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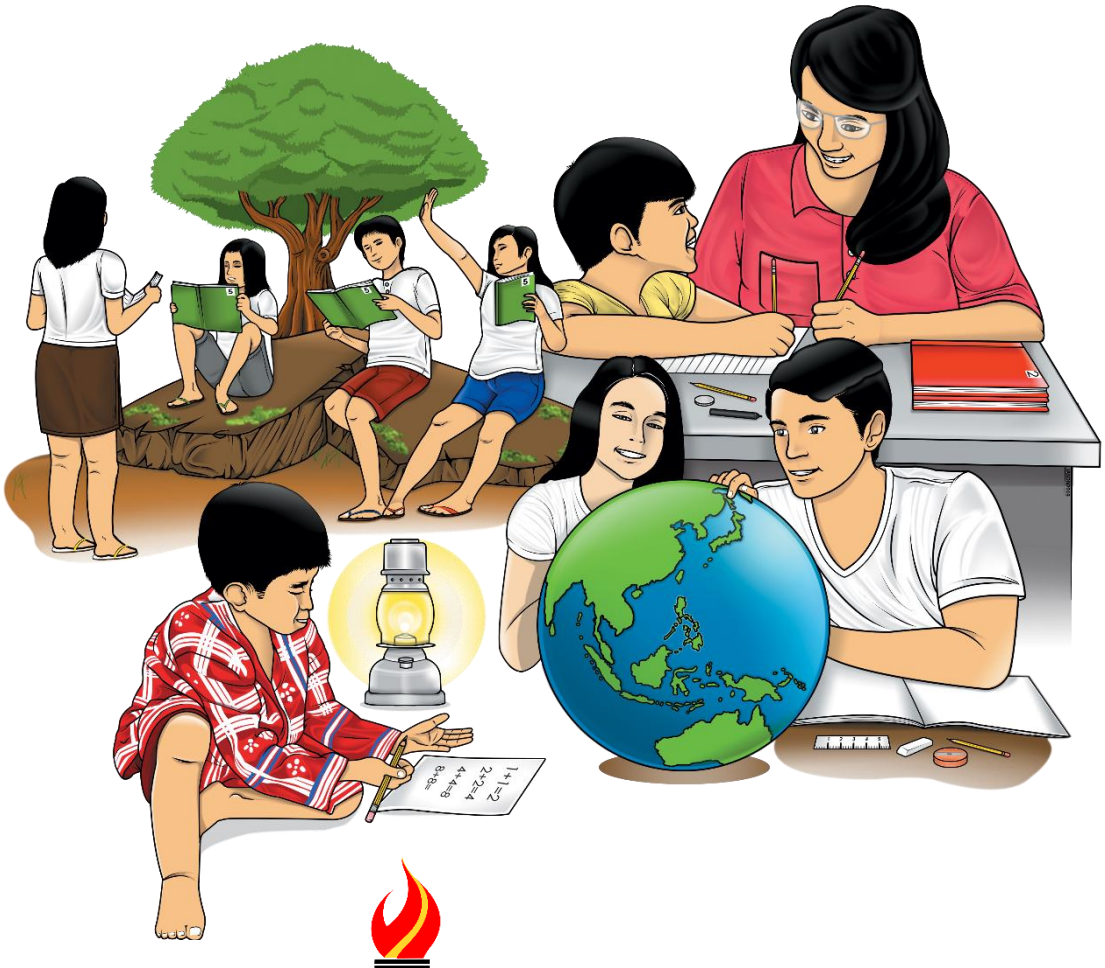
Mathematics

Quarter 3 – Module 5:
Solving Routine and Non-Routine Problems Involving Percentage



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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

Good day Mathletes! In this module, you are going to learn how to solve routine and non-routine problems involving percentage, with reasonable answer. Mastery of the skills in this concept will help you deal with your daily life experiences that involve money and other activities with percentage computations. Fun and challenging activities are also provided to strengthen your understanding of the lesson.

When you finish up this module, you will be able to:

1. solve routine and non-routine problems involving percentage using appropriate strategies and tools.

Before you go ahead with the lesson, let us check first your prior knowledge on solving routine and non-routine problems involving percentage.

What I Know

Directions: Read and understand the problem. Encircle the letter of your answer. You may use a separate sheet of paper for your solutions.

1) Fifty-five percent of people in a survey said that they do exercise on a fairly regular basis. If 12,000 people were surveyed, how many of them exercised on a fairly regular basis?
   A. 5000 B. 5500 C. 6000 D. 6600

2) The price of canned sardines decreased by 18%. If a can of sardines was sold at P 22.50 before the decrease, how much was the decrease?
   A. P4.00 B. P4.05 C. P5.00 D. 5.50

3) In a certain city, about 8% of the people between the ages of 50 and 65 years old are infected with COVID-19. If the city population between the ages of 50 and 65 is 1 550, about how many of them are infected?
   A. 167 B. 145 C. 132 D. 124

4) The Gonzalez family planned to save at least 25% of their monthly income of P 25 000. At least how much did they plan to save monthly?
   A. 6250 B. 6265 C. 6280 D. 6295

5) Jason, a basketball player, usually makes 55% of his field shots. If he attempted 40 field shots during a game, how many field shots did he most likely make in that game?

A. 22 B. 27 C. 32 D. 37

6) Alicia works as an assistant baker at a fancy cake shop. She saves at least 15% of her monthly salary of P15500. At least how much does she save per month?

A. P2300 B. 2325 C. P2350 D. P2375

7) Andrew saves 15% from his P400.00 weekly allowance while Myra saves 22% from his P350.00 weekly allowance. Who saves more, Andrew or Myra, and by how much?

A. Andrew, by P60
B. Myra, by P77.
C. Andrew, by P77.
D. Myra, by P17.

8) Alvin is a volleyball player. He usually scores 60% of all the points his team scores in a game. If the team scored 90 points in a particular game, around how many points did he score in that game?

A. 45 B. 54 C. 63 D. 72

9) Leo had some money in his pocket. He gave 40% of this to his mother and 25% to his three younger sisters. He now just has P700.00 left in his pocket. How much money did Leo have in his pocket at first?

A. P2000 B. P2500 C. P3050 D. P3500

10) A department store signage says, "For every 10 points in your reward card, you are entitled to a 5% discount on your total bill". You have 22 points in your reward card. If the total bill for your groceries is P700.00, how much discount are you entitled to?

A. 100 B. 85 C. 70 D. 55

Lesson 1 Solving Routine and Non-Routine Problems Involving Percentage

In order to solve routine and non-routine problems involving percentage, you need to master the skill of finding the percentage of a number. You also need to master identifying the base, percentage and rate in a problem to help you understand the lesson in this module. Here, you will learn how to solve routine and non-routine problems involving percentage. Are you ready to explore the lesson? Let's get started then.

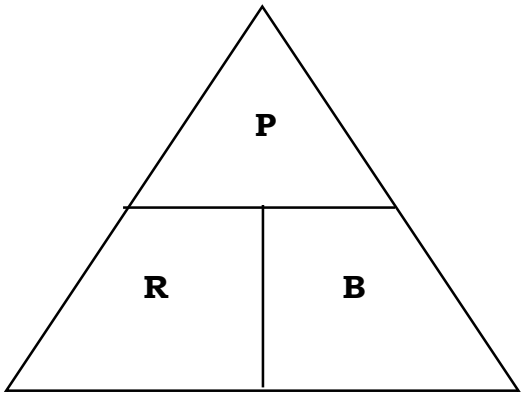
What's In

Before we proceed, let us recall our previous lesson. Can you still remember the steps in finding the percentage of a number?

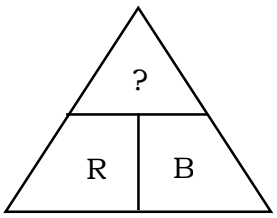
Remember that **percentage** is a *part of a whole*. The *whole or total* of which the percentage is just a part is what we refer to as the **base**; while the number which is usually expressed in *percent* or has the percent sign *(%)* is the **rate**.

In situations where we are trying to find the percentage of a number, we use the formula: **Percentage = Rate x Base** or **P = R x B**. R is usually expressed in percent, or as a decimal or a fraction. Usually too, P is less than B, but only if R is less than 100%. But if R is greater than 100%, B would be less than P.

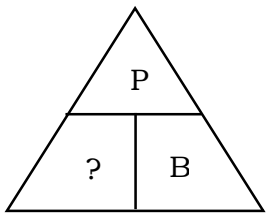
You may also use Techans triangle which is shown below. It is a mnemonic device or a memory device to help us remember the formula in solving problems involving percent.



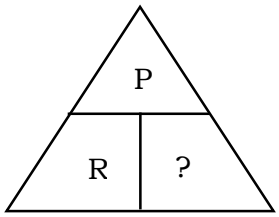
To use Techans triangle, we cover that part which has the letter that represents what we are trying to find in a particular problem. P, for percentage; R for rate; and B for base.



So, if we are trying to find the percentage P, we cover P. What remain are R and B which are side by side. This means we need to multiply R and B to get P.



On the other hand, if we are trying to find the rate R, we cover R. What remain are P and B, with P above B, just like a fraction with P as the numerator and B, the denominator. This means we need to divide P by B to find R.



We do similarly if we are trying to find B.

Let us now consider the following examples.

1) Identify the base, rate and the percentage in the number sentence, 50% of 72 is 36.

   Answer: The **base is 72** because it is the whole or the total. The **rate or percent is 50%** because it has the percent sign. And the **percentage is 36** because it is that part of 72 which corresponds to 50%.

2) In a survey involving 6,000 TV viewers, 10% said that they love to watch TV 5. From this data, identify the following:
   1.) Base
   2.) Rate
   3.) Percentage

   Answers:
   1. The base is 6,000
   2. The rate is 10%
   3. The percentage is 600.

What's New

Read and analyze the problem below:

Carla is a transferee from Manila. Due to Covid-19, her family decided to move back to the province. She is an incoming Grade 5 pupil at Calbayog Pilot Central School and took the entrance examinations last week. In the 80-item Math test, Carla answered 90% of the items correctly. How many items did she answer correctly?

What is It

Everyday, we encounter percentages in many different forms. Thus, knowing how to identify and compute percentages is very important in our daily lives.

Remember that in solving routine problems involving percentage, there are only 4 easy steps to follow:

Step 1: **Understand**	Know what is asked. Know the given facts. Determine hidden questions, if there are any.
Step 2: **Plan**	Determine the operation/s to be used Write the number sentence
Step 3: **Solve**	Solve the number sentence.
Step 4: **Check and Look back**	Write the correct answer

On the other hand, non-routine problems typically do not have an immediately apparent strategy for solving them, it can be done in multiple ways and with a variety of strategies. Here are some of the different strategies used in solving non-routine word problems.

- Look for a pattern
- Guess and check
- Work backward
- Make a model/ visualize the problem
- Break up the problem into smaller parts and solve each part

Note that, in answering routine word problems, you may answer them using a known or immediate strategy such as the 4-step process or using a unique strategy such as illustrations and drawings. While the non-routine problems are any complex problem that requires some degree of creativity or originality to solve and are not answerable using the 4-step process.

Let's consider the problem from the previous part of this module as our first example. Study the solution below.

Example 1:

Carla is a transferee from Manila. Due to Covid-19, her family decided to move back to the province. She is an incoming Grade 5 pupil at Calbayog Pilot Central School and took the entrance examinations last week. In the 80-item Math test, Carla answered 90% of the items correctly. How many items did she answer correctly?

Step 1: Understand

- What is asked: The number of items Carla answered correctly
- Given facts: 80-item test: 90% of the items answered correctly

Step 2: Plan

- Determine the operation to be used: **Multiplication**
- Write the number sentence: n = 0.90 x 80;

Step 3: Solve

- Solution: P = R x B; R = 90% or 0.90; B = 80;

Multiply:

0.90	-	no. of items Carla answered correctly as a percentage of total no. of items
x 80	-	total no. of items
72	-	no. of items Carla answered correctly

Step 4: Check

- Check and look back
- See if your answer makes sense

Multiply:

0.10	-	no. of items Carla failed to answer correctly as a percentage of total no. of items
x 80	-	total no. of items
8	-	no. of items Carla failed to answer correctly

Add:

72	-	no. of items Carla answered correctly
+ 8	-	no. of items Carla failed to answer correctly
80	-	total no. of items

- State the complete answer

Answer: Carla got 72 correct answers in the 80-item test.

But we can also answer this problem in a non-routine way using another strategy. See the diagrams below.

50% x (80 items) = 40 items	50% x (80 items) = 40 items

Consider the table as the whole 80-item test. We are looking for what is 90% of 80 items. We have 50% + 40% = 90% but we have no idea yet what 40% of 80 is.

50% x (80 items) = 40 items	40% x (80 items) = ? items

Solving for n, we have,

$$n = 40\% \times 80$$
$$n = 32$$

We thus have,

$$90\% \times 80 = (50\% \times 80) + (40\% \times 80)$$
$$= 40 + 32$$
$$= 72$$

Completing the table, we have

50% (80 items) = 40 items	40% (80 items) = 32 items

Therefore, Carla got 72 correct items in an 80-item test and had 8 mistakes.

Example 2:

Romeo celebrated his 11th birthday. He counted the people who attended his party and found out that 40% of the 200 attendees were his classmates. How many attendees were his classmates?

Step 1: Understand

- What is asked: The number of attendees who were Romeo's classmates
- Given facts: 200 attendees: 40% of the attendees were Romeo's classmates

Step 2: Plan

- Determine the operation to be used: **Multiplication**
- Write the number sentence: P = R x B = 0.40 x 200 = n; 200 – n = no. of attendees who were not Romeo's classmates

Step 3: Solve

Solution

Multiply:	0.40	No. of attendees who were Romeo's classmates as a percentage of the total no. of attendees
	x 200	Total no. of attendees
	80	No. of attendees who were Romeo's classmates

Step 4: Check

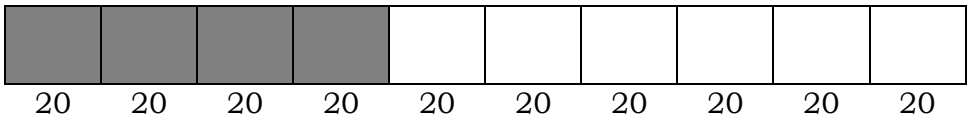
Add:	120	No. of attendees who were not Romeo's classmates
	+ 80	No. of attendees who were Romeo's classmates
	200	Total No. of attendees

- State the complete answer

  Therefore, 80 of the attendees were Romeo's classmates.

You can also solve the problem by making an illustration first**.**

The problem says 40% of the 200 attendees were Romeo's classmates. The figure below consisting of a box representing the 200 attendees. The box is divided into 10 smaller boxes each representing 20 attendees.



Forty percent may also be expressed as 4/10. We therefore get 4 of the 10 smaller boxes and this is shown by the shaded boxes. Four 20s is 80. Therefore, our answer is, 80 attendees in Romeo's party were his classmates.

As we have seen in the two examples above, we can make use of illustrations to help us visualize and solve problems much more easily.

Example 3:

There are 45 questions in a summative examinations. For every correct answer, 5 points is scored. For every incorrect answer, 3 points are deducted. Shiela scored 185 points. How many correct answers did she have? What percent is this of 45?

Assume that Shiela scored perfectly in the summative exam. She would then have a score of 45 x 5 or 225. If she had 1 incorrect answer, she would have scored (44 x 5) – (1 x 3) or 217.

Observe that from the highest possible score of 225, 8 points is deducted for every incorrect answer. This is because 5 points is lost for failing to give the correct answer and 3 points is lost because of the deduction. This is summarized in the table below.

No. of correct answers (c)	Points Scored c x 5	No. of incorrect answers (i)	Points deducted (i x 3)	Total points
45	225	0	0	225
44	220	1	3	217
…	…	…	…	…
40	200	5	15	185

}225 – 217 = 8

Since, Shiela got 185 points, we need to find how many correct answers she had.

Points lost by Shiela = 225 – **185** = 40. Refer to the last row.
No. of incorrect answers = 40 ÷ 8 = **5**

For the next question, what percent of the 45 total number of items did Shiela answer correctly, we have,

P = R x B,
R = P/B (using Techan's Triangle)
= 40/45 x 100%
= $0.\overline{8}$ x 100% = 88.89%

Therefore, Shiela's 40 correct answers is is 88.89% of the 45 total no. of items.

Congratulations for reaching this far. Now try to answer the activities below.

What's More

Activity 1: Start Moving!

Directions**:** Read and understand the following word problems and answer the questions that follow.

Of the 50 members of the Clean and Green Movement, 90% voted for the new president. How many did not vote for the new president?

1. What is asked in the problem?
2. What are the given facts?

Of the 10 on-going projects of the DPWH, 60% are fully implemented. How many projects were fully implemented?

3. Is there a hidden question? What is it?
4. What is the operation to be used?

Among 60 women in a slums area, 40% earn a living peddling plants. The rest earn their living as live-out domestic helpers. How many are live-out domestic helpers?

5. What is the number sentence?

Activity 2: Get Moving!

Directions: Read and understand the word problem using the 4-step process of solving routine problems.

Ava's family went to a resort which charges an entrance fee of P80.00 per person. They are a family of 10 with 7 adults and 3 kids. The cashier told them that the entrance fee for a child was only P50.00. They were given a receipt for P710.00 instead of what they thought was P800.00.What percent of the P800 supposed total entrance fee for 10 people did Ava's family not have to pay because 3 members of their family were children?

Activity 3: Keep Moving!

Directions: Read and understand the word problem inside the box. Then, supply the missing information using the 4-step plan.

Marie is a working student of Mrs. Gomez. Every week, she receives P750.00 as allowance. If she saves 15%, how much is her weekly savings?

Understand:

What is asked? _____

Given facts. _____

Hidden questions. _____

Plan:

Operation to be used: _____

Number sentence: _____

Solve:

Solution. _____

Check and Look back: _____

Now, that you already know the flow of process in solving routine word problems as well as you have the idea of figuring out how to answer non-routine word problems, let's summarize what you had learned.

What I Have Learned

Directions: Fill in the blanks with the correct word or group of words to make the statement complete.

1) To solve routine problems involving percentage, we follow the _____.
2) Before solving the problem, you should _____.
3) Part of understanding the problem is to determine if there is a _____.
4) Once the problem is understood, you need to determine the _____ to be used.
5) If the operation is already identified, write the _____.
6) After solving, to make sure if your answer is correct, you need to _____.
7) Non-routine problems typically do not have an immediately apparent strategy for solving them, it can be done in _____.
8) One of the different strategies used in solving non-routine word problems is looking for a _____.
9) Making a model is one of the multiple ways in solving _____.
10) Non-routine problems are any complex problem that requires some degree of _____ to solve.

Nice work! Let's practice some more.

What I Can Do

Now, apply what you have learned about solving routine and non-routine problems involving percentage. Read and understand the sample real-life situation presented below. Feel free to use an extra sheet of paper for your solutions.

Arnold is finally going home to Calbayog. He is one of the many locally stranded individuals (LSI) in Manila who had been wanting to go home to his hometown. He has spent all his money and had to ask his aunt for fare money. If his aunt gave him P3,000.00, of which he used P1,200.00 to buy his bus ticket, what percent of the money his aunt gave him does he have left?

Good job! You certainly did well today. You are almost done; just two more activities to go.

Assessment

Directions: Select the letter that corresponds to the reasonable answer. You may use an extra sheet of paper for your solutions.

1) Of the 40 members of the Mathematics Club, 35% are also members of the Science Club. How many members of the Mathematics Club are also members of the Science Club?
   A. 14 B. 16 C. 18 D. 20

2) The Brgy. Macatingog Council and Officials conducted a General Assembly.~~,~~ 180 people attended. Among them, 30% were female. How many were female attendees?
   A. 34 B. 44 C. 54 D. 64

3) A fish vendor was able to sell 65% of his 80 kilos of fish. How many kilos of his fish was he able to sell?
   A. 52 B. 42 C. 32 D. 22

4) Mang Cenon planted 68% of his farm with rice. What percent of his farm is not planted with rice?
   A. 22% B. 32% C. 42% D. 52%

5) Amanda correctly answered 75% of the items in her spelling test. How many percent of the items did she not answer correctly?
   A. 15% B. 10% C. 25% D. 20%

6) The Gonzales family planned to save at least 25% of their monthly income of P25 500. At least how much did they plan to save from their monthly income?
   A. P6 400 B. P6 375 C. P6 350 D. P6 325

7) Gerald saves 18% from his P300.00 weekly allowance while Mirasol saves 25% from his P250.00 weekly allowance. Who saves more per week, Gerald or Mirasol, and by how much?
   A. Gerald, by P8.00
   B. Mirasol, by P54.00
   C. Gerald, by P62.50
   D. Mirasol, by P8.50

8) Marvin, a basketball player, usually scores on 60% of his field shot attempts. If he attempted 30 field shots during a particular game, about how many of his field shot attempts did he score on in that game?
   A. 16 B. 18 C. 20 D. 22

9) Mark had some money in his pocket. He gave 25% of this to his mother and another 25% to his three younger sisters. He now just has P750.00 left in his pocket. How much money did Mark have in his pocket at first?

A. P1000 B. P1500 C. P2000 D. P2500

10) A department store signage says, "For every 10 points in your reward card, you are entitled to a 5% discount on your total bill". You have 32 points in your reward card. If the total bill for your groceries is P1,000.00, how much discount are you entitled to?

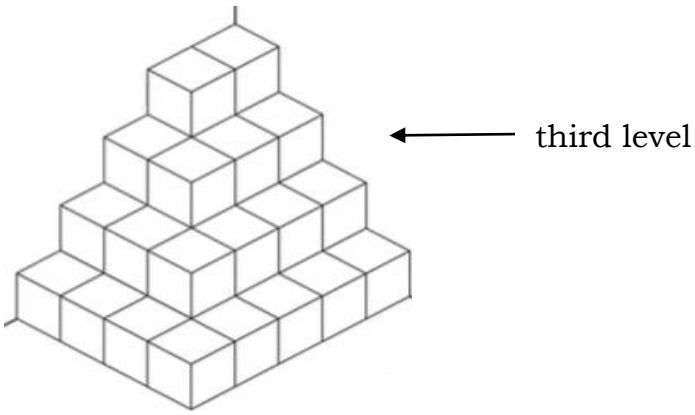
A. 50 B. 100 C. 150 D. 200

One more activity and you will be ready for the next module. Surely you can do it. Good luck!

Additional Activities

Directions: Answer the following routine and non-routine problems below. Use an extra sheet of paper for your solutions.

1) A test has 20 questions. If Peter answered 80% of the questions correctly, how many questions did Peter not answer correctly?
2) In a school, 25 % of the teachers teach basic math. If there are 50 teachers who teach basic math, how many teachers are there in the school?
3) What percent of the total number of piled boxes are those in the third level?



Answer Key

What's More

Activity 3: Keep Moving!

-Marie's weekly savings
-P750 weekly allowance and 15% savings
-The amount of Marie's expenses less than her savings
-Multiplication
– amount of Marie's weekly savings

P = R x B
R = Amount of Marie's weekly allowance that she saves as a percentage of her allowance = 15%
B = Marie's weekly allowance = 750
P = !5% x 750 = 112.50

What I Have Learned

1. 4-Step
2. Plan
3. Non-routine
4. problems
5. picture
6. operation
7. number
8. sentence
9. check
10. given

What I Can Do

P = R x B
P = price of bus ticket = 1200
B = amount Arnold received from her aunt = 3000
Amount Arnold had left in his pocket = 3000 – 1200 = 1800
R = percent of amount from aunt that Arnold had left in his pocket = P/B = 1800/3000 x 100% = 60%

Assessment

1. A
2. C
3. A
4. B
5. C
6. B
7. D
8. B
9. B
10. C

Additional Activities

1. P = R x B
   B = no. of questions = 20
   R = percent of correct answers = 80%;
   P = no. of correct answers = 80% x 20 = 16
   no. of incorrect answers = 20 – 16 = 4.

2. P = R x B
   P = no. of basic math teachers = 50
   R = % of teachers who teach basic math = 25%
   B = total no. of teachers
   B = P/R = 50/25% = 50/(25/100) = 200

3. Multiply:

Level		# of boxes		
1	x	2	=	2
2	x	3	=	6 –3rd level
3	x	4	=	12
4	x	5	=	20

   P = R x B
   B = Total no. of boxes = 2 + 6 + 12 + 20 = 40
   P = No. of boxes in the 3rd level = 6
   R = % of total no. of boxes that are in the 3rd level
   R = P/B x 100% = 6/40 x 100% = 15%

What I Know

1. D
2. B
3. D
4. A
5. A
6. B
7. D
8. B
9. A
10. C

What's More

Activity 1: Start Moving!

1. How many of the 50 committee members did not vote for the president.
2. There are 50 committee members and 90% of them voted for the president
3. The number of projects that were not fully implemented.
4. Multiplication
5. P = R x B
   no. of women who earn a living peddling plants = 0.40 x 60
   no. of women who are live-out domestic helpers = 60 – (.04 x 60)

Activity 2: Get Moving!

Amount to pay if 10 adults = 10 x 80 = 800
Amount to pay for 7 adults and 3 kids =
(7 x 80) + (3 x 50) = 710
Additional amount to pay if 10 adults instead of 7 adults and 3 kids =
800 – 710 = 90
P = R x B; R = P/B
P = 90; B = 800

To compute for the amount they did not pay as a percentage of what they would have paid if 10 adults:

1. R = 90/800 x 100% = 11.25%. or
2. R = 100% - (710/800 x100%)
   100% - 88.75% = 11.25%

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