

TEACHER ANSWER KEY

LEVEL
**SECONDARY -
MATHEMATICS**

AGE GROUP:
12-14

PART 1

QUESTION 1

A) INCOME CALCULATION:

(proportions)

Variables

x: Hours worked

y: Salary (\$)

Data

Hours worked	32	40
Salary (\$)	480	600

Rule

$$a = \Delta y / \Delta x = (600 - 480) / (40 - 32) = 15$$

$$y = 15x$$

Alice's weekly salary

$$y = 15(30) = \$450$$

Alice's monthly salary

$$450 \times 4 = \$1,800$$

ALICE EARNS \$1,800.00 A MONTH.

B) EXPENSE CALCULATION

Alice's electricity costs (exponents and square roots)

Electricity costs

$$2^2 \times \sqrt{625} = 4 \times 25 = \$100$$

ALICE SPENDS \$100.00 A MONTH ON ELECTRICITY.

CELLPHONE COSTS

$$15/100 \times 100 = \$15$$

$$100 + 15 = 115$$

ALICE SPENDS \$115.00 A MONTH ON HER CELLPHONE.

TRANSPORTATION COSTS

(polygon perimeter and area, fractions)

Data

$$A_{\text{polygon}} = 168 \text{ km}^2$$

$$a_{\text{polygon}} = 7,000 \text{ m}$$

Conversion a_polygon

$$7,000 \text{ m} \div 1,000 = 7 \text{ km}$$

Measurement of pentagon's side

$$A_{\text{polygon}} = (s \times a \times n) / 2$$

$$168 = (s \times 7 \times 5) / 2$$

$$s = 9.6 \text{ km}$$

Measurement of pentagon's perimeter

$$P = 5 \times s = 5 \times 9.6 = 48 \text{ km}$$

Distance to work from apartment

$$1/3 \times 48 = 16 \text{ km}$$

Cost of taxi, before taxes

$$16 \times 0.75 = \$12$$

$$12 \times 2 \text{ (roundtrip)} \times 5 \text{ days} \times 4 \text{ weeks} = \$480$$

Cost of taxi, including taxes

$$15/100 \times 480 = \$72$$

$$480 + 72 = \$552$$

ALICE SPENDS \$552.00 A MONTH ON TRANSPORTATION.

FOOD COSTS

(fractions and order of operations)

Cafeteria meal costs, before taxes

$$5 \times 5 \text{ days} \times 4 \text{ weeks} = \$100$$

Cafeteria meal costs, including taxes

$$15/100 \times 100 = \$15$$

$$100 + 15 = \$115$$

Restaurant meal costs

$$4,2 \times (5,62 + 8,38)^2 - 48,02 \times 15$$

$$= 4,2 \times (14)^2 - 48,02 \times 15$$

$$= 4,2 \times 196 - 48,02 \times 15$$

$$= 823,2 - 720,3$$

$$= \$102.90$$

Monthly restaurant meal costs

$$102,90 \times 4 = \$411.60$$

Total food costs

$$115 + 411,60 = \$526.60$$

ALICE SPENDS \$526.60 A MONTH ON FOOD.

LEISURE COSTS

(assuming there are four weeks in a month)

$$55 \times 4 = \$220$$

ALICE SPENDS \$220 A MONTH ON LEISURE ACTIVITIES.



C) ALICE'S MONTHLY BUDGET

INCOME	
Net salary	\$1,800.00
EXPENSES	
Home	\$500.00
Electricity	\$100.00
Cellphone	\$115.00
Food	\$552.00
Transportation	\$526.60
Leisure	\$220.00
TOTAL EXPENSES	\$2,013.60
BALANCE	\$203.60

D) EXPLAIN YOUR ANSWER:

Alice's budget is not balanced because her monthly expenses exceed her monthly income—she is losing money at the end of each month.

BUDGET ANALYSIS

A budget analysis provides an overview of your expenses and determines what percentage of income should be attributed to each category.

CATEGORY (expense items)	Average %	
	min.	max.
Home (rent, mortgage, taxes, insurance)	25%	35%
Utilities (electricity, heating, water, phone, etc.)	5%	10%
Food	5%	15%
Transportation	10%	15%
Leisure	5%	10%
Other (clothes, tuition, healthcare, debt payments, etc.)	15% +	

QUESTION N°2

A) CALCULATE THE PERCENTAGE OF HER INCOME ALICE SPENDS ON EACH CATEGORY

CATEGORY (rent, mortgage, taxes, insurance)	Alice's %
Home (rent, mortgage, taxes, insurance)	28%
Utilities (electricity, heating, water, phone, etc.)	31%
Food	12%
Transportation	29%
Leisure	12%

B) WHERE WOULD YOU SUGGEST THAT ALICE CUT DOWN ON HER SPENDING? WHY?

Alice is spending a reasonable proportion of her income on rent. However, she is spending too much on transportation, food, phone service and leisure activities. These items exceed the recommended proportions, causing her monthly budget to become unbalanced.



PART 2

QUESTION 3

A) CELLPHONE COSTS

Plan 1

Cost for 400 minutes before taxes

$$400-350=50 \text{ min.}$$

$$50 \times 0.28 = \$14$$

$$48 + 14 = \$62$$

Cost including taxes

$$15/100 \times 62 = \$9.30$$

$$62 + 9.30 = \$71.30$$

Plan 2

Cost including taxes

$$15/100 \times 60 = \$9$$

$$60 + 9 = \$69$$

Plan 3

Cost for 400 minutes before taxes

$$400 \times 0.16 = \$64$$

Cost including taxes

$$15/100 \times 64 = \$9.60$$

$$64 + 9.60 = \$73.60$$

PLAN 2 IS THE CHEAPEST AT \$69.00 A MONTH.

B) TRANSPORTATION COSTS

(single-variable algebraic equation)

Identification of unknown values

Cost of a Green Line ticket: x
(line Alice will use to get to work)

Cost of a Purple Line ticket: $x-1$

Cost of a Blue Line ticket: $2x$

Cost of a Red Line ticket: $2x-2$

Equation

$$2x + 2(x-1) + 2(2x) + 2(2x-2) = 54$$

$$2x + 2x - 2 + 4x + 4x - 4 = 54$$

$$12x - 6 = 54$$

$$12x = 60$$

$$x = 5$$

A Green Line ticket costs \$5.00.

Monthly transportation costs

$$5 \times 2 \text{ (roundtrip)} \times 5 \text{ days} \times 4 \text{ weeks} = \$200$$

ALICE WOULD NOW SPEND \$200.00 A MONTH ON TRANSPORTATION.

C) FOOD COSTS

(arithmetic mean)

Cost of weekly groceries

$$x = (60.50 + 60.75 + 64.25 + 65.75 + 67.50 + 71.75 + 75.50 + 78) / 8 = \$68$$

Monthly food costs

$$68 \times 4 = \$272$$

ALICE WOULD NOW SPEND \$272.00 A MONTH ON FOOD.

D) LEISURE COSTS

(percentage)

Depending on teacher's suggestions:

For 5% of income:

$$5/100 \times 1,800 = \$90$$

Pour 10% du revenu

$$10/100 \times 1,800 = \$180$$

ALICE COULD NOW SPEND \$90.00 TO \$180.00 A MONTH ON LEISURE ACTIVITIES.



E) ALICE'S UPDATED MONTHLY BUDGET

INCOME	
Net salary	\$1,800.00
EXPENSES	
Home	\$500.00
Electricity	\$100.00
Cellphone	\$69.00
Food	\$200.00
Transportation	\$272.00
Leisure	\$90.00
TOTAL EXPENSES	\$1,231.00
BALANCE	\$569.00

F) BASED ON THESE CALCULATIONS, IS ALICE'S UPDATED BUDGET BALANCED? EXPLAIN YOUR ANSWER.

In theory, a balanced budget should have more income than expenses. Alice's budget meets this criterion, but includes no savings or emergency fund. This means that Alice would actually have \$569.00 a month to put toward her emergency fund and future projects.

QUESTION 4

A) CALCULATE THE NEW PERCENTAGE OF HER INCOME ALICE WOULD NOW SPEND ON EACH CATEGORY.

CATEGORY (expense items)	Alice's %
Home (rent, mortgage, taxes, insurance)	28%
Utilities (electricity, heating, water, phone, etc.)	11%
Food	9%
Transportation	15%
Leisure	5%

B) HOW DOES THIS UPDATED BREAKDOWN OF HER EXPENSES COMPARE TO THE OLD ONE?

Her budget is now balanced because the proportions of all expense categories fall within the recommended ranges.