

Effects of Social Interactive - Constructivist Approach in Teaching Mathematics

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Abstract

This study aimed to determine the effectiveness of Social Interactive – Constructivist Approach in teaching Mathematics for Grade 10 learners in Dawis National High School (DNHS), Bayawan City for the School Year 2017 – 2018. The study made use of an experimental design particularly the Pre-Test and Post-Test Control Group Design wherein there were two groups of learners involved—the control group and the experimental group. The study disclosed that both control and experimental groups got a failing rating in their pretest performance. After utilizing the conventional approach for the control group and social interactive-constructivist approach for the experimental group, the former group generally obtained a “fairly satisfactory” rating while the latter group, a “satisfactory” rating. Lastly, the use of the social interactive-constructivist approach is better than the conventional approach.

Keywords: *interactive-constructivist approach, experimental group, control group*

I. INTRODUCTION

Learning Mathematics is a fundamental and essential knowledge, hence, life without it is unimaginable (Hyman, 2017). It is a common saying that “Mathematics is the mother of all subjects” (Faluyi, 2016); that is why it is considered to be more than a subject and is conceived of a key problem solving. Mathematics is not only numbers and computations (Li, 2010); but also a process that requires deep thinking and patience for it to be fully appreciated (Fullan, et. al., 2017). But then, Mathematics already has a big unpleasant impression to learners (Etuk, et. al, 2013). Approaches in teaching which emphasize memorization of Mathematics facts is one of the reasons that most learners suffer from Math anxiety (Barshay, 2015). Many people believe that Mathematics is all about getting the correct answers, not interpretation or meaning - and it has to be that way, hence, reasoning is the core of Mathematics (NCTM, 2007). It is about analyzing or reflecting why certain techniques are practicable and why we need to use such techniques (Boaler, 2015).

However, the learners’ Mathematics performance continues to be a problem in some countries including the Philippines. For example, the report of TIMSS on 2011 shows that achievement in Mathematics drops at or below Low International Benchmarks. In the National Achievement Test (NAT) results for SY 2011-2012, the learners’ overall Mean Percentage Score (MPS) of 46.37 implies poor performance in this subject. This also shows that Mathematics is the second lowest rank to Science with 40.53 overall MPS. Furthermore, the Trends in International Mathematics and Science Study (TIMSS) confirms the teacher’s poor performance in Mathematics as reported. Ironically, its nearby Asian countries like Singapore, South Korea, Hongkong, Chinese Taipei, and Japan are among the world’s leaders in Mathematics achievement (Mullis, 2011).

Teaching Mathematics is a challenge, testing the teachers’ competence, capabilities, and

resourcefulness. They must be resourceful in using approaches in teaching Mathematics so that learners will find Mathematics easier to understand, thus achieving an impressive academic performance.

The researcher has taught Mathematics for several years, and, just like other Mathematics teachers nationwide, had been thoroughly trained and prepared for the full implementation of K to 12 Programs as prescribed by the Department of Education. Her competence and capability to teach this subject can be evaluated through her learners' performance; how far they have learned and the skills they have developed will reflect on the kind of teacher she is.

Since the researcher is concerned with the learners' academic performance, she thought of approaches in teaching Mathematics that would possibly enhance learners' learning abilities, thereby improving their performance in learning Mathematics. Social Interactive - Constructivist Approach in teaching Mathematics is an effective way to connect with the 21st century learners who are used to interactive communication (Zwang, 2011).

Michael (2006) concluded that active learning, learner-centered approaches to teaching physiology work, is proven to work better than more passive approaches. Although no single definitive experiment has been made to prove this, nor can there be given the nature of the phenomena at work, but the very multiplicity of sources of evidence makes the argument compelling. Therefore, teachers should start improving their teaching methods and employing those techniques that encourage active learning. Also, they must utilize those approaches that match their own teaching styles, personalities, the particular courses, and most importantly, the learners' needs. Doing so well means that they too become learners in the classroom.

There are also recent studies of Game-Based Mathematics Instruction which encourages using Mathematical games in some lessons to motivate and enhance learners' performance (Perrotta, et. al, 2013). This is the driving force that motivated the researcher to undergo this study, which is to find out the effects of Social Interactive - Constructivist Approach in teaching Mathematics to be used in every topic to be taken up in Grade 10 Mathematics. The use of Social Interactive – Constructivist Approach in teaching Mathematics has never been employed in Dawis National High School; and therefore, there is no proof of effectiveness when employed to learners, especially in public schools. It is the researcher's desire to improve the Mathematics performance of learners by engaging them in an interactive learning environment. This can only be determined through the learners' performance in pretests and posttests. The findings will guide the researcher towards knowing the appropriate teaching approach and making Mathematics teaching more effective and more enjoyable for the Grade 10 learners in Dawis National High School (DNHS), Bayawan City.

II. METHODOLOGY

Research Design

The study made use of an experimental design particularly the Pretest and Posttest Control Group Design. This design consisted of two groups—experimental group and control group. A pretest was given to both groups before the intervention (use of Social Interactive–Constructivist Approach) and a posttest was administered following the intervention.

Research Respondents

The respondents of the study were the Grade 10 learners of Dawis National High School, Dawis, Bayawan City for the academic year 2017-2018. Since the Grade 10 level of the school only consisted of two

sections, the two groups were specially selected and randomly assigned as experimental or control group through a coin toss, for the first topic. The succeeding topics were distributed alternately in such a way that the experimental group in the previous topic became the control group on the next topic, and vice versa. This method enabled the researcher to give both groups fair chances of getting selected to receive the intervention (the use of Social Interactive–Constructivist Approach). The researcher would like to stress that the two groups of learners have more or less the same knowledge based on the result of the t-test.

Distribution of the Respondents

Topic	Control Group	Experimental Group	Number of Learners
1. Identifying a Polynomial Function	Malikhain	Makatao	40
2. Finding the Zeros of Polynomial Functions	Makatao	Malikhain	40
3. Intercepts of the Polynomial Functions	Malikhain	Makatao	40
4. Graph of the Polynomial Functions	Makatao	Malikhain	40
Total Number of Learners			80

Research Instruments

To determine the performance of the learners under Social Interactive–Approach in teaching Mathematics, a researcher-made test was administered to the respondents—both control and experimental groups—before and after the presentation of each topic. The said test instruments were referred to a panel of experts to determine its validity and elicit their suggestions and comments for the improvement of the tests. A dry-run was conducted to learners, who were not included in the study, to evaluate the degree of difficulty of the items through an item analysis. Using test-retest method the reliability coefficient yields to 0.756 which is beyond the acceptable value of 0.70.

Research Procedure

After the design hearing, the researcher considered the suggestions of the panel members. A letter of request to conduct the study was sent to the Schools Division Superintendent of the Division of Bayawan City during the first quarter of the School Year. At the start of the second quarter period, the signed and approved request was presented to the school principal. Upon the approval of the school principal, the two classes of Grade 10 were randomly selected as experimental group for the first topic “Describing Polynomial Function” by tossing a coin. The other Grade 10 section which was not selected became the control group automatically. Each of the groups took the same pretest. The experimental group was taught using the Social Interactive–Constructivist Approach with; activity learning method, group work method, inquiry method, jigsaw method, and think-pair and share; which was specially chosen by the researcher in each topic; while the control group was instructed using the conventional approach in every topic. The posttest, which is parallel to the pretest, was administered after each of the topics has been discussed.

III. RESULTS AND DISCUSSION

This part of the study deals with the presentation, analysis and interpretation of data. After the test question validation process which was administered in two (2) groups of Grade 10 learners in Villasol National High School, the collection of data was immediately started.

The gathered data are presented in tabular and textual forms, analyzed and interpreted to suit the problems presented earlier in this study.

Table 1. *Pretest Performance of the Control and Experimental Groups in the Four Examinations*

Topic	Control Group			Experimental Group		
	Rating	VD	sd	Rating	VD	sd
1. Identifying a Polynomial Function	70.60	Did not meet expectations	4.63	69.90	Did not meet expectations	4.16
2. Finding the Zeros of Polynomial Functions	70.40	Did not meet expectations	4.34	70.18	Did not meet expectations	3.30
3. Intercepts of the Polynomial Functions	72.65	Did not meet expectations	5.98	73.2	Did not meet expectations	7.08
4. Graph of the Polynomial Functions	68.70	Did not meet expectations	2.58	69.85	Did not meet expectations	2.33
Overall	70.59	Did not meet expectations	4.38	70.78	Did not meet expectations	4.22

Table 1 manifests the pretest performance of the two groups of learners in four selected topics. As reflected, their pretest performance in four topics was failing or did not meet expectations. The present finding is in consonance with the results of Galia's study which also made use of experimental and control groups wherein the two appeared to be comparable as indicated in their respective pretest mean scores which feel under the verbal description, "did not meet expectations".

Table 2. *Posttest Performance of the Control and Experimental Groups in the Four Examinations*

Topic	Control Group			Experimental Group		
	Rating	VD	Sd	Rating	VD	sd
1. Identifying a Polynomial Function	79.25	Fairly Satisfactory	9.53	80.93	Satisfactory	9.67
2. Finding the Zeros of Polynomial Functions	77.38	Fairly Satisfactory	6.82	82.23	Satisfactory	7.04
3. Intercepts of the Polynomial Functions	77.55	Fairly Satisfactory	8.15	82.93	Satisfactory	8.10
4. Graph of the Polynomial Functions	76.63	Fairly Satisfactory	5.57	80.98	Satisfactory	5.64
Overall	77.70	Fairly Satisfactory	7.52	81.77	Satisfactory	7.61

Table 2 presents the posttest performance of the two groups of learners after the topics have been discussed using the Conventional Approach for the control group and Social-Interactive Constructivist Approach for the experimental group. As reflected, the posttest ratings of the control group increased and could be classified as “fairly satisfactory”. On the other hand, the posttest rating of the experimental group also had an improvement which was classified as “satisfactory”.

The data clearly indicate that the ratings of the two groups of learners have reached the 75% criteria of the Department of Education.

The posttest results in the study runs parallel with that of Galia (2016) wherein it was disclosed that the mean scores of the posttest performance of the control and experimental groups were classified as “Good” level for the former, and “Very Good” for the latter.

Table 3. Difference in Pretest and Posttest Performance of the Control Group

Topic	Pretest	Posttest	t-value	p-value	Decision	Remark
1. Identifying a Polynomial Function	70.60	79.25	6.048	0.000	Reject H ₀	Significant
2. Finding the Zeros of Polynomial Functions	70.40	77.38	6.982	0.000	Reject H ₀	Significant
3. Intercepts of the Polynomial Functions	72.65	77.55	4.891	0.000	Reject H ₀	Significant
4. Graph of the Polynomial Functions	68.70	76.63	11.547	0.000	Reject H ₀	Significant
Overall	70.59	77.70	13.218	0.000	Reject H₀	Significant

level of significance = 0.05

The data in Table 3 indicate that all the computed p-values are lesser than the level of significance which is set at 0.05. This finding leads to the rejection of the null hypothesis (H₀₁). This means that there is a significant difference in the pretest and posttest performance of the learners in favor of the latter results. This signifies that using the conventional approach of teaching, the learners learned the different topics in Polynomial Function. This finding is in line with the study of Schwerdt and Wuppermann (2011). They revealed that using the traditional lecture style of teaching yields significantly higher learner achievement.

Table 4. Difference in Pretest and Posttest Performance of the Experimental Group

Topic	Pretest	Posttest	t-value	p-value	Decision	Remark
1. Identifying a Polynomial Function	69.90	80.93	7.642	0.000	Reject H ₀	Significant
2. Finding the Zeros of Polynomial Functions	70.18	82.23	12.954	0.000	Reject H ₀	Significant
3. Intercepts of the Polynomial Functions	73.2	82.93	10.838	0.000	Reject H ₀	Significant
4. Graph of the Polynomial Functions	69.85	80.98	14.515	0.000	Reject H ₀	Significant
Overall	70.78	81.77	21.118	0.000	Reject H₀	Significant

level of significance = 0.05

The data in Table 4 indicate that all the p-values in the four examinations and overall rating are lesser than the level of significance (0.05). Hence, the null hypothesis (H_0) will be rejected. This signifies that a significant difference exists between the pretest and the posttest performance of the learners. This implies that using the Social- Interactive Constructivist Approach, resulted to a significant improvement in the students' knowledge of the concepts.

This findings conform to the study of Prideaux (2007) which stressed that active learning strategies in the classroom are truly effective and can improve learners' understanding of the subject matter.

Table 5. *Difference in the Posttest Performance of the Experimental and Control groups*

Topic	Control	Experi- mental	z-value	p-value	Decision	Remark
1. Identifying a Polynomial Function	79.25	80.93	0.7800	0.435	Do not reject H_0	Not significant
2. Finding the Zeros of Polynomial Functions	77.38	82.23	3.128	0.002	Reject H_0	Significant
3. Intercepts of the Polynomial Functions	77.55	82.93	2.956	0.003	Reject H_0	Significant
4. Graph of the Polynomial Functions	76.63	80.98	3.469	0.001	Reject H_0	Significant
Overall	77.70	81.77	4.724	0.000	Reject H_0	Significant

level of significance = 0.05

The data in Table 5 illustrate that in Topic. 1, the p-value is greater than the level of significance (0.05), which led to the acceptance of the null hypothesis. Nonetheless, all the p-values of the remaining topics are less than the level of significance (0.05). However, considering the fact that not all the results are significant, null hypothesis 3 cannot be categorically rejected. This finding signifies that there is a significant difference between the posttest performance of the control and experimental groups except for topic number 1. Since the experimental group in the 3 topics has higher performance than the control group, one can say that the use of Social Interactive - Constructivist Approaches is more effective than the conventional approach.

The findings in this study are in consonance with the results of Bimbola and Daniel (2010) that constructivist approach is better than the conventional (lecture) approach. Gurses et al. (2015) also agree with the results of this study when they said that the learners who are taught through the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) Approach have shown a way better performance than those instructed through traditional learning approach.

Andam et al. (2015) likewise revealed improvement on learners' skills when they employed constructivist approach in teaching during the intervention, for it stimulated learners' active participation in the teaching and learning process, thus created a collaborative learning environment.

IV. CONCLUSIONS

Based on the findings of this study, the following conclusions are hereby presented:

1. The pretest performance of the control and experimental groups does not meet the set standard of the expected target.
2. The posttest performance of the control and experimental groups meet the standards set, but the experimental groups attained higher mean score than the control group.
3. There is a significant difference between the pretest and posttest performance of the control group in all topics. The difference is attributed to the use of the conventional approach in teaching.
4. There is a significant difference between the pretest and posttest performance of the experimental group in all topics. The difference is due to the use of Social Interactive - Constructivist Approach in teaching.
5. There is a significant difference between the posttest performance of the control and experimental groups in favor of the latter.

In general, the use of Social Interactive – Constructivist Approach in teaching Mathematics enables the learners to understand better the concepts of Polynomials.

V. RECOMMENDATIONS

On the bases of the findings and conclusions presented, the following recommendations are hereby proposed:

1. Mathematics teachers are encouraged to use Social Interactive – Constructivist Approach in teaching Polynomials since it enhances learners' performance.
2. Future researchers may study other interactive and constructivist approach in teaching Mathematics that would suit the trends of the rapidly growing technology and that would meet the interests of the fast changing learning styles of the learners, e.g. use of interactive Mathematical apps/games, and etc.

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APPENDICES

Table 6 Distribution of Topics

	TOPIC	SOCIAL INTERACTIVE - CONSTRUCTIVIST APPROACH	EXPERIMENTAL	CONTROL
A p p e P R E E S A	Describing Polynomial Function	Group Work Approach	Makatao	Malikhain
	Zeros of Polynomial Functions	Inquiry Method and Think-Pair-Share	Malikhain	Makatao
	Intercept of a Polynomial Function	Activity Learning Method	Makatao	Malikhain
	Graph of a Polynomial Function	Jigsaw and Think-Pair-Share	Malikhain	Makatao

Describing of Polynomial Function

Directions: Multiple choice - Read and choose the best answer of the following items below.

1. What should n be if $f(x) = x^n$ defines a polynomial function?
 - A. an integer
 - B. a non-negative integer
 - C. any number
 - D. any number except 0
2. Which of the following is an example of a polynomial function?
 - A. $f(x) = \frac{4}{x^3} + 3x - 1$
 - B. $f(x) = 2x^2 - \frac{3}{2}x^2$
 - C. $f(x) = \sqrt{7}x - 2x^6$
 - D. $f(x) = x^3 + \sqrt{3}x - 5$
3. What is the leading coefficient of the polynomial function $f(x) = 2x + x^3 + 4$?
 - A. 1
 - B. 2
 - C. 3
 - D. 4
4. How should the polynomial function $f(x) = 2x + x^3 + 3x^5 + 4$ be written in standard form?
 - A. $f(x) = x^3 + 2x + 3x^5 + 4$
 - B. $f(x) = 4 + 3x^5 + 2x + x^3$
 - C. $f(x) = 4 + 2x + x^3 + 3x^5$
 - D. $f(x) = 3x^5 + x^3 + 2x + 4$

5. What is the degree of the polynomial function $y = x(x^2 - 7)$?
 - A. 1
 - B. 2
 - C. 3
 - D. 0
6. Write the polynomial function $y = x(x^2 - 5)$ in Standard Form.
 - A. $x^2 - 5$
 - B. $x^3 - 5x$
 - C. $x^2 - 5x$
 - D. $x^2 - x - 5$
7. Give the constant of the given polynomial function $y = (x + 5)(x + 1)(x - 1)^2$.
 - A. 1
 - B. 2
 - C. 4
 - D. 5
8. How many turning point is the polynomial function $y = x^4 - 7x^2 + 6x$?
 - A. 4
 - B. 3
 - C. 2
 - D. 1
9. Give the degree of the given polynomial function $f(x) = x + 2x^2 + 3x^3 + 6$?
 - A. 0
 - B. 1
 - C. 2
 - D. 3
10. What is the degree of the given polynomial function $f(x) = -x(x - 3)(x + 3)$?
 - A. 1
 - B. 2
 - C. 3
 - D. 4
11. Transform the given polynomial function $f(x) = (2x + 3)(x - 1)(x - 4)$ into standard form.
 - A. $2x^3 + 7x^2 - 7x + 2$
 - B. $7x^2 + 2x^3 + 2 - 7x$
 - C. $2x^3 - 7x^2 - 7x + 12$
 - D. $7x^2 - 2x^3 - 2 + 7x$
12. What is the leading coefficient of the polynomial $f(x) = (x + 4)(x + 1)(x - 1)^2$.
 - A. 1
 - B. 2
 - C. 3
 - D. 4

B. ZERO OF A POLYNOMIAL FUNCTION

Directions: Multiple choice - Read and choose the best answer of the following items below.

1. Find the zeros of $P(x) = (x - 3)(x + 2)(x - 1)(x + 1)$.
 - A. -2, -1, 1, 3
 - B. -1, 1, 2, 3
 - C. -2, 1, -1, -3
 - D. 0, -2, -1, 1, 3
2. Find the zeros of $P(x) = (x + 3)^3(x^2 - 25)$.
 - A. -5, 5, -3 (3 times)
 - B. -5, 5, -3 (2 times)
 - C. -5, -5, 3 (3 times)
 - D. -5, 5, 3 (2 times)
3. Solve for the other zero of $P(x) = x^3 + 8x^2 + 19x + 12$ given that one zero is -3.
 - A. -1, 4
 - B. 1, 4
 - C. -1, -4
 - D. -3, 4
4. Which of the following are the zeros of the polynomial function; $f(x) = (x - 1)(x^2 - 5x + 6)$?
 - A. 1, 2, 3
 - B. -1, -2, -3
 - C. -1, 2, -3
 - D. 1, -2, 3
5. Solve the zeros of the functions $f(x) = (x + 4)(x^2 - 25)$.
 - A. 4, 5, -5
 - B. -4, -5, -5
 - C. -5, 4, 0
 - D. -5, -4, 5
6. Give the zeros of the polynomial function $h(x) = (2x + 1)(x - 3)(4x + 3)(x - 1)$.
 - A. $-\frac{3}{4}, -\frac{1}{2}, 3, 1$
 - B. $-1, 3, -3, 1$
 - C. $\frac{1}{2}, -3, -\frac{3}{4}, 1$
 - D. $2, 3, \frac{4}{3}, -1$
7. If one zero of the function is 2, find the remaining zeros of the polynomial function; $P(x) = x^3 - 7x + 6$.
 - A. -3, 1
 - B. -3, -1
 - C. 3, 6

- D. 3,-6
8. Identify the zeros of $P(x) = (x + 1)(x - 2)(x + 2)$.
- 2, -1, 1
 - 1, -2, 2
 - 1, -2, -2
 - 1, -2, -2
9. How many zeros in the given polynomial functions $f(x) = x^4 - 5x - 14$?
- 1
 - 2
 - 3
 - 4
10. Find all the zeros of the polynomial function $P(x) = x^4 - 3x^3 - 5x^2 + 3x + 4$.
- 1, -4, 1 (2 times)
 - 1, -4, 1
 - 1, 4, -1, (2 times)
 - 1, 4, -1
11. Which of the choices below has (-2, -1, 3) zeros of the polynomial function.
- $f(x) = x^3 - 6x^2 - 7x - 6$
 - $f(x) = x^3 - 7x - 6$
 - $f(x) = x^3 - 7x + 6$
 - $f(x) = x^3 + 6x^2 - 7x - 6$
12. Given the polynomial function $f(x) = -x(x + 2)(x + 4)$, which of the following are the zeros of the function?
- 1, -2, -4
 - 4, 0, 2
 - 0, -2, 4
 - 4, -2, 0

C. INTERCEPTS OF A POLYNOMIAL FUNCTION

Directions: Multiple choice - Read and choose the best answer of the following items below.

- Find the x-intercept of the polynomial function $f(x) = (x + 5)(x - 3)(x + 4)$.
 - 5, -4, 3
 - 5, -4, 3
 - 5, 4, 3
 - 5, -4, -3
- Find the y-intercept of the polynomial function $f(x) = (x + 5)(x - 3)(x + 4)$.
 - 60
 - 60
 - 12
 - 12
- Find the x-intercept of the polynomial function $f(x) = x^2 - 5x + 6$.
 - 3, 2
 - 3, -2

- C. 6, 1
D. -6, -1
4. Find the y-intercept of the polynomial function $f(x) = x^2 - 5x + 6$.
A. 6
B. -6
C. 5
D. -5
 5. Find the x-intercept of the polynomial function $y = x^2(x + 3)(x + 2)(x - 2)(x - 3)$.
A. -3, -2, 0, 2, 3
B. -3, -2, 0, -2, -3
C. 3, 2, 0, 2, 3
D. -3, 2, 2, 3
 6. Determine the y-intercept of $y = x^2(x + 3)(x - 2)(x + 2)(x - 3)$.
A. **0**
B. -1
C. **36**
D. -36
 7. Find the x-intercept of the polynomial function $y = x^4 + 6x^3 - x^2 - 6x$.
A. 1
B. 0
C. -6
D. -1
 8. Find the y-intercept of the polynomial function $y = (x^2 - 5x + 6)(x - 1)(x + 3)$.
A. -18
B. 18
C. -6
D. 3
 9. Find the x-intercept of the polynomial function $y = -x^2 + 25$.
A. 25, -25
B. 1, -1
C. 5, -5
D. 10, -10
 10. Find the y-intercept of the polynomial function $y = 2x^4 + 8x^3 + 4x^2 - 8x - 6$.
A. -6
B. 6
C. 2
D. -2
 11. Find the x-intercept of the polynomial function $f(x) = (x + 4)(x + 2)(x - 1)$.
A. 4,2,1
B. -2,-2,-1
C. -4,-2,1
D. 3,-4,-2
 12. Find the y-intercept of the polynomial function:

$$y = -(x + 5)(2x + 3)(x - 1)(x - 2).$$

- A. 5
- B. 3
- C. -2
- D. 30

D. GRAPH OF A POLYNOMIAL FUNCTION

Directions: Multiple choice - Read and choose the best answer of the following items below.

1. Determine the zeros of the polynomial and their multiplicity of

$$y = x(x + 3)(x + 1)^4(x - 1)^3.$$

- A. 0, -3, -1 multiplicity of 4 and 1 multiplicity 3
- B. 0, 3, 1 multiplicity of 4 and 1 multiplicity 2
- C. 0, -3, 1 multiplicity of 3 and -1 multiplicity 3
- D. 0, -3, -1 multiplicity of 3 and 1 multiplicity 4

2. Determine the y-intercept of the polynomial function

$$y = x(x + 3)(x + 1)^4(x - 1)^3.$$

- A. 1
- B. -1
- C. 3
- D. -3

3. Determine the behavior of the graph of the polynomial

$$y = 3x^3 - 7x^2 + 5x + 3.$$

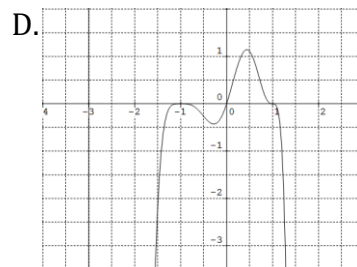
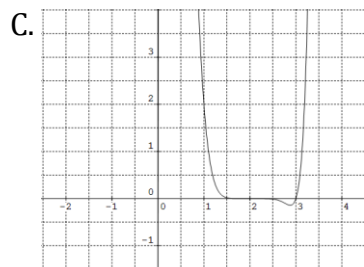
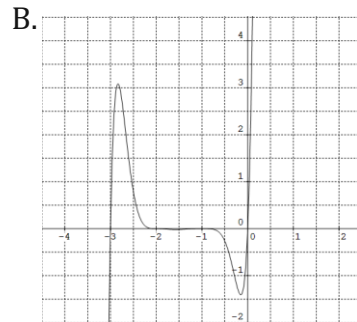
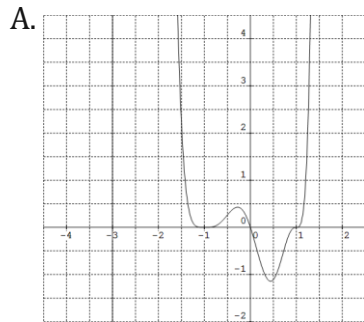
- A. left-hand rising, right-hand falling
- B. left-hand falling, right-hand falling
- C. left-hand falling, right-hand rising
- D. left-hand rising, right-hand rising

4. Identify the leading coefficient polynomial function

$$y = x(x + 3)(x + 1)^4(x - 1)^3$$

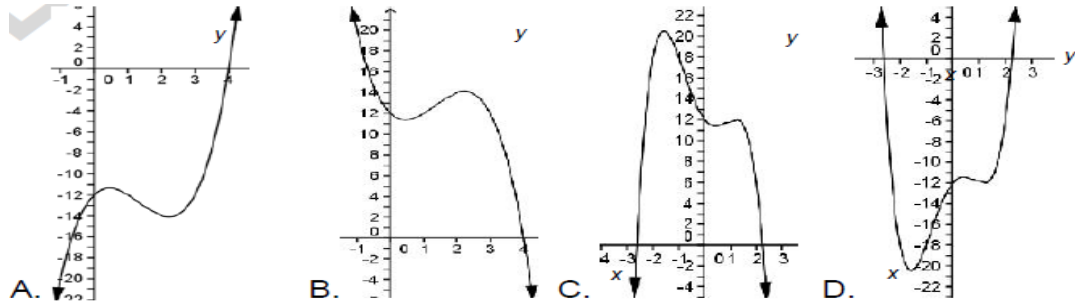
- A. 0
- B. 1
- C. -1
- D. 3

5. Sketch the graph of the polynomial function $f(x) = x(x + 3)(x + 1)^4(x - 1)^3$.

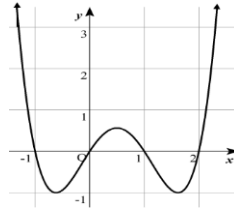


6. How will the graph of $y = x(x + 2)^2$ be drawn with respect to the x-axis?
 A. Sketch it crossing both $(-2, 0)$ and $(0, 0)$.
 B. Sketch it crossing $(-2, 0)$ and tangent at $(0, 0)$.
 C. Sketch it tangent at $(-2, 0)$ and crossing $(0, 0)$.
 D. Sketch it tangent at both $(-2, 0)$ and $(0, 0)$.

7. Which of the following could be the graph of the polynomial function $y = x^3 - 4x^2 + 3x - 12$?



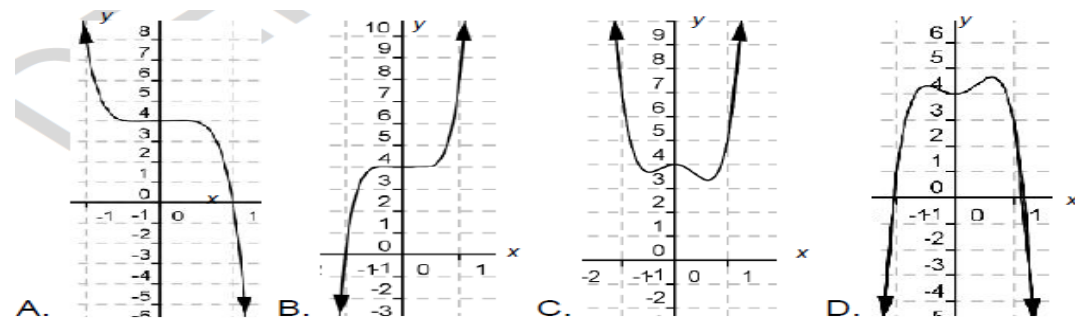
8. From the choices, which polynomial function in factored form represents the given graph?
 A. $y = (x + 2)(x + 1)(x - 1)$
 B. $y = (x + 1)(x - 1)(x - 2)$
 C. $y = x(x + 2)(x + 1)(x - 1)$
 D. $y = x(x + 1)(x - 1)(x - 2)$



9. What are the end behaviors of the graph of $y = -2x + x^3 + 3x^5 - 4$?

- A. rises to the left and falls to the right
 B. falls to the left and rises to the right
 C. rises to both directions
 D. falls to both directions

10. You are asked to illustrate the sketch of $f(x) = x^3 - 3x^5 + 4$ using its properties. Which was your sketch?

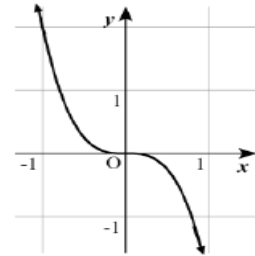


11. Your classmate Linus encounters difficulties in showing a sketch of the graph of $y = 2x^3 + 3x^2 + 4x - 6$. You knew that the quickest technique is the Leading Coefficient Test. What hint/clue would you give Linus to help him with his problem?

- A. The graph falls to the left and rises to the right
 B. The graph rises to both left and right.
 C. The graph rises to the left and falls to the right.
 D. The graph falls to both left and right.

12. If you was asked to choose from -2, 2, 3, and 4, what values for a and n will you consider so that $y = ax^n$ could define the graph below?

- A. $a = 2, n = 3$
- B. $a = 3, n = 2$
- C. $a = -2, n = 4$
- D. $a = -2, n = 3$



Lesson Plan Using Social Interactive – Constructivist Approach

Group Work Approach

I. Objectives:

- Identify a polynomial function.
- Write a polynomial function in standard form.
- Relate polynomial functions in real life situations.

II. Subject Matter:

- Topic: Describing Polynomial Functions
- Reference: LM Math Grade 10 (pp. 106 – 107)
- Materials: Visual Aids, Power Point Presentation, Flash Cards, Felt-tip pen.

III. Procedure:

A. Preparation

- a. Prayer, Checking of Attendance/Checking of Assignment
- b. PRETEST (Refer to Appendix F)
- c. Review/Motivation

- * Brainstorming: (5 Minutes - Somebody in the class will give polynomial expressions and write these on the chalkboard).
- * Aims of the activity: To activate prior knowledge of the learners involving polynomial expressions.

B. Presentation - *Group Activity*

Aims of group Activity

1. To develop active participation of learners in the class.
2. To allow learners gain advance knowledge in the topic base on the given task.
3. To build up self-confidence, creative and critical thinking among learners.
4. Learners themselves will discover the abstract topic through the activity and are able to discuss it in front of the class.

Activity task

1. The teacher will divide the class into five groups and will give those flash cards containing a polynomial function. Each group will answer an item from the table reflected below with respect to their group number.
2. Each group is given 5 minutes to complete the table provided in the task card assigned to them.

- After posting task cards on the board, the teacher will give each group two minutes to discuss their work activity provided with his/her guide questions.

Polynomial Function	Polynomial Function in Standard Form	Degree	Leading Coefficient	Constant Term	No. of Zeros
1. $f(x) = 2 - 11x + 2x^2$					
2. $f(x) = \frac{2x^3}{3} + \frac{5}{3}11x$					
3. $y = x(x^2 - 5)$					
4. $y = x(x + 3)(x - 3)$					
5. $y = (x + 5)(x + 1)(x - 1)^2$					

Discussion:

Teachers' guide questions:

- What have you noticed in your activity?
- Did you find any difficulty in doing the task assigned to you?
- How did you arrive at your answers?
- How do you define a polynomial function?

Definition

Polynomial Function -A polynomial function is a function of the form

$P(x) = a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \dots + a_1x + a_0, a_n \neq 0$, where n is a nonnegative integer, a_0, a_1, \dots, a_n are real numbers called coefficients, a_nx^n is *leading term*, a_n is the leading coefficient, and a_0 is the constant term. The terms of a polynomial may be written in any order. However, if they are written in decreasing powers of x , we say the polynomial function is in standard form.

C. Practice-Individual Activity: Complete the table below.

Polynomial Function	Polynomial Function in Standard Form	Degree	Leading Coefficient	Constant Term	No. of Zeros
1. $f(x) = 4 + 2x + 6x^2$					
2. $f(x) = x(x^2 + 6)$					
3. $y = -x(x - 2)(x + 2)$					
4. $y = 2x + 3x^4 + 2x^2 - x^3 + 2$					

Ask:

- How do you write a polynomial function in standard form?
- What is the relationship of the number of zeros of the polynomial functions to its degree?

3. *How important polynomial function in our life? (Show a video clip)*

D. Assessment - Posttest: Refer to Appendix G.

E. Assignment - Factor the following polynomial functions.

1. $x^2 - 7x + 10$

3. $x^2 - 100$

2. $x^2 + x - 6$

4. $x^3 + 3x^2 - 4x - 12$

Steps in Group Work Method of Teaching

1. Set clear expectations for group work.

Learners should be introduced to practices such as developing ground rules (relating to personal and professional conduct), which outline the expectations for participation of group members and consider mechanisms/roles that strengthen effective work management.

2. Think carefully about group size and composition.

The optimal group size is cited as been between four and six people, as this allows learners to develop a sense of identity and ownership (Kerr & Bruun, 1983).

3. Help manage the logistics of group work.

Tutors should consider how they can mitigate issues relating to communication, meeting up and accessing resources as they plan group work and introduce management strategies to learners.

4. Encourage intercultural group work.

When introducing group work, tutors should explain the importance of cross-cultural collaboration (Wisker, 2000).

5. Design innovative group work activities.

Group work activities should be sufficient in size and complexity to require the collective knowledge and effort of all group members (Gibbs, 1995).

6. Monitor the groups' activities.

This can make learners aware of whose responsibility managing group work is and encourage them to consider explicitly how to manage group work, and for the tutor it can provide evidence of the group's activities.

7. Manage assessed group work.

This reflects the complexity of assessing group work; tutors need to consider whether they are assessing the product of group work, the process that has led to this product or both the product and the process (Gibbs, 2010).

Think – Pair – Share

I. Objectives:

- Determine a polynomial function in factored form.
- Solve the zeros of a polynomial function.
- Share knowledge in solving real world problems involving zeros of polynomial functions.

II. Subject Matter:

- Topic: Zeros of a Polynomial Function
- Reference: Advanced Algebra Trigonometry and Statistics (pp. 100 - 102)
- Materials: Visual Aids, Power Point Presentation, Chalk

III. Procedure:

A. Preparation

- a. Prayer, Checking of Attendance/Checking of Assignment
- b. PRETEST (Refer to Appendix F)
- c. Review/Motivation

Think-Pair-Share - Preparatory Activity.

Supply the missing term to make the statement true. (The Teacher will flash the following expressions below using the projector one at a time.)

1. $m^2 + 12m + 36 = (m + \underline{\quad})^2$
2. $x^2 - 5x + 6 = (x - 3)(x + \underline{\quad})$
3. $x^3 - 8 = (x - 2)(x^2 + \underline{\quad} + 4)^2$
4. $(n + 4)(x - 5) = (n^2 - n + \underline{\quad})$

(2 Minutes to think, then, look for a pair and compare/discuss your answer with your partner, then show your answer to the teacher.)

Ask:

1. Did you find any difficulty in doing the task assigned to you?
2. How did you find the missing term on the following expressions?
3. How do you describe the relationship between the expressions from left to right side of the equation?

 B. Presentation - *Inquiry Learning Method*

Aims of Inquiry Learning Method

1. To develop learners higher-order thinking skills.
2. To arouse learners' interest and elicit participation in the learning process.
3. To build initiative and self-directions.
4. To accommodate the diverse learning styles of the learners.

(Group the learners into 5 groups. Afterwards, the teacher will project the problem on the screen. Let the learners collaborate with their group mates in 10 minutes to solve the problem with the guide questions provided by the teacher.)

Problem: Find all zeros of $f(x) = x^5 - 10x^4 - 20x^2 - 15x - 4$:

- (A) 1,-1,-1,-1, (B) -1,-1, 4 (D) -1,-1,-1,-1, 4
 4 (C) -1,-1,-1

Guide Questions:

1. How many zeros does the given polynomial function have?
2. What are the processes in finding the zeros of a polynomial function in standard form?
3. How will you write the polynomial function in factored form?
4. What will the values be when you equate the factors to zero?
5. Which of the choices above are the zeros of the given polynomial function?

(After 10 minutes, the learners will post their work on the board. The teacher may choose someone to explain their work.)

Discussion:

Ask:

1. What do you think our lesson is all about?
2. Did you find any difficulties in transforming standard form of polynomial function into factored form?
3. What method did you use in finding the zeros of the polynomial function?
4. What is the process in finding the zeros of the polynomial functions in standard and also in factored form?

Generalization

Remember: A zero of a polynomial function $f(x)$ is a value of the variable x , which makes the polynomial function equal to zero or $f(x) = 0$.

Process in finding the zeros of a polynomial function.

a. Change the function in factored form, using:

- a.1) synthetic division;*
- a.2) quadratic formula;*
- a.3) factoring*

b. Equate all factors to zero.

(Illustrative example was shown by the teacher)

C. Practice

Try this with your group mates! Give the zeros of the polynomial function.

1. $f(x) = (2x + 4)(x - 2)(x + 3)$
2. $f(x) = x^3 - 2x^2 - 4x + 8$
3. $h(x) = (x + 2)^3(x - 29)$
4. $g(x) = (x - 3)(x^2 - 169)$

Ask:

1. How do you transform a polynomial function in standard form into factored form?
2. What is the significance of synthetic division in transforming polynomial function in standard form to factored form?

3. *What is the importance of finding the zeros of a polynomial function in relation to daily life situation? (Show a video clip)*

D. Assessment - Posttest: Refer to Appendix G.

E. Assignment - Write your answer in your activity notebook.

1. Find the zeros of the polynomial function $y = (x - 1)^4(x^2 - 7x + 12)$.

2. Solve for other zeros of $p(x) = x^3 - 2x^2 - 4x + 8$ given that one zero is 2.

Steps in Think-Pair-Share Method of Teaching

1. Let your learners know that you are using the technique and provide them with instructions.
2. Plan the activity in advance of the lecture.
3. Pose a challenging question around a topic or concept that you know learners find difficult.
4. Think: Begin by asking a question about a topic or concept and allow learners to think individually about their answer (1-3 minutes.)
5. Pair: Each learner is paired with another (if uneven numbers, allow 3). To discuss their answers (2-5 minutes).
6. Share: Expand the discussion to the whole class by calling upon learners to discuss their proposed solutions and any difficulties they had. You can call upon learners randomly or have volunteers discuss their thoughts.
7. Provide feedback to learners by using this opportunity to correct misconceptions and reinforce correct answers.

Steps in Inquiry Learning Method of Teaching

1. Present discrepant event or specific problematic situation.
2. Encourage observation for developing a statement of research objectives.
3. Ask learners for observation and explanation.
4. Encourage the testing of the hypothesis.
5. Develop tentative conclusions and generalization.
6. Debrief the process.

Activity Learning Approach

I. Objectives:

Recall the relationship between factors and x-intercepts.

Determine the intercepts of a polynomial function.

Appreciate the importance of x and y intercept in relation to real world problems.

II. Subject Matter:

Topic: Intercepts of a Polynomial Function

Reference: LM Math Grade10 (pp. 109 - 111)

Materials: Felt-tip pen, Visual Aids, Power Point Presentation, Flashcards

III. Procedure:

A. Preparation

- a. Prayer, Checking of Attendance/Checking of Assignment
- b. PRETEST (Refer to Appendix F)
- c. Review/Motivation

Preparatory Activity – Flash Cards

X-Factor Game: The class was divided into 5 groups. Each group will compete for a pad of paper. The group with most number of items answered correctly within 1 minute time allotted will win the prize.

Aims of the activity:

1. To develop learners' speed and accuracy.
2. To arouse learners' alertness and focus on class knowledge.
3. To enhance teamwork and unity in solving problems.
4. To increase the level learning and retention.

Problems:

- A. Give the zeros of $y = (x + 3)^3$
- B. What is the constant of the function $f(x) = 3x^3 + 2x^2 + 3x - 10$?
- C. Factor $x^2 - 8x + 16$
- D. What is the value of x in $(2x+3)$?
- E. Find the zeros of $(x+2)$ $(x-3)$ $(2x+1)$.
- F. Factor $x^2 - 100$
- G. Give the constant of the $y = 2x^4 + 3x^3 - 4x^2 + 2x$
- H. What is the value of x in $x^2 + 7x + 10$?

Ask:

1. What strategy and techniques did you apply during the contest?
2. What moral values have you learned from the activity?

B. Presentation - Activity Learning Method

Aims of Activity Learning Method

1. It enhances creative aspect of experience.
2. It gives reality for learning.
3. It provides varied experiences to the learners to facilitate the acquisition of knowledge, experience, skills, and value.
4. It builds the learners' self-confidence and develops understanding through work in his/her group.
5. It develops happy relationship between learners and learners, teacher and learners.

Activity 1: Individual

Finding “WHY”!

Direction: Substitute 0 to the value of “X” in the given equations below. Write this activity in your activity notebook. (5 Minutes only)

1. $y = x^2 - 8x + 16$

2. $y = x^5 + 3x^4 - 5x^2 + 5x$

3. $y = (2x^2 - 8x + 3)(x - 3)$

4. $y = (x - 3)(x + 1)(x - 2)$

Ask:

1. *How did you find the activity?*
2. *How would you describe the value of y when x is zero?*
3. *What can you conclude about the value of y?*

(Note: The teacher will elaborate more about the y value.)

Activity 2: Group Activity

Remembering your “EX” and determining “WHY”!

Direction: Using the same grouping, in the X-Factor game; find the zeros of the following equations and determine the value of y. (10 minutes only)

1. $y = 2x^3 - 7x^2 - 7x + 12$

2. $y = x^5 + 10x^3 - 9x$

3. $y = (x^2 + 7x + 10)(x^2 - 4x + 4)$

4. $y = (x - 7)(2x + 1)(x - 2)(x - 1)$

Ask:

1. *Do you find any difficulty in doing the activity?*
2. *How did you find the values of x and y?*
3. *What can you conclude about value of y?*

Discussion: Guide Questions

1. *What do you think our lesson is all about?*
2. *Did you find any difficulties in doing the activities?*
3. *What method did you use in finding the values of x and value of y?*
4. *How would you relate the values of x to the zeros of the polynomial; and the value of y to the constant of the polynomial function?*

Generalization

Remember: The previous activities were very important for you since they had something to do with the x-intercept of a graph. These are the x-values when $y = 0$, thus, the point(s) where the graph intersects the x-axis can be determined.

(The teacher will show an illustrative example. Refer to LM-10, pp. 109)

C. Practice

Try this with your group mates! Determine the intercept of the graphs of the following polynomial functions. Explain your answer.

1. $y = 2x^4 + 8x^3 + 4x^2 - 8x - 6$

2. $y = x^2(x - 2)(x + 2)(x + 3)(x - 3)$

Ask:

1. Are there any difficulties in getting the intercepts of the polynomial functions?
2. What is the significance of synthetic division in transforming polynomial function in standard form to factored form?
3. What is the importance of finding the intercepts of polynomial function in relation to daily life situation? (Show a video clip)

D. Assessment - Posttest: Refer to Appendix G.

E. Assignment - Bring graphing paper on the next meeting.

Steps in Activity Learning Method Teaching

1. Planning
2. Involving learners in the learning process
3. Making each learner an active learner.
4. For each activity, be sure you follow the principles of:
 - What?
 - How?
 - Work directions step by step, including; when, where, how long, what after?
5. Make sure you give clear instruction before each activity. It must focus on the above 1- 4.
 - Jigsaw and Think-Pair-Share

I. Objectives:

- Identify the intercepts of a polynomial function.
- Sketch the graph of a polynomial function.
- Relate the behavior of the graph of a polynomial function to real life situations.

II. Subject Matter:

- Topic: Graph of a Polynomial Function
- Reference: LM Math Grade10 (pp. 116 - 119)
- Materials: Felt-tip pen, Visual Aids, Power Point Presentation

III. Procedure:

A. Preparation

- a. Prayer, Checking of Attendance/Checking of Assignment
- b. PRETEST (Refer to Appendix F)
- c. Review/Motivation

Preparatory Activity – Group Work Activity (10 minutes only)

Aims of the activity:

1. To develop learners' speed and accuracy.
2. To arouse learners' alertness and focus on class knowledge.
3. To enhance teamwork and unity in solving problems.
4. To increase the level learning and retention.

What is the destiny of my behavior? In this activity, the class was divided into 5 groups. Each group will have an activity sheet that contains the steps of the activity.

Instructions: Given the polynomial function $y = (x + 4)(x + 2)(x - 1)(x - 3)$, complete the table below. Answer the questions that follow.

Value of x	Value of y	Relation of y value to 0: $y > 0$, $y = 0$, or $y < 0$?	Location of the point (x, y): Above the x-axis, on the x-axis, or below the x-axis?
-5	144	$y > 0$	above the x-axis
-4			
-3			
-2	0	$y = 0$	on the x-axis
0			
1			
2			
3			
4			

Questions:

1. At what point(s) does the graph pass through the x-axis?
2. If $x < -4$, what can you say about the graph?
3. If $-4 < x < -2$, what can you say about the graph?
4. If $-2 < x < 1$, what can you say about the graph?
5. If $1 < x < 3$, what can you say about the graph?
6. If $x > 3$, what can you say about the graph?

B. Presentation - *Think-Pair-Share*

Activity 1: Refer to Math LM-10, pp. 116-117. Case 1 – 4. The teacher will flash the polynomial function and its actual graph using a projector. The teacher then will ask the following questions in each case:

- a. Is the leading coefficient a positive or a negative number?
- b. Is the polynomial of even degree or odd degree?
- c. Observe the end behaviors of the graph on both sides. Is it rising or falling to the left or to the right?

The teacher then will summarize the activity by asking the following questions:

Based on your findings from the four cases above, what do you observe if:

- ✓ the degree of the polynomial is odd and the leading coefficient is positive?
- ✓ the degree of the polynomial is odd and the leading coefficient is negative?
- ✓ the degree of the polynomial is even and the leading coefficient is positive?
- ✓ the degree of the polynomial is even and the leading coefficient is negative?

Jigsaw Method

Aims of Jigsaw Method

1. It enhances creative aspect of experience.
2. It gives reality for learning.
3. It provides varied experiences to the learners to facilitate the acquisition of knowledge, experience, skills, and value.
4. It builds the learners' self-confidence and develops understanding through work in his/her group.
5. It develops happy relationship between learners and learners, teacher and learners.

C. Practice - *Activity 2*: It's your turn, show me.

The class shall be divided into groups of 5. Each of the group will have been given a task taken from the lesson of the day.

Instructions: In sketching the graph of the given polynomial functions, the following steps are needed. The discussion of the steps flows as seen below:

- a. leading term - was discussed by group 1
- b. end behavior - was discussed by group 2
- c. x-intercepts points on the x-axis - was discussed by group 3
- d. multiplicity of roots - was discussed by group 4
- e. y-intercept point on the y-axis - was discussed by group 5
- f. number of turning points - was discussed by group 6
- g. sketch - was discussed by group 7

Lastly, group 8 will do the recap of the whole discussions.

- i. $y = -(x + 3)(x + 1)^2(2x - 5)$
- ii. $y = (x^2 - 5)(x - 1)^2(x - 2)^3$
- iii. $y = -x^3 + 2x^2 - 2x + 4$
- iv. $y = x^2(x^2 - 7)(2x + 3)$
- v. $y = 2x^4 - 3x^3 - 18x^2 + 6x + 28$

Discussion: *Guide Questions*:

1. *How did you find the activity?*
2. *Were you able to apply all the necessary concepts and properties in graphing each function?*

Generalization

Remember: The process in sketching the graph of a polynomial function follows simple steps stated above.

(The teacher will show a video clip on the process of sketching the graph.)

Ask:

1. Are there any difficulties in sketching the graph of the polynomial functions?
2. What is the significance of identifying the leading coefficient and its degree in determining the end behavior of the graph?
3. What is the importance of determining the end behavior of the graph in real life situations?

D. Assessment - Posttest: Refer to Appendix G.

E. Assignment - Study for the summative test examination.

Steps in Jigsaw Method of Teaching

1. Divide the learners into 5 or 6 person jigsaw groups. The group should be diverse in terms of gender, ethnicity, race and ability.
2. Appoint one learner from each group as a leader. Initially, this person should be the most mature learner in the group.
3. Divide the day's lesson into 5-6 segments.
4. Assign each learner to learn one segment.
5. Give learners time to read over their segment at least twice and become familiar with it. There is no need for them to memorize it.
6. Form temporary "expert groups" by having one learner from each jigsaw group join other learners assigned to the same segment. Give learners in these expert groups time to discuss the main points of their segment and to rehearse the presentations they will make their jigsaw group.
7. Bring the learners back into their jigsaw groups.
8. Ask each learner to present her or his segment to the group. Encourage others in the group to ask questions for clarification.
9. Float from group to group, observing the process. If any group is having trouble, make an appropriate intervention. Eventually, it's best for the group leader to handle this task. Leaders can be trained by whispering an instruction on how to intervene, until the leader gets the hang of it.

10. At the end of the session, give a quiz on the material. Learners quickly come to realize that this session is not just fun and games but it really counts.

POSTTEST

A. Describing of Polynomial Function

Directions: Multiple choice - Read and choose the best answer of the following items below.

- How should the polynomial function $f(x) = 4x^2 + x^3 + 3x^5 + 2$ be written in standard form?
 - $f(x) = 3x^5 + 4x^2 + x^2 + 2$
 - $f(x) = 4x^2 + 3x^5 + 2 + x^3$
 - $f(x) = 3x^5 + x^3 + 4x^2 + 2$
 - $f(x) = 4x^2 + x^3 + 3x^5 + 2$
- Which of the following is an example of a polynomial function?
 - $f(x) = 4x^3 + 3x^2 + 2x - 1$
 - $f(x) = \frac{4}{x^3} + \frac{3}{x^2} + \frac{2}{x} - 1$
 - $f(x) = \sqrt{2}x - 2x^5 + 3x + 2$
 - $f(x) = 5x^{-2} - 4x^2 + 3x + 2$
- What is the degree of the polynomial function $y = x(x^2 - 5)$?
 - 0
 - 1
 - 2
 - 3
- How many turning points has the polynomial function $y = x^4 + 5x^3 + 3$?
 - 4
 - 3
 - 2
 - 1
- What is the leading coefficient of the polynomial function $f(x) = 2x^2 - 3x + 4x^3 + 7$?
 - 7
 - 4
 - 3
 - 2
- Transform the given polynomial function $f(x) = (3x - 1)(x + 1)(x - 2)$ into standard form.
 - $f(x) = 3x^3 + 4x^2 - 5x + 2$
 - $f(x) = -3x^3 - 4x^2 - 5x - 2$
 - $f(x) = -3x^3 + 4x^2 + 5x - 2$
 - $f(x) = 3x^3 - 4x^2 - 5x + 7$

7. What is the leading coefficient of the polynomial $y = (x - 4)^2(x + 2)(x - 3)$.
 - A. 1
 - B. 2
 - C. 3
 - D. 4
8. Give the constant of the given polynomial function $y = (x + 3)(x + 1)^2(x - 1)$.
 - A. 1
 - B. -1
 - C. 3
 - D. -3
9. Write the polynomial function $f(x) = x(x^2 - 3)$ in Standard Form.
 - A. $x^2 - 3$
 - B. $x^3 - 3x$
 - C. $x^3 + 3x$
 - D. $x^3 + 3$
10. What should n be if $f(x) = x^n$ defines a polynomial function?
 - A. any number
 - B. an integer
 - C. any number except 0
 - D. a non-negative integer
11. Give the degree of the given polynomial function $f(x) = 6 + 2x^3 + x - 3x^2$?
 - A. 0
 - B. 1
 - C. 2
 - D. 3
12. What is the degree of the given polynomial function $f(x) = -x(x + 5)(x - 7)$?
 - A. 1
 - B. 3
 - C. 5
 - D. 7

B. ZERO OF A POLYNOMIAL FUNCTION

Directions: Multiple choice - Read and choose the best answer of the following items below.

1. Find the zeros of $P(x) = (x + 5)(x - 7)(x + 7)$.
 - A. 5, 7, 7
 - B. -5, 7, 7
 - C. -5, -7, 7
 - D. -5, -7, -7
2. Which of the following are the zeros of the polynomial function; $f(x) = (x - 2)(x^2 - 7x + 10)$?
 - A. 2, -2, -5
 - B. 0, 2, -5
 - C. -2, 2, 5
 - D. 0, 2, -5

3. How many zeros are in the given polynomial functions
 $f(x) = x^5 - 2x^4 + 2x^2 - 7x + 9$?
- 1
 - 2
 - 3
 - 5
4. Find the zeros of $P(x) = (x - 4)(x + 3)(x - 2)(x + 2)$.
- 3, -2, 2, 4
 - 3, 2, 4,
 - 3, -2, -4
 - 3, -2, 0, 4
5. Which of the choices below has $(-2, 1, 3)$ zeros of the polynomial function.
- $f(x) = x^3 - 2x^2 - 5x + 6$
 - $f(x) = x^3 + 2x^2 - 5x + 6$
 - $f(x) = x^3 + 2x^2 + 5x - 6$
 - $f(x) = x^3 - 2x^2 - 5x - 6$
6. Find all the zeros of the polynomial function $P(x) = x^4 - 2x^3 - 7x^2 + 8x + 12$.
- 2, -1, 2, -3
 - 2, -1, 2, 3
 - 2, -1, -2, -3
 - 2, 1, 2, 3
7. Identify the zeros of $h(x) = (x + 5)^3(x^2 - 16)$.
- 5 (3 times), -4, 4
 - 5 (3 times), -4, 4
 - 4, 4, 5
 - 4, 4, -5
8. Solve for the other zeros of $P(x) = x^3 - 5x^2 + 2x + 8$ given that one zero is -1.
- 2, 4
 - 2, -4
 - 1, -4
 - 2, -4
9. Give the zeros of the polynomial function;
 $h(x) = (x + 3)(2x - 1)(x + 4)(5x + 3)(x - 1)$.
- 4, -3, $\frac{3}{5}$, $\frac{1}{2}$, 1
 - 4, -3, $-\frac{3}{5}$, $\frac{1}{2}$, 1
 - 4, 3, $-\frac{3}{5}$, $\frac{1}{2}$, 1
 - 4, -3, $-\frac{3}{5}$, $-\frac{1}{2}$, -1
10. Solve the zeros of the functions $f(x) = (x + 2)(x^2 - 81)$.
- 9, -2, 9
 - 1, 2, 9
 - 2, -9, 1
 - 9, -9, -2

11. Given the polynomial function $f(x) = -x(x + 3)(x + 5)$, which of the following are the zeros of the function?
- 5, 0, 3
 - 5, 0, -3
 - 5, -3, 0
 - 0, 3, 5
12. If one zero of the function is 2, find the remaining zeros of the polynomial function; $P(x) = x^3 + 8x^2 + 19x + 12$.
- 4, -2
 - 4, 2
 - 6, 8
 - 6, -8

C. INTERCEPTS OF A POLYNOMIAL FUNCTION

Directions: Multiple choice - Read and choose the best answer of the following items below.

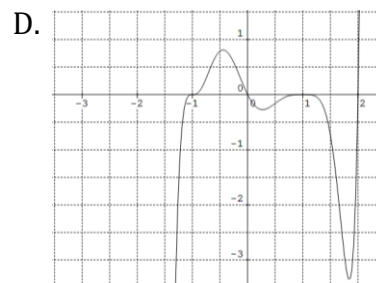
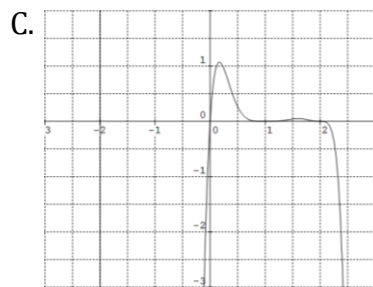
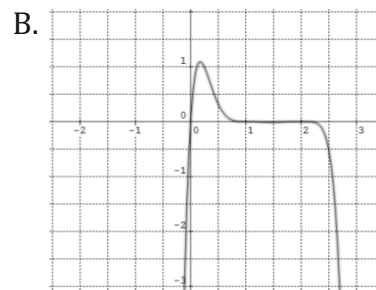
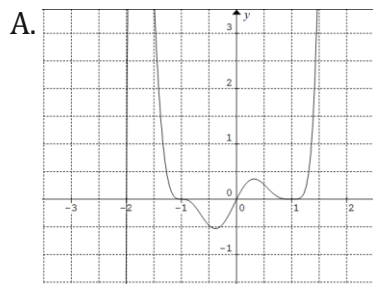
- Find the x-intercept of the polynomial function $f(x) = (x + 7)(x - 5)(x + 3)$.
 - 7, -3, 5
 - 7, 3, 5
 - 7, 3, -5
 - 7, -3, -5
- Find the y-intercept of the polynomial function $f(x) = (x + 7)(x - 5)(x + 3)$.
 - 105
 - 105
 - 15
 - 15
- Find the x-intercept of the polynomial function $f(x) = x^2 - 10x + 21$.
 - $x = 7, x = 3$
 - $x = -7, x = -3$
 - $x = 7, x = -3$
 - $x = -7, x = 3$
- Find the y-intercept of the polynomial function $f(x) = x^2 - 10x + 21$.
 - 21
 - 21
 - 10
 - 10
- Determine the x-intercept of the polynomial function $y = x^2(x - 5)(x + 4)(x - 4)(x + 5)$.
 - 0, 5, -4, 4, -6
 - 5, -4, 0, 4, 5
 - 5, 0, -4, 6
 - 0, -5, -4, 4
 - E.

6. Determine the y-intercept of $y = x^2(x - 1)(x + 2)(x - 4)(x + 5)$.
- 40
 - 5
 - 0
 - 10
7. Find the x-intercept of the polynomial function $y = x^3 + x^2 - 12x$.
- 0, 3, 4
 - 0, 3, -4
 - 0, -3, -4
 - 3, 4, 12
8. Find the y-intercept of the polynomial function $y = (x^2 - 7x + 10)(x - 1)(x - 4)$.
- 40
 - 40
 - 10
 - 10
9. Determine the x-intercept of the polynomial function $y = -x^2 + 100$.
- 5, 5
 - 25, 25
 - 10, 10
 - 100, 100
10. Identify the y-intercept of the polynomial function $y = 3x^4 - 8x^3 + 4x^2 + 10x - 9$.
- 9
 - 10
 - 4
 - 8
11. Find the x-intercept of the polynomial function $f(x) = (3x + 4)(x - 3)(2x - 1)$.
- $-\frac{4}{3}, \frac{1}{2}, 3$
 - $\frac{4}{3}, 3, 4$
 - $-\frac{4}{3}, -3, \frac{1}{2}$
 - $\frac{4}{3}, 4, -3$
12. Find the y-intercept of the polynomial function $y = -(x + 3)(3x - 1)(x - 1)(x + 2)$.
- 4
 - 6
 - 6
 - 4

D. GRAPH OF A POLYNOMIAL FUNCTION

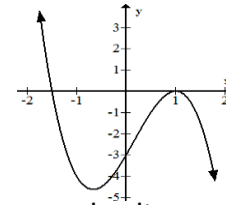
Directions: Multiple choice - Read and choose the best answer of the following items below.

1. Determine the zeros of the polynomial and their multiplicity of $y = x(x - 3)(x - 1)^4(x + 1)^3$.
 - A. 0, -3, -1 multiplicity of 4 and 1 multiplicity 3
 - B. 0, 3, 1 multiplicity of 4 and -1 multiplicity 3
 - C. 0, -3, 1 multiplicity of 3 and -1 multiplicity 3
 - D. 0, -3, -1 multiplicity of 3 and 1 multiplicity 4
2. Determine the y-intercept of the polynomial function $y = (x + 2)(x + 1)^3(x - 1)^4$.
 - A. 1
 - B. -1
 - C. 2
 - D. -2
3. Determine the behavior of the graph of the polynomial $y = 5x^3 + 7x^2 - 3x + 5$.
 - A. left-hand rising, right-hand falling
 - B. left-hand falling, right-hand falling
 - C. left-hand falling, right-hand rising
 - D. left-hand rising, right-hand rising
4. Identify the leading coefficient polynomial function $y = x(x + 2)(x + 1)^3(x - 1)^4$
 - A. 1
 - B. -1
 - C. 3
5. Sketch the graph of the polynomial function $f(x) = x(x + 2)(x + 1)^3(x - 1)^4$.

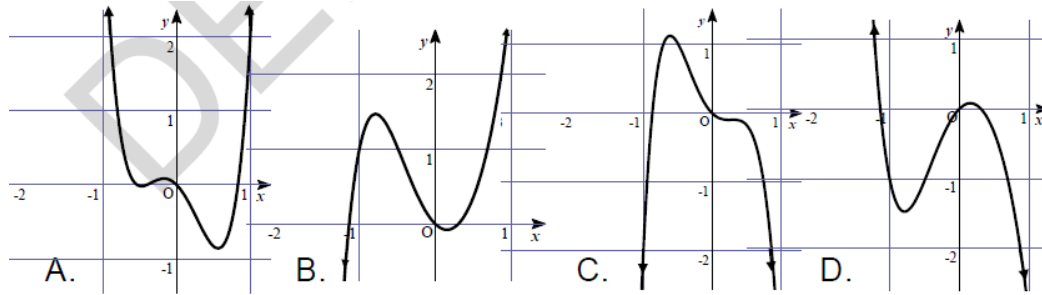


6. Which polynomial function in factored form represents the given graph?

- A. $y = (2x + 3)(x - 1)^2$
- B. $y = -(2x + 3)(x - 1)^2$
- C. $y = (2x + 3)^2(x - 1)$
- D. $y = -(2x + 3)^2(x - 1)$



7. You are asked to graph $f(x) = -x^6 + x^5 - 5x^4 - x^3 + 3x^2 - x$ using its properties. Which of these was your graph?

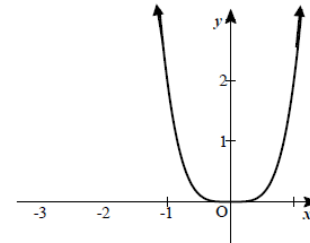


8. If you will draw the graph of $y = x^2(x - 1)$, how will the graph behave at the x-axis?

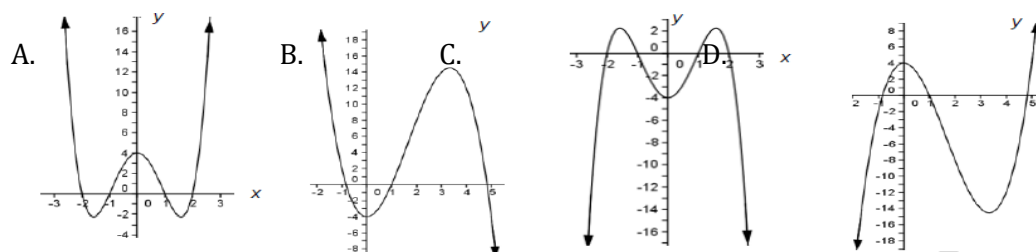
- A. The graph crosses both $(0, 0)$ and $(1, 0)$.
- B. The graph crosses $(0, 0)$ and is tangent to the x-axis at $(1, 0)$.
- C. The graph crosses $(1, 0)$ and is tangent to the x-axis at $(0, 0)$.
- D. The graph is tangent to the x-axis at both $(0, 0)$ and $(1, 0)$.

9. If you were to choose from 2, 3, and 4, which pair of values for a and n would you consider so that $y = ax^n$ could define the graph below?

- A. $a = 2, n = 3$
- B. $a = 3, n = 2$
- C. $a = 2, n = 4$
- D. $a = 3, n = 3$

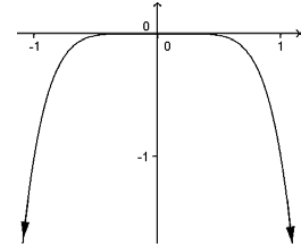


10. Which of the following could be the graph of $y = x^4 - 5x^2 + 4$?



11. Your friend Aaron Marielle asks your help in drawing a rough sketch of the graph of $y = -(x^2 + 1)(2x^4 - 3)$ by means of the Leading Coefficient Test. How will you explain the behavior of the graph?
- The graph is falling to the left and rising to the right.
 - The graph is rising to both left and right.
 - The graph is rising to the left and falling to the right.
 - The graph is falling to both left and right.
12. Lein Andrei is tasked to choose from the numbers $-2, -1, 3,$ and 6 to form a polynomial function in the form $y = ax^n$. What values should he assign to a and n so that the function could define the graph below?

- $a = 3, n = -2$
- $a = 3, n = 6$
- $a = 6, n = 3$
- $a = -1, n = 6$



CURRICULUM VITAE

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 March 1999

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 Bayawan City
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Work Experience	Secondary School Teacher III Dawis National High School Dawis, Bayawan City 2013-Present
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