

Errors in solving equations reducible to quadratic form education essay

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In the General Cambridge Examination Ordinary (G. C. E. O) Level Additional Mathematics course of study, working equations reducible into quadratic signifier plays an important function as it affects about all mathematics strands in the course of study: Algebra ; Geometry and Trigonometry ; Calculus. The important numbers of subjects in Additional Mathematics that require the construct of working and solving equations reducible to quadratic signifier highlights the importance of this survey.

Problem Statement

Students in Singapore secondary schools are expected to get and get the hang of the accomplishment of algebraic use and solving equations peculiarly additive equations and quadratic equations by the terminal of Secondary 2 (Grade 8) (Ministry of Education, 2007) . Students who take Extra Mathematics in their Upper Secondary (Grade 9 - Grade 11) are expected to be able to reassign their algebraic cognition and accomplishments peculiarly in solving equations and use constructs and utilize it to work out more complex equations. Complex equations working in Additional Mathematics involves higher-degree algebraic powers, exponential maps, logarithm maps and trigonometry maps. Over the old ages, I have observed many pupils who were unable to work out equations reducible into quadratic signifier when given different maps as mentioned. This present survey is an effort to analyze pupils ' mistakes in solving equations reducible to quadratic signifier through written and verbal signifier every bit good as supply some contemplation on instruction.

Purpose of the Study

This survey attempts to place the types of mistakes that pupils make in working out equations reducible to quadratic form. The equations in this survey refer to equations affecting exponential maps, logarithm maps and trigonometry maps which can be simplified to $ax^2 + bx + c = 0$ (a , b and c are invariables and x is the maps mentioned). This survey intends to reply the undermentioned inquiries:

What sort of mistakes do pupils hold when working out equation that is reducible to quadratic form?

Why do these pupils ' make these mistakes?

How we can avoid such type of mistakes?

Significance of the Study

In mathematics, equation resolution is an of import accomplishment in progress algebra subjects. The usage of equation as a job working out tool is applicable to other subjects such as Physics. The mistake analysis that is being carried out in this survey would lend to an apprehension of the cause of pupils 'failure in working out equations and to better schoolroom direction. Error analysis reveals both common and unexpected mistakes.

Acknowledging and understanding the beginning of mistakes made by pupils will assist instructors to be after instructional activities to avoid some of the common mistakes if instructors are cognizant of the nature of their pupils ' misinterpretation. An apprehension of pupils ' mistakes in equation resolution will supply a better successful redress action by instructors.

Conceptual Model

The following is the conceptual model of the survey. Beginnings of mistakes can be found at any phase and the mistakes will be analysed.

Equation in footings of P, where P are map such as exponential, logarithm or trigonometry

Substitution, allow $p = \text{ten}$

Identify structural characteristics

Quadratic equation signifier:

$$ax^2 + bx + c = 0$$

Interpret solution

Solve for P

Solve for ten

LITERATURE REVIEW

In the literature reappraisal, a general overview of algebra will be discussed, followed by troubles in learning algebra and troubles in working out equations. Next, research of types of mistakes will be discussed. Last a reappraisal on understanding mathematics constructs is examined.

2.1 Algebra

Algebra involves variables ; whereas algebraic looks contain variables, invariables and operation marks ; whereas algebraic equation contains

algebraic looks and equal mark. Students are required to understand the construct of variables, the significance of algebraic term before cut downing algebraic look right (Filloy & A ; Rojano, 1989) . Thereafter, pupils need to cognize that that the construction of an equation is based onequalityof algebraic looks (Kieran, 1981 ; 1989) . Variable plays an of import portion in advanced therefore I am utilizing Usiskin (1988) construct of school algebra into four constructs where he emphasized on the function and significance of variables in each of his construct. One of the of import characteristics of variable in this survey is sing algebra as a survey of construction (Usiskin, 1998) .

2. 2 Surveies on Troubles in Learning Algebra

Many instructors and pupils will readily hold that algebra is hard to larn. Many surveies have been conducted to place or explicate pupils ' troubles in algebra are chiefly from primary or in-between school. The surveies on algebra are chiefly focused on variables, looks and work outing additive equations (Kuchemann, 1981 ; Rosnick, 1981 ; Sleeman, 1984; Booth, 1988 ; Kieran, 1989 ; Wagner and Parker, 1993) . There are few surveies on the troubles or misconceptions on work outing quadratic equations (Vaiyavutjamai & A ; Clements, 2006) in assorted National Council of Teachers of Mathematics (NCTM) research publications. There is besides fewer surveies conducted on algebra which are focused on high school or university degree (Wagner & A ; Parker, 1993 ; Vaiyavutjamai & A ; Clements, 2006 ; Novotna & A ; Hoch, 2008) .

2.3 Troubles in Equation Solving

Students' troubles in understanding the construction of algebraic look will hold an impact on work outing equations (Kieran, 1981, 1989) . Research on equations and work outing equations dealt with pupils' acknowledgment and usage of construction, either implicitly or explicitly (Kieran, 1989) . In acknowledging the construction of different types of equation, work outing it requires different processes. Hence, pupils require the right process before they can successfully work out an equation right. Ekenstam & A ; Nilsson (1979) survey found that the place the unknown every bit good as the types of solution in the equation affect the public presentation of the pupils.

Using concrete theoretical accounts approach to understand the construct of equality to minimise pupils' troubles in work outing equation was successful in Filloy & A ; Rojano (1989) survey. However, this survey does non back up state of affairs where negative Numberss are used. Lima (2007) cited Linchevski and Sfard (1991) research where pupils made errors in work outing equation as they misinterpret the techniques used to work out equation every bit good as deficiency the significance of the mathematical symbols.

2.4 Surveys on Error Analysis

Mathematical mistakes are a common phenomenon in pupils' acquisition of mathematics and there is a long history for mistake analysis in mathematics instruction (Peng, 2010) . Knowledge of the common mathematical mistakes and misconception of pupils can supply instructors with an penetration into pupil thought and a focal point for learning and larning

(Chua and Wood, 2005 ; Kaur, 1989 ; Ryan and McCrae, 2005 ; Wong, 2000)

2. 4. 1 Types of Mistakes

Mistakes can be classified as procedural and conceptual mistake

Bagni (2000) concluded in his research that high school pupils improperly extend simple regulations into two types ; misconceptions of additive functions and balance misconception. These misconceptions are operational misconceptions which were caused by an improper over-use of metaphorical projections. Bagni (2000) classified the undermentioned illustrations as misconception of additive functions, while Wong (2000) classified it as inappropriate usage of distributive jurisprudence:

; wickedness ;

Example of balance misconception is as follows:

where

Bagni (2000) suggested that to get the better of these mistakes, the function of counterexamples dramas an of import portion to do pupils cognizant of wrong replies and of their conflicting thoughts.

Some of the ill-famed confusion regulations are in work outing of algebraic equations utilizing the `` move-over and change-sign '' (Wong, 2000) or `` Switching-Addends '' mistake (Kieran, 1989) and `` Redistribution '' mistake (Kieran, 1989) . Wong (2000) accent that is was no surprise that pupils frequently mix up the regulations because they do non hold relational

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apprehension of what they are making and their long-run memory is jumbled with legion regulations that look similar.

2. 5 Understanding

Understanding was defined as doing connexion (Hibert & A ; Carpenter, 1992) . Understanding new construct means to construct a relationship between the new construct and the old construct. Hibert and Carpenter (1992) suggested different ways to ease understanding by traveling through undertakings which requires contemplation, communicating and working on reliable or real-life jobs. This is verified by the survey of Brenner et. Al (1997) with junior high school pupils on the construct of maps. Mistakes are the symptoms of misconstruing. If the grounds on why pupils made mistakes can be good understood, it should be easier to better their apprehension.

2. 5. 1 Conceptual and Procedural Understanding

Conceptual and procedural apprehension in mathematics has its topographic point in mathematics. There have been two schools of idea when it comes to learning and acquisition of mathematics (Long, 2005) . Novotna and Hoch (2008) survey was with high school pupils and university pupils, where they have troubles in developing deeper apprehension of mathematical impressions in their mathematics classs even though, they were high-achieving pupils in middle-school or high-school. These pupils have deficiency of construction sense a term created by Linchevski and Livneh (1999) , in other words they do non hold conceptual apprehension of construction. Kieran (1989, 1992) discussed pupils ' inability to separate

structural characteristics of equations. Thomas and Tall (1991) indicated the versatility of idea is necessary to exchange from an analytical attack to a planetary one, giving as an illustration to see $3x + 5$ as a common factor in the look $(3x + 5)^2 - 2x (3x + 5)$. These illustrations indicate that pupils are required to hold conceptual apprehension in learning mathematics constructs when it comes to progress mathematics.

Methodology

A qualitative attack was chosen for this survey, as I want to happen out about the mathematical thought underlying the mistakes when work outing equations. Experimental attack or quantitative attack will non be suited to seek the information required in the research inquiries. In order to show a wide image of the pupils ' mistakes and apprehension, it was necessary to utilize a written trial. Semi-structuredinterviewSessions will be conducted after the analysis of the written trial. Interviews session will be the platform where pupils supply penetrations into the grounds for mistakes. Beginnings of informations from the written trial, interview Sessions and past markers ' study will be able to triangulate the beginning of mistakes which is required in this survey. The sample of the survey is secondary Five (Grade 11) pupils. They were selected for the survey as these pupils would hold covered most types of equations as compared to secondary Four (Grade 10) pupils. The pupils ' cognition in mathematics could be tested in more state of affairss and would pull out greater assortment of mistakes.

This survey was planned to:

analyze the mistake patterns in phases of work outting equations reducible to quadratic signifier,

compare the mistake forms of convergent thinkers of different abilities in work outting equations,

place the idea procedure underlying the mistake patterns.

WORKPLAN

All pupils are given the instrument incorporating 7 inquiries on work outting equations. Duration of the trial is 40 proceedings. The written solution will be marked and mistakes that are surfaced for each inquiry will be written and categorised. Following, the Markss of the trial will be tabulated and the pupils will be categorized to three sets: high ability ; medium ability ; low ability. The mistakes from each set will be farther analysed. Interview Sessionss with a few pupils from each set will keep to happen out why these mistakes occur. During the interview session, worked out solution of the pupils ' ain working and other pupils solutions will be used to analyze how the mistakes occurred. Interview session will be held in the period 7 March - 11 March 2011. In the hebdomads to come, I will finalise my findings from the interview. I will go on to read more literature on symbols, apprehension, mistakes and equation work outting for readying of the concluding study.