

GED Math Graphics: Illustrated Guide to Self-Confidence

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Unit 2

GED PROBLEMS

- Whole Number Skills and Problems
- Ratio
- Proportion
- Percent
- Percent Change

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*** Typical GED Questions

GED Skill – Cancel with Coin Factors

You know these – Now use them!

Quarters



$$25 \times 4 = 100$$

Dimes



$$10 \times 10 = 100$$

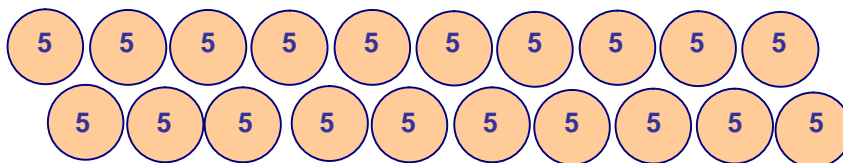
Nickels



$$5 \times 2 = 10$$



$$5 \times 5 = 25$$



$$5 \times 20 = 100$$

Examples:

$$75 \div 50 = \frac{75}{50} = \frac{3 \times \cancel{25}}{\cancel{25} \times 2} = \frac{3 \times \cancel{25}}{\cancel{25} \times 2} = \frac{3}{2}$$

$$60 \div 10 = \frac{60}{10} = \frac{6 \times \cancel{10}}{\cancel{10} \times 1} = \frac{6 \times \cancel{10}}{\cancel{10} \times 1} = 6$$

$$25 \div 40 = \frac{25}{40} = \frac{5 \times \cancel{5}}{\cancel{5} \times 8} = \frac{5 \times \cancel{5}}{\cancel{5} \times 8} = \frac{5}{8}$$

Factors, Products, *Perfect Squares*

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

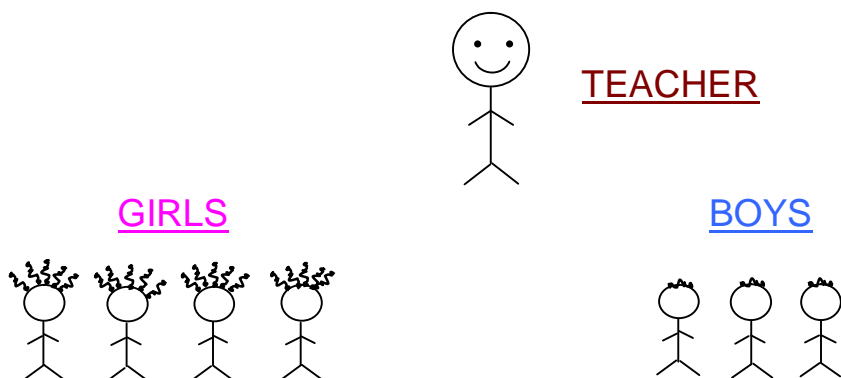
Find a Common Factor and Cancel

$$\frac{35}{21} = \frac{\overset{5 \times 7}{\cancel{35}}}{\underset{3 \times 7}{\cancel{21}}} = \frac{\overset{5 \times \cancel{7}}{\cancel{35}}}{\underset{3 \times \cancel{7}}{\cancel{21}}} = \frac{5}{3}$$

$$\frac{120}{40} = \frac{\cancel{120}}{\cancel{40}} = \frac{\overset{4 \times 3}{\cancel{12}}}{\underset{4}{\cancel{4}}} = \frac{\overset{\cancel{4} \times 3}{\cancel{12}}}{\cancel{4}} = 3$$

$$\frac{36}{81} = \frac{\overset{6 \times 6}{\cancel{36}}}{\underset{9 \times 9}{\cancel{81}}} = \frac{\overset{2 \times \cancel{3} \quad 2 \times \cancel{3}}{\cancel{6} \times \cancel{6}}}{\underset{9 \times 9}{\cancel{81}}} = \frac{\overset{2 \times \cancel{3} \quad 2 \times \cancel{3}}{\cancel{6} \times \cancel{6}}}{\underset{9 \times 9}{\cancel{81}}} = \frac{4}{9}$$

A Ratio Compares Two Different Quantities



Examples: Write the words, count the numbers. The ratio of girls to boys is 4 to 3.

RATIOS:

$$\frac{\text{GIRLS}}{\text{BOYS}} = \frac{4}{3} \quad (\text{Also "4:3" or "4 to 3"})$$

$$\frac{\text{BOYS}}{\text{GIRLS}} = \frac{3}{4} \quad (\text{Also "3:4" or "3 to 4"})$$

$$\frac{\text{TEACHER}}{\text{STUDENTS}} = \frac{1}{7} \quad (\text{Also "1:7" or "1 to 7"})$$

$$\frac{\text{GIRLS}}{\text{PERSONS}} = \frac{4}{8} = \frac{1}{2} \quad \text{Always express in lowest terms}$$

~~4~~
~~8~~
4 x 2

Typical GED Questions – Cancel Your Ratios

Always express in lowest terms

Example

What is the ratio of Mets fans to Yankee fans at a subway series game where there are 25,000 Mets fans and 30,000 Yankee fans?

$$\frac{\text{Mets fans}}{\text{Yankee fans}} = \frac{\cancel{25,000}}{\cancel{30,000}} = \frac{25}{30} = \frac{\cancel{5} \times 5}{\cancel{5} \times 6} = \frac{5}{6}$$

Why?

$$\begin{array}{r} \cancel{25} \times \cancel{1,000} \\ \cancel{25,000} \\ \cancel{30,000} \\ \cancel{30} \times \cancel{1,000} \end{array}$$

Example

Your father bought three raffle tickets, your sister bought two, and you bought one. If 18,000 tickets were sold, what are the chances that someone in your family will win?

$$\frac{3 + 2 + 1}{18,000} = \frac{\cancel{6} \times 1}{\cancel{18,000}} = \frac{1}{\cancel{6} \times 3,000} \quad (\text{Or } 1:3000)$$

These easy shortcuts save precious time on the test!
Do you use them?

Definition: A **Proportion** is TWO EQUAL RATIOS

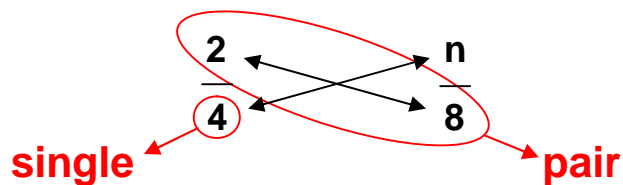
To Solve a Proportion:

$$\frac{2}{4} = \frac{n}{8}$$

Variable →

I. Find the variable (above), and the cross products (below).

II. Find the pair of numbers, and the single number.



III. Multiply the pair, divide the single.

$$n = \frac{(2)(8)}{4}$$

$$n = \frac{\cancel{4} \times 2}{\cancel{4}} = 4$$

The Perfect Proportion—Every Time!

$$\begin{array}{ccc} \text{Little Ratio} & & \text{Big Ratio} \\ \frac{\text{● little apples}}{\text{● little oranges}} & = & \frac{\text{● BIG APPLES}}{\text{● BIG ORANGES}} \end{array}$$

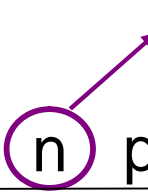
1. Your “**apple**” quantity must be on top in both ratios.
2. Your “**orange**” quantity must be on the bottom.
3. **Don’t mix them up!**

“**Apples**” and “**oranges**” can’t **BOTH** be on top!

Typical GED Question – Basketball:

If you can score 3 points in 5 free throws, how many points can you score in 25 free throws?

$$\begin{array}{c}
 \bullet \text{ 3 points} \\
 \hline
 \bullet \text{ 5 free throws}
 \end{array}
 =
 \begin{array}{c}
 \bullet \text{ } \\
 \hline
 \bullet \text{ 25 free throws}
 \end{array}$$

Variable


Multiply the pair,
divide the single.

$$n = \frac{3 \times 25}{5} = \frac{75}{5} = 15 \text{ points}$$

For the GED:
Cancel first, then multiply.

$$n = \frac{3 \times \cancel{25}}{\cancel{5}} = 15 \text{ points}$$

~~5~~ x 5

Typical GED Question – Proportions with a Calculator

Sam drove $5\frac{3}{4}$ hours at 55 miles per hour. To the nearest mile, how far did he travel?

Clue: The rate of speed (55 miles per hour) is a ratio.

So:

$$\frac{\text{55 miles}}{\text{1 hour}} = \frac{\text{n miles}}{\text{5}\frac{3}{4} \text{ hours}}$$

Variable—“how many?”

Multiply the pair, divide the single.

$$n = \frac{55 \text{ miles} \times 5\frac{3}{4} \text{ hours}}{1 \text{ hour}}$$

Next, change $\frac{3}{4}$ to a decimal number:

On a calculator: $3 \div 4 = 0.75$

So: $n = 55 \text{ miles} \times 5.75 = 316.25 \text{ miles}$

hundreds *tens* *ones*

3 1 6 . 2 5

“The nearest whole number” means the ones place.

Underline the ones place.

$$31\text{ 6}.25$$

Look one place to the right. Is it 5 or more? In this case no, so:

- Drop all digits to the right of the rounding place.

$$n = 316 \text{ miles}$$

Percent Problems – Proportions, Too

$$\frac{\text{little apples}}{\text{little oranges}} = \frac{\text{BIG APPLES}}{\text{BIG ORANGES}}$$

With **percents**, it looks like this:

$$\frac{\text{PART}}{\text{WHOLE}} = \frac{\%}{100}$$

When the problem asks for:

Write:

Any number, such as 50%	$\frac{50}{100}$
“What percent?”	$\frac{n}{100}$

Solving Percent Problems

$$\frac{\text{PART \#}}{\text{WHOLE \#}} = \frac{\% \#}{100}$$

- **100** never changes.
- The other 3 numbers are:
 1. **PART #**
 2. **WHOLE #**
 3. **% #**
- Percent problems give 2 of these 3 numbers.

The third is your **n**.

- Your job:

Fill in the proportion diagram and solve for **n**.

Typical GED Questions – Percent

Example: Let's say that 10 out of 50 cars in a parking lot are red.

Here are 3 types of questions from that:

1. What percent of the cars are red?

Clue: "What percent" means the **%#** is your **n**.

$$\frac{10}{50} = \frac{n\%}{100} \qquad n\% = \frac{(10)(100)}{50} = \frac{\overset{5 \times 2}{\cancel{40}}(\cancel{100})}{\cancel{50}} = 20\%$$

2. If 20% of 50 cars are red, how many cars are red?

Clue: Red cars are part but not all of the total, so **n** is the **PART #**.

$$\frac{n}{50} = \frac{20}{100} \qquad n = \frac{(50)(20)}{100} = \frac{\cancel{50}(\cancel{20})}{\cancel{100}} = 10$$

3. The 10 red cars are 20% of what total number?

Clue: "What total number" means **n** is the **WHOLE #**.

$$\frac{10}{n} = \frac{20}{100} \qquad n = \frac{(10)(100)}{20} = \frac{\overset{2 \times 5}{\cancel{40}}(\cancel{100})}{\cancel{20}} = 50$$

Typical GED Questions – Percent with a Calculator

- What is the saving on a **25% discount**?

$$25\% \text{ discount} = \underline{.25} \times \text{price}$$

Example:

What is the saving for a 25% discount on a price of \$17.80?

$$25\% \text{ discount} = \underline{.25} \times \$17.80 = \$4.45$$

What is the purchase price?

Price	\$17.80
- Discount	- 4.45
Purchase price	<u>\$13.35</u>

- What is the **interest payment** at 1.5% per month?

$$1.5\% \text{ interest} = \underline{.015} \times \text{unpaid balance}$$

Example:

What is the interest payment on a balance of \$156.00 at 1.5% per month?

$$1.5\% \text{ interest} = \underline{.015} \times \$156.00 = \$2.34$$

Typical GED Question – Percent with Rounding

- What is the **sales tax** at 7%?

$$7\% \text{ sales tax} = \underline{.07} \times \text{price}$$

Example:

What is the **sales tax** at 7% on a purchase of \$3.85?

$$\underline{0.07} \times \$3.85 = \$0.2695$$

Round to the nearest cent.

1. Know your rounding places.

dollars
dimes
cents
 \$ 0 . 2 6 9 5

2. Underline your rounding place for cents.

↓
 \$.2695

3. Look one place to the right. Is it 5 or more? In this case yes, so:

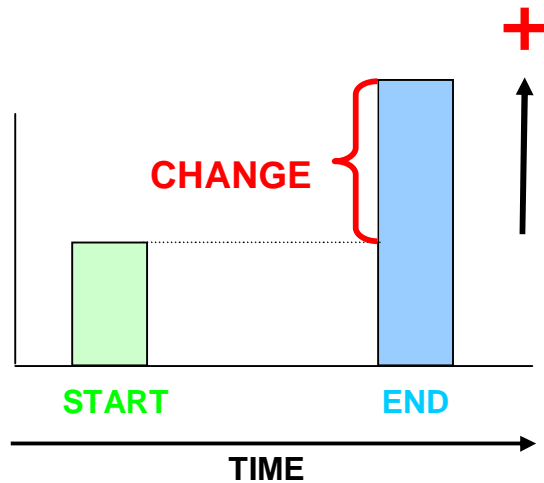
- Add one to the rounding place, and
- Drop all digits to the right of the rounding place.

$$\$0.2695 = \$0.27$$

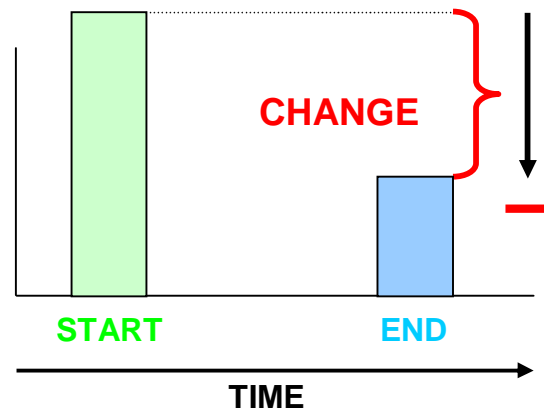
Percent Change: A Change in Quantity over Time

$$\text{CHANGE} = \text{END} - \text{START}$$

- An **increase** points **up**, for a **positive change (+)**.



- A **decrease** points **down**, for a **negative change (-)**.



For quantity changes, the percent proportion looks like this:

$$\frac{\text{CHANGE}}{\text{START}} = \frac{\% \text{ CHANGE}}{100}$$

Typical GED Questions – Percent Change

- Your team scored 45 points yesterday, and 54 points today. What percent increase is that?

Step 1

$$\text{CHANGE} = \text{END} - \text{START}$$

$$\text{CHANGE} = 54 - 45 = +9 \text{ (increase)}$$

Step 2

$$\frac{\text{CHANGE}}{\text{START}} = \frac{\% \text{ CHANGE}}{100}$$

$$\frac{+9}{45} = \frac{\% \text{ CHANGE}}{100}$$

$$\% \text{ CHANGE} = +9 \times \frac{100}{45} = +20\% \text{ (increase)}$$

$\begin{array}{r} 5 \times 20 \\ \hline 9 \times 5 \end{array}$

- Your team won 12 games last month, and 9 this month. What percent decrease is that?

Step 1

$$\text{CHANGE} = \text{END} - \text{START}$$

$$\text{CHANGE} = 9 - 12 = -3 \text{ (decrease)}$$

Step 2

$$\frac{\text{CHANGE}}{\text{START}} = \frac{\% \text{ CHANGE}}{100}$$

$$\frac{-3}{12} = \frac{\% \text{ CHANGE}}{100}$$

$$\% \text{ CHANGE} = -3 \times \frac{100}{12} = -25\% \text{ (decrease)}$$

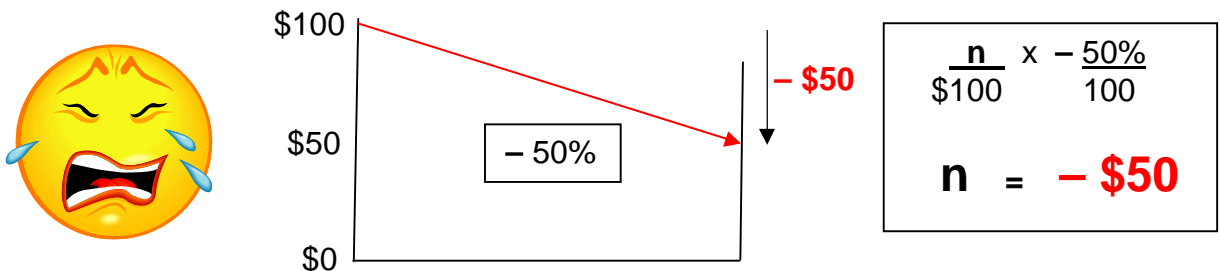
$\begin{array}{r} 4 \times 25 \\ \hline 3 \times 4 \\ \hline 3 \times 4 \end{array}$

Don't make this **Common Mistake!**

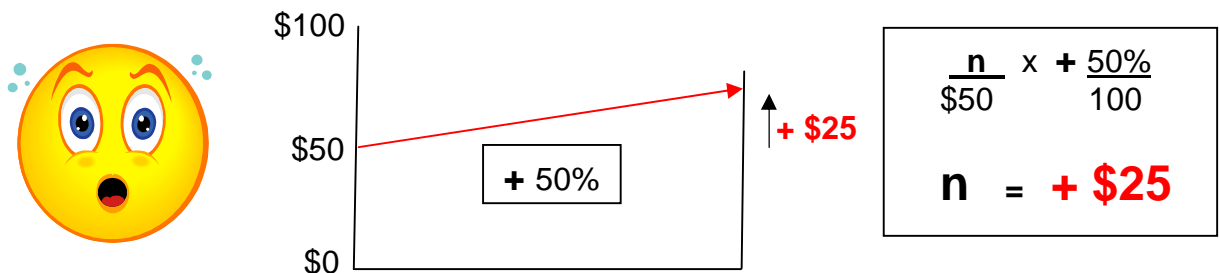
If you lose 50% and then gain 50%,
you are **NOT** back to your start!

Example

- If you start with \$100 and lose 50% (equal to one half) you have \$50 left.



- But then if you gain back 50% of your \$50, that's only \$25.



- To get back up to \$100, you would have to gain **100%** of your \$50!

