$

22

What annual rate of return is needed to receive \$1920 in one year on an investment of \$48,000.

20

1st List variables and details

- 1) gain on investment = \$1920 = Part
- 2) Investment = \$48,000 = Base
- 3) Time Investment in investment vehicle = 1 year
- 4) what is annual rate of return?

2nd set up and solve

$$\left\{ \begin{array}{l} \text{Annual} \\ \text{Rate of} \\ \text{Return} \end{array} \right\} = \frac{\text{Part}}{\text{whole}} = \frac{\text{Part}}{\text{Base}}$$

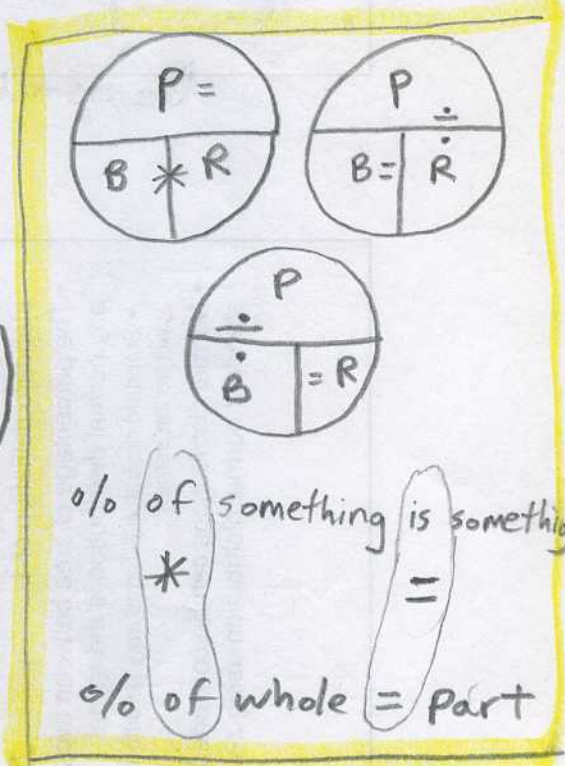
$$\left\{ \begin{array}{l} \text{Annual} \\ \text{R of R} \end{array} \right\} = \frac{\$1920}{\$48000} \quad \text{units cancel}$$

$$\left\{ \begin{array}{l} \text{Annual} \\ \text{R of R} \end{array} \right\} = \frac{1920}{48000} = .04$$

$$\begin{array}{r} .04 \\ 48000 \overline{) 1920.00} \\ \underline{- 1920 \ 00} \\ 0 \end{array}$$

$$\begin{array}{r} 3 \\ 48000 \overline{) 192000} \\ \underline{192000} \\ 0 \end{array}$$

$$\Rightarrow .04 \Rightarrow 4\%$$



3rd write answer in words

Answer

If you invest \$48000 for one year & earn \$1920, the annual rate of return is 4%