Blended Learning: The Use of Cellphone in Teaching Geometry in Mathematics in the Senior Phase in Johannesburg North District in Gauteng Province During and After the Pandemic

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This paper presents the challenges in learning experienced by school learners nationally and internationally. In the Spring of 2020, this question quickly turned into a mandate for the world due to the pandemic. Most schools encouraged face to face teaching and learning but with the inventions of Technological learning new strategies need to be put in place moving in line with the technological world. Teachers had to migrate from the traditional face to face strategies to technological learning. As with most emergencies swift, decisions based on fast and technological solutions are often made by teachers with little technological experience. This study used the cellphone as a mode of collecting data and the focus was on number concepts in the context of the Pythagoras Theorem. Data and interviews were collected from technological inclusive education teaching was collected from five learners from the senior phase. The analysis revealed that there are a variety of functions that are closely tied to inclusive technological learning in the Senior Phase. The findings suggest the cellphone, with its many functions could help in the teaching of the number concepts in the context of geometry, Pythagoras Theorem through various modes.This paper focused on how teachers migrate from the old school (Face to face) inclusive education strategies in the new Covid -19 pandemic affected in the South African curriculum delivery. The situations have changed and the traditional ways of teaching were inevitable. There was a need to understand how teachers thought about inclusive technological teaching and how they apply technical gadgets as the teachers use modern methods.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused by the novel coronavirus (SARS-CoV-2) has created an unprecedented challenge for governments, public health agencies, medical officials, and populations globally. Researchers propose that all learners should be catered for without discrimination, “Every learner matters and matters equally.” (UNESCO, 2017, p. 12). Since 1994 inclusive education has been adopted to ensure the quality of education and right to education for all learners is now a contemporary approach recognized globally (Subotic, Orosco, & Lussier, 2014)The concept of e-learning is a technology-mediated learning approach of great potential from the educational perspective and it has been one of the main research lines of Educational Technology in the last decades (Valverde-Berrocoso , María del Carmen , & Morales-Cevallos , 2009-2018)This even became more popular across the world when COVID-19 struck the world and South Africa was not spared by this unprecedented event. The world health organisation (WHO) reported the first outbreak of the coronavirus in Wuhan on 31 December 2019 (UNICEF/Jannatul , 2021) and this is also stated that With the first case of unknown pneumonia reported in the province of Wuhan (People's Republic of China) on 31 December 2019, within few weeks the coronavirus (Covid-19) was declared a pandemic by the World Health Organization on 30 January 2020 (Binder, Crego, & Eckert, 2020)The president of the Republic of South Africa called for the state of emergence and just like all the countries of the world went on lockdown on 26 March 2020 bring all business and educational institutions to a standstill. The closure of schools had adverse consequences as follows:

- Interrupted learning
- Confusion and stress for teachers
- Parents unprepared for distance and homeschooling
- Challenges creating maintain and improving distance learning
- Social isolation
- Challenges in measuring and validating learning (UNESCO, Adverse consequences of school closures.More on UNESCO 's COVID-19 Education Response, 2020)

My experience as a teacher during the pandemic ignited the topic **Blended Learning: The use of cellphone in teaching geometry in mathematics in the senior phase in Johannesburg North District in Gauteng Province during and after the pandemic.**The pandemic situation compelled the teachers, learners and schooling system into effective inclusive technological learning and this type of learning became its academic discipline. There was a massive change in the way the lessons were conducted. There were challenges in the education system and this is supported by (Hargis, 2020) who attains that some believed the situation was temporary, so they did not commit to creating an updated model of learning. Some of the teachers and learners thought the learners would return to traditional ways of learning but thanks to the “new normal” Effective Inclusive Technological Learning Strategies.

Teaching and learning during the pandemic

The schools and all businesses were closed as all countries of the world embarked on lockdown.Most private schools in Johannesburg started Blended Learning Strategies in Spring (2020) following the stance taken by most universities and schools. Most schools prepared the COVID -19 policies for learning and teaching to be followed by teachers, learners and parents. They used e-mails, phone calls, study packs and the D 6 communication modes. Considering that these days almost all households have one or more cellphones, it was then used as a means to teaching and learning during the pandemic and this led to the following research questions.

Keywords

Cellphone, network, snapshot,pandemic.

Research questions

What is the effect of using the cellphone as a means of learning geometry during the pandemic?

Sub questions

- What are the properties of right-angled triangles in geometry?
- How can missing measurements be calculated in a right-angled triangle?
- What are the perceptions of the use of the cellphone by learners in the contexts of geometry?

Objectives

- ❖ To find out the properties of the right-angled triangle in geometry using the cellphone teaching method
- ❖ To calculate the missing measurements in a right-angled triangle using the cellphone teaching method
- ❖ To find out the perceptions of the use of the cellphone by learners in the contexts of geometry.

Pr**oblem statement**

I have been in the teaching profession for more than three decades and I believe that Effective Inclusive Technological Learning should be taught instead of the old school teaching methods (face to face). The teachers for Effective Inclusive Technological Learning need to focus on (pedagogy) the methods of teaching and (andragogy) to understand the mechanism of technology to be able to offer similar or improved learning chances. Teachers should be introduced to these technologies; the pandemic was a lesson of its that found teachers learning the hard way (the whirlwind situation of change).Theory encourages teachers to learn technology in teaching. (Weller, 2020) published a meta-study book but technology is not new. Blended Learning is supported by some researchers (Zhonggen, 2015) the researcher reviewed thirty articles to explore the advantages and disadvantages of Blending Learning (BL). The universities and all businesses were closed as all countries of the world embarked on lockdown. Most universities in Johannesburg started Blended Learning Strategies in Spring (2020) following the stance taken by most universities. This stance was popular in universities but not used in schools. The gap was identified in this study as senior learners and intermediate phase learners also needed to learn thus formulating the study Blended Learning: The use of cellphone in teaching geometry in mathematics in the senior phase in Johannesburg North District in Gauteng Province during and after the pandemic**.**

Methodology

The Pythagoras Theorem was introduced to the learners who were in grades 7,8 and 9 using the cellphone during the time of the pandemic. Firstly, the learners revised the square roots and squares of given numbers. The learners from whom the data was collected were 6 and all from the senior phase. They were provided with the assumed knowledge for the Pythagoras Theorem and then given the main task in the interview. The data was collected and qualitatively unanalyzed following the content analysis method. The results were transcribed by the researcher and findings were passed and conclusions were given. Amongst the findings were the advantages and disadvantages of using the cellphone as a mode/means of teaching in the senior phase during the crisis periods such as the pandemic.

Sampling

Participants were 4 learners sampled from a group of 200 learners doing mathematics in Grade 7,8 9 at schools in Johannesburg North district of South Africa's Gauteng Cape province. The school understudy is 13 kilometres from Johannesburg. Some learners also come from several neighbouring informal settlements. At this school, English is taught as a first additional language. Traditionally, this is equivalent to English as a second language and English as a medium of instruction, as applied to South Africa before 2001. Learners and teachers are expected to use English as a medium of instruction (Department of Education 2003).

Instruments

Two sets of instruments were used to collect data in this study. The first set consisted of mobile phones and texting, while the second set comprised two types of questionnaires. The mobile phone data were in the form of SMSs, whereas data were in the form of mobile instant messagesThe data were collected in three distinct phases. The third phase concentrated on answered script data, while the last phase involved administering a post-participation questionnaire.

Ethical Clearance

Permission to conduct the study in the study area was obtained from relevant authorities, the principal of the school and the school's district manager. Both learner participants and parent participants signed informed consent forms. Further, participation in the study was voluntary and the participants were made aware of their rights, including the right to withdraw from the study at any point should they deem it necessary. All this was done following the Tshwane University of Technology prescribed in 2016.

Results

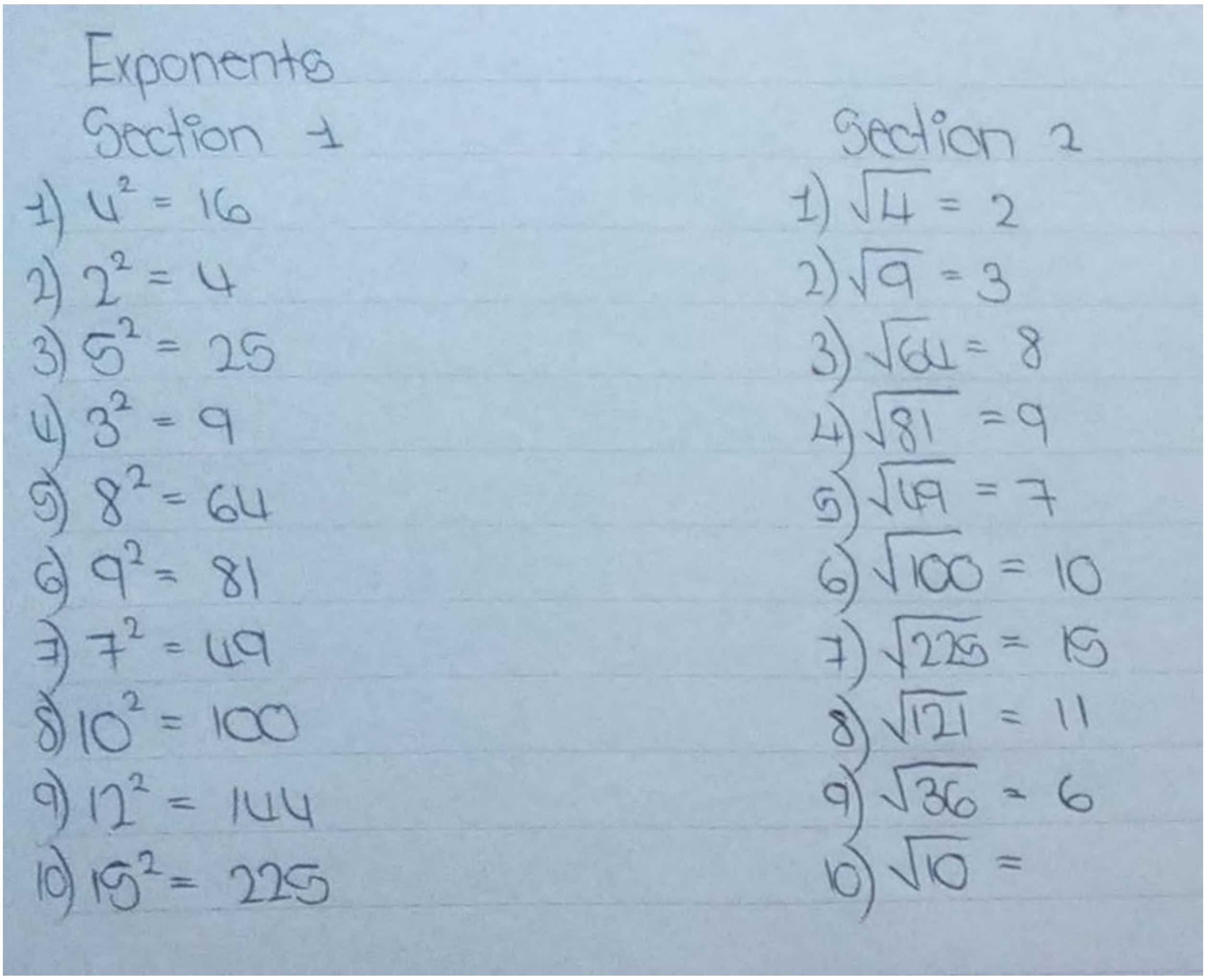
The participants used the cellphone to communicate with the researcher,The results wererecorded in different stages and depending on the outcome,The first stage was the assumed knowledge level and this had square roots and squares of numbers,followed by the instructional level,the introduction of the Pythagoras Theorem activity,task 1 mechanical problems and then task2, statement problems and the results were recorded as follows.

Participants	Assumed	Assumed	Pythagoras	Task 1	Task 1	Perception

	knowledge Square-roots	knowledge Squares	Theorem Instructional	Mechanical Problems	Mechanical Problems	Of the Use of the cell phone in learning
Aids	able	Able	Able	Able	Able	liked
Erry	able	able	Able	able	able	Liked
Dee	able	able	Able	able	able	Liked
Why	able	able	unable	Unable	unable	Liked
Mika	able	able	Able	able	able	liked
5	5	5	4	4	4	5
Percentage	100%	100%	80%	80%	80%	100%

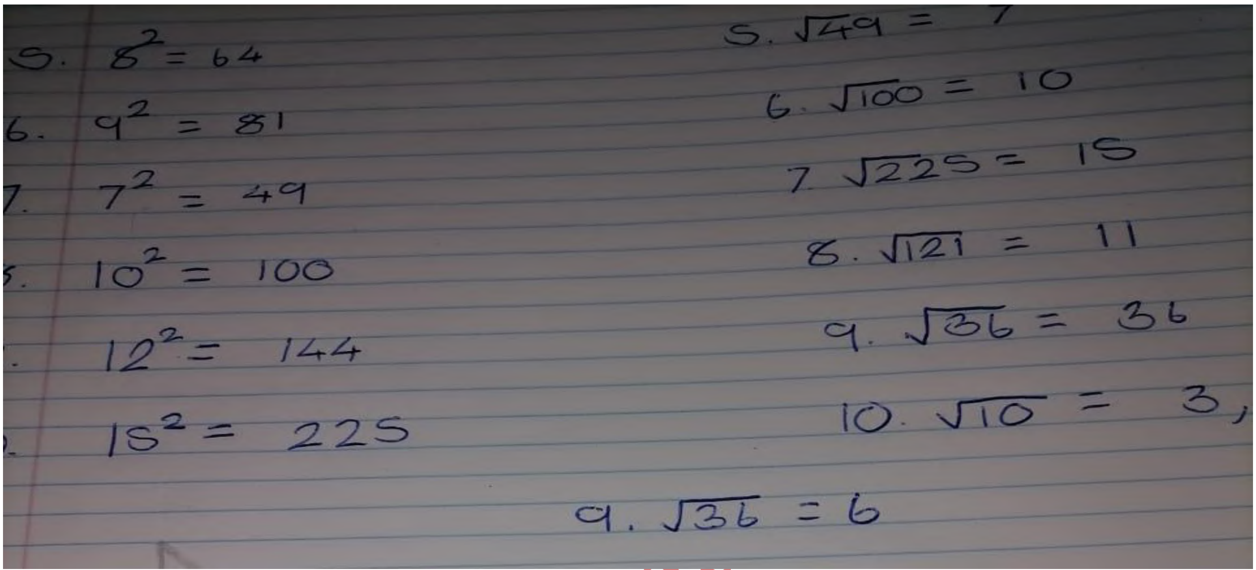
The responses for Assumed knowledge

All the participants could calculate the squares and the square roots of the given numbers given using the cellphone as the mode of teaching and learning.The first response on the assumed knowledge sections was given by Erry as follows.

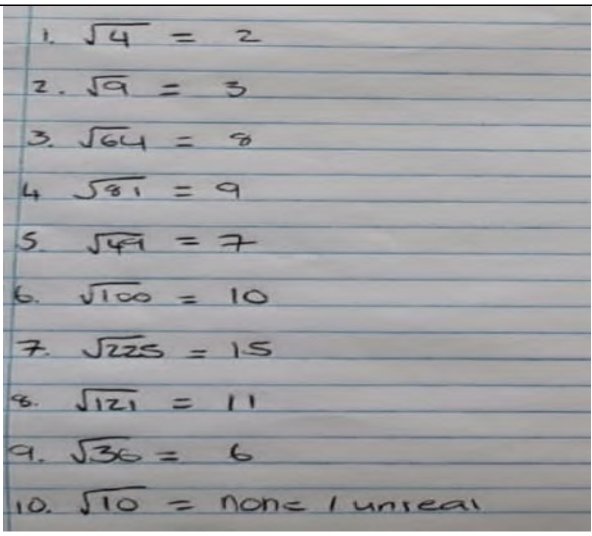


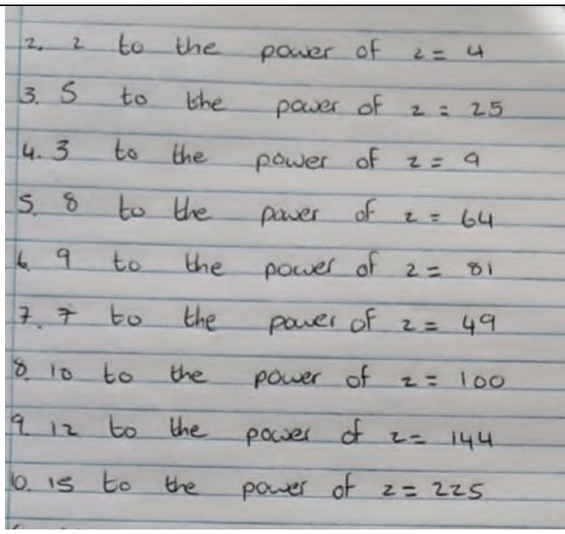
According to the responses given by Erry the square root of 10 could not be found and does not exist.After a video call and explanation, she could calculate the squareroot of 10.The cell [hone was successfully used as a mode of learning the Pythagoras Theorem in the crisis of the pandemic.

The second participant to be interviewed was Dee,Dee a boy aged 13 years,from grade seven gave the following responses.According to the responses given by Dee, the square root of 10 could not be found and does not exist.After a video call and explanation, she could calculate the squareroot of 10.The cell [hone was successfully used as a mode of learning the Pythagoras Theorem in the crisis of the pandemic.



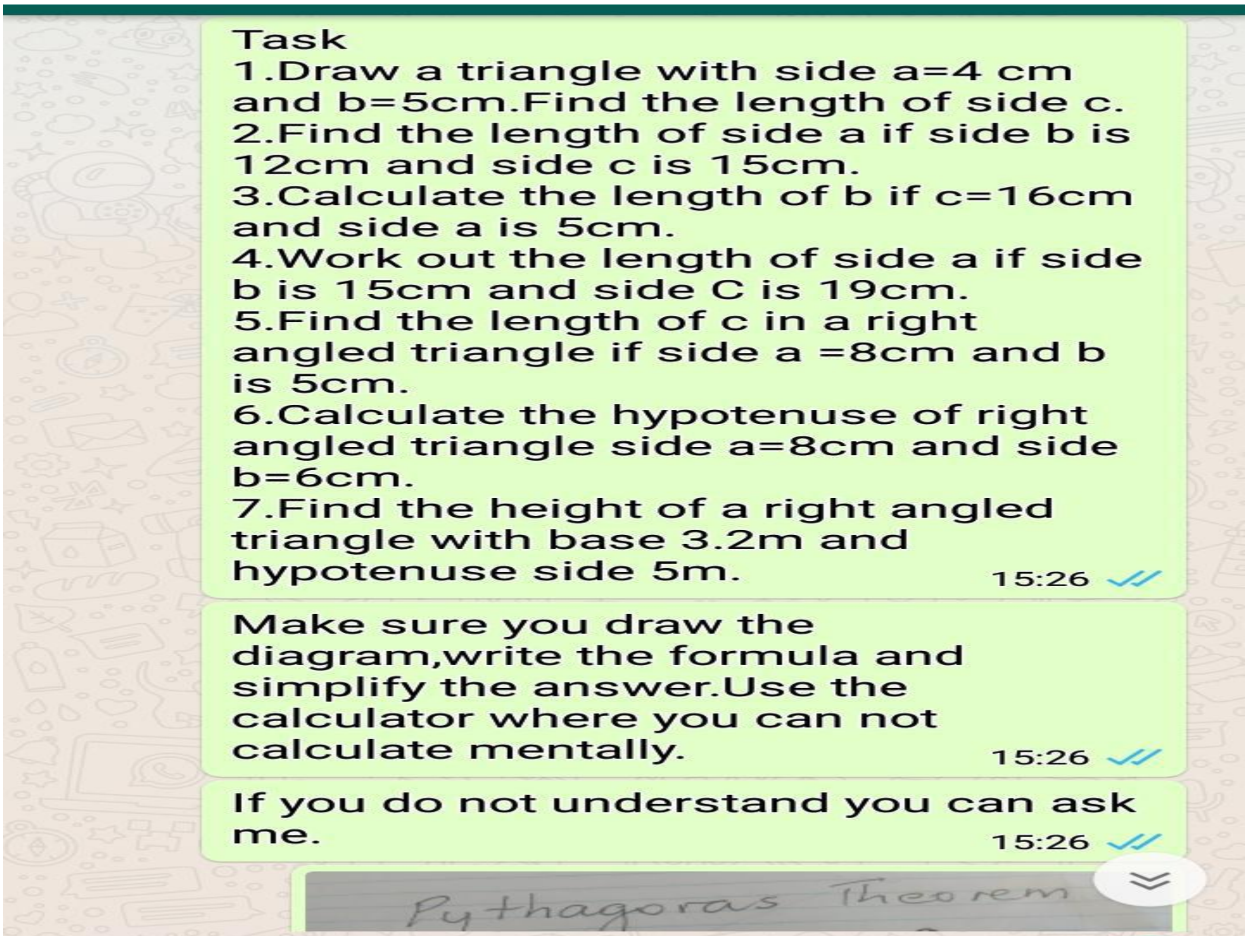
The third participant to be interviewed in this section was Mika.Mika a girl from grade 8 aged 15 years gave the following responses.According to the responses given by Mika the square root of 10 could not be found and does not exist.After a video call and explanation, she could calculate the squareroot of 10.According to Mika, the square root is unreal.The cell phone was successfully used as a mode of learning the Pythagoras Theorem in the crisis of the pandemic.



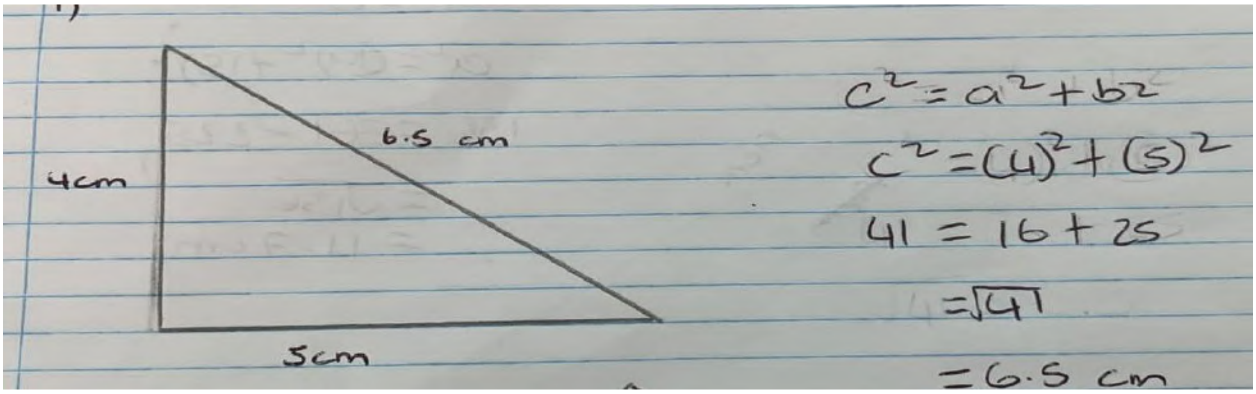


The following are the instructions given to the learners in the first interview.

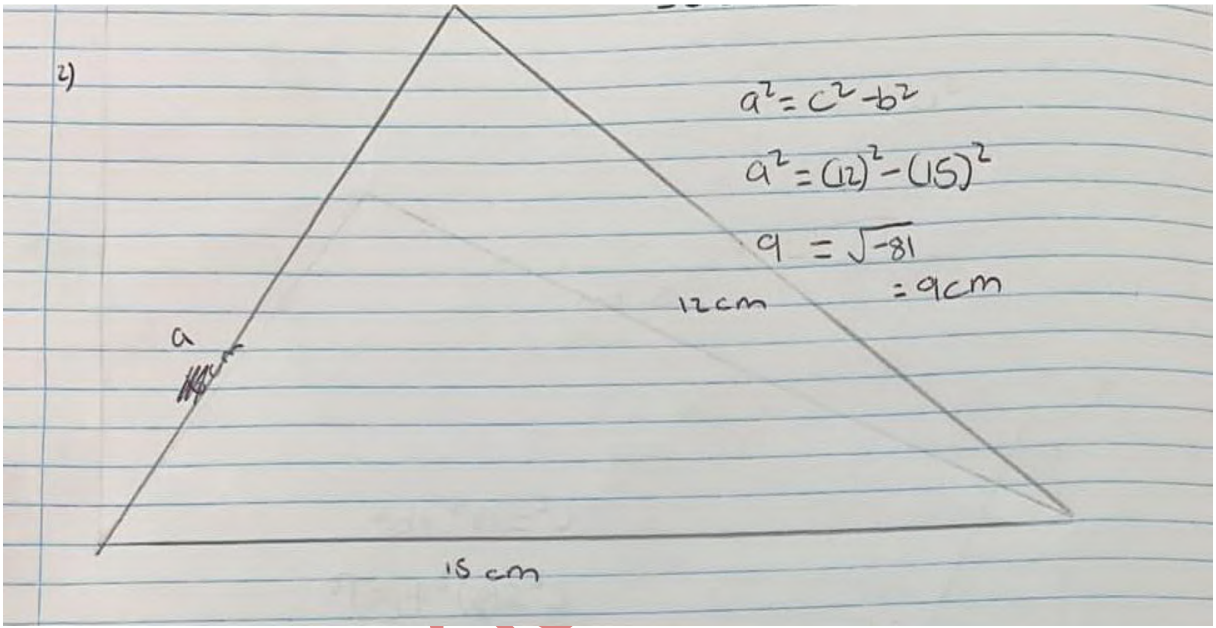
Instructional stage



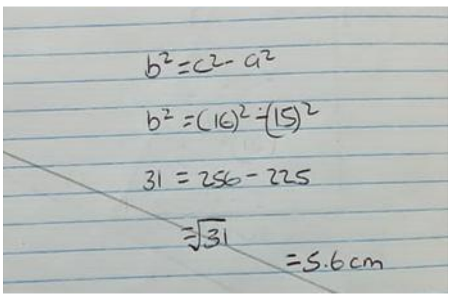
During the instructional stage, the participant was required to follow instructions to show their understanding of the Pythagoras theorem and in response to these instructions Mika presented the following posted on the cellphone pictures.,Although the work presented by Mika showed accurate calculations she, however, did not write the formula and also show the right angle sign on the diagram shown and this was corrected by the researcher as this was still in the teaching and learning instructional stage.

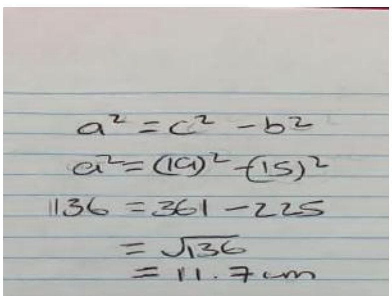


In question 2 the participants were asked to find the length of side a when c=15cm and b=12 cm and below was the work produced by Mika.



Corresponding to the response to question 3 the following excerpt.The question was find b when c =16cm and 15cm.According to the response provided by Mika, the diagram drawn was as follows:





Analysis

The analysis was done in four stages were stages 1,2,3and 4.Stage one was checking on the assumed knowledge of the squaring of numbers and the square roots of given numbers which wasa basic necessity for the main activity and involved one basic movement.Stage two involved two movements firstly the formula and then the replacement of the formula by numbers for simplification.This was then followed by stage three where the learners were given Pythagoras formulae stories to analyse and calculate the required dimension. The response was collected from Aids,Erry,Dee,Mika and Why.

The first responses were given by Aids

According to the response provided by Aids, Aids, a boy aged 13 from Grade 7 could find the squares of given numbers for example the square of 8 is 64, the square of 9 is 81 and the square of 12 is 144. Aids could calculate the square root of 100 which is shown at the bottom of the page is 10, the square root of 225 is 15, the square root of 121 is 11 and the square root of 10 is 3,1. The square roots and the squares of numbers were the assumed knowledge in mastering the Pythagoras Theorem. Although Aids could give correct calculation it is observed that Aids did not draw the triangle showing the right-angled triangle sign.

The following responses were provided by Aids

$$c^2 = a^2 + b^2 a^2 = c^2 - b^2 b^2 = c^2 - a^2$$

Aids was able to change the subject of the Pythagoras theorem, substitute the values and calculate the length of the missing side although she could not indicate which one was the right angle in the diagram. According to Aid's response in question 7, she wrote $a^2 = c^2 - b^2$ and then she substituted the letters by the numbers with correct calculations. According to the work shown by Aids, the Pythagoras Theorem could be taught using the cellphone during a time of crisis and any other time when there is no crisis.

The following responses were provided by Mika

$$c^2 = a^2 + b^2 a^2 = c^2 - b^2 b^2 = c^2 - a^2$$

Mika was able to change the subject of the Pythagoras theorem, substitute the values and calculate the length of the missing side although she could not indicate which one was the right angle in the diagram. According to Mika's response in question 7, she wrote $a^2 = c^2 - b^2$ and then she substituted the letters by the numbers with correct calculations. According to the work shown by Mika, the Pythagoras Theorem could be taught using the cellphone during a time of crisis and any other time when there is no crisis.

The following responses were provided by Erry

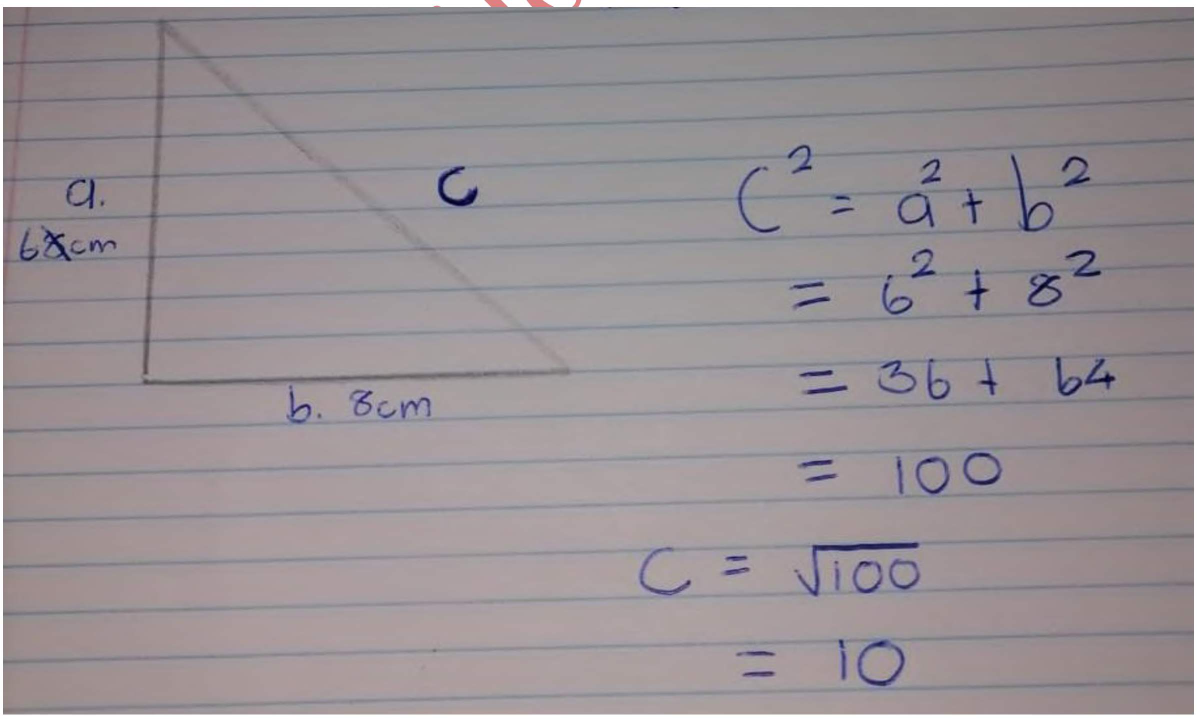
The second session involved two stages, firstly the stating of the Pythagoras Theorem using the letters. This includes the following $c^2 = a^2 + b^2 a^2 = c^2 - b^2 b^2 = c^2 - a^2$ and the replacement of letters by numbers. Erry could come up with the formula and calculations, but she did not indicate the right-angled triangles in some cases. Although all the answers were correct at first Erin did not simplify the final answers. She left $\sqrt{41}$ without writing the final answer which was supposed to be 6,4 and she left $\sqrt{81}$ which was supposed to be 9cm. Only after a third instruction and discussion, Erry was able to come up with the correct answers. The teaching of the Pythagoras Theorem of cellphone was successfully implemented in the case of Erry. The following were the responses provided by Erry.The first formula is not correctly written, and the second formula is correctly followed by correct interpretations, but the final substitution was correct though it was not simplified.The final answers for the above could have been 6.4 in number 1 and 9 in number 2.

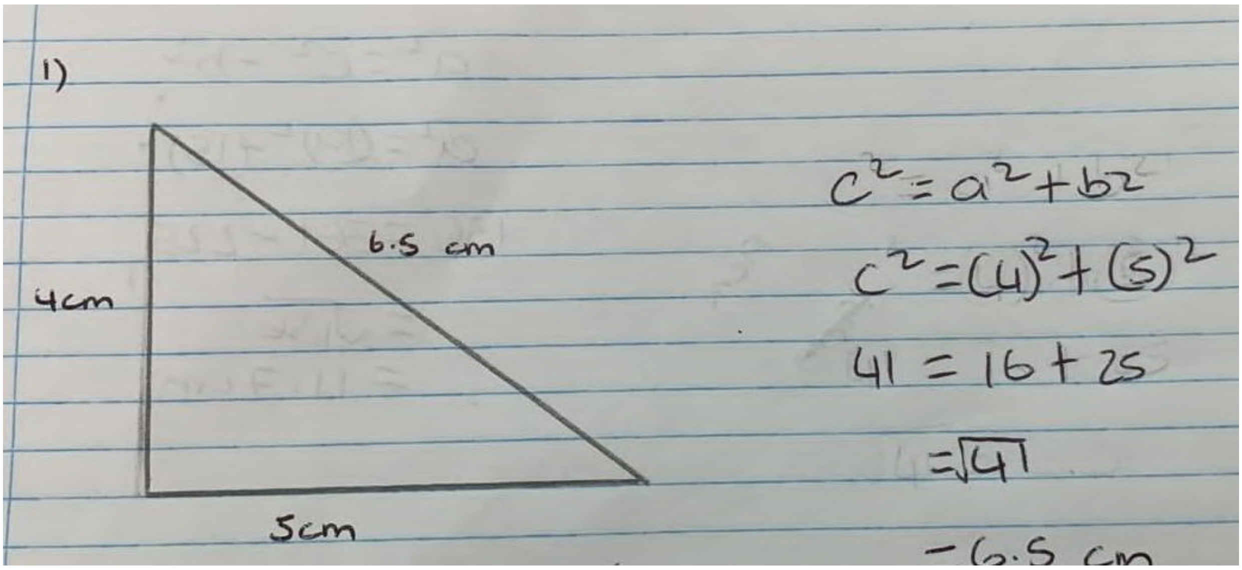
The following responses were provided by Dee

According to the response provided by Dee, Dee, a boy aged 13 from Grade 7 could find the squares of given numbers for example the square of 8 is 64, the square of 9 is 81 and the square of12 is 144. Dee could calculate the square root of 100 which is shown at the bottom of the page is 10, the square root of 225 is 15, the square root of 121 is 11 and the square root of 10 is 3,1. The square roots and the squares of numbers were the assumed knowledge in mastering the Pythagoras Theorem. Although Dee could give correct calculation it is observed that Dee did not draw the triangle showing the right-angled triangle sign.

The following responses were provided by Mika

According to the response provided by Mika, Mika, a girl aged 15 from Grade 8 could find the squares of given numbers for example the square of 8 is 64, the square of 9 is 81 and the square of12 is 144. Mika could calculate the square root of 100 which is shown at the bottom of the page is 10, the square root of 225 is 15, the square root of 121 is 11 and the square root of 10 is 3,1. The square roots and the squares of numbers were the assumed knowledge in mastering the Pythagoras Theorem during the instructional stage.

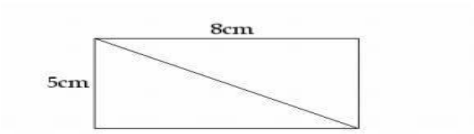




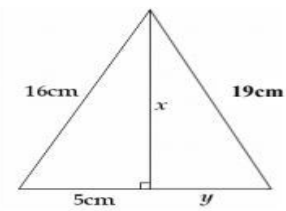
The Analysis

The learners were given statement problems that are related to the Pythagoras theorem. The first question was coded 7 and the learner was required to find the diameter of a given rectangle. The grade 7,8 and 8 learners were asked to respond to the given questions related to the Pythagoras theorem. The learners interviewed were Aids, Erry, Mika, Dee and Why. The questions are given as follows:

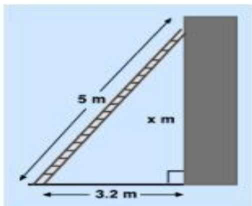
7. Find the length of the diagonal of the rectangle



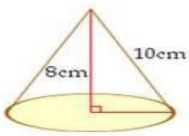
8. Find the unknown sides



9. A 5 metre ladder is positioned 3.2 metres from a building, as shown in the diagram. Will the ladder reach a window which is 4 metres from the ground?



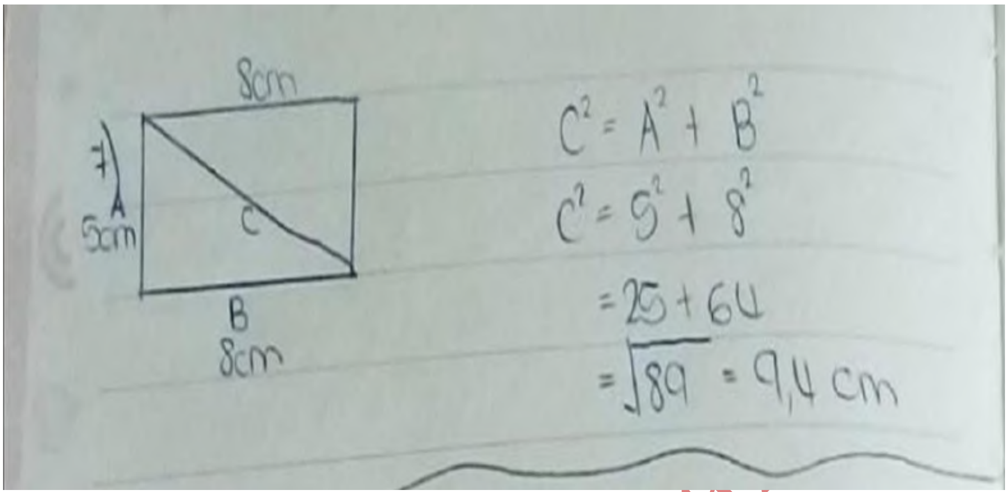
10.



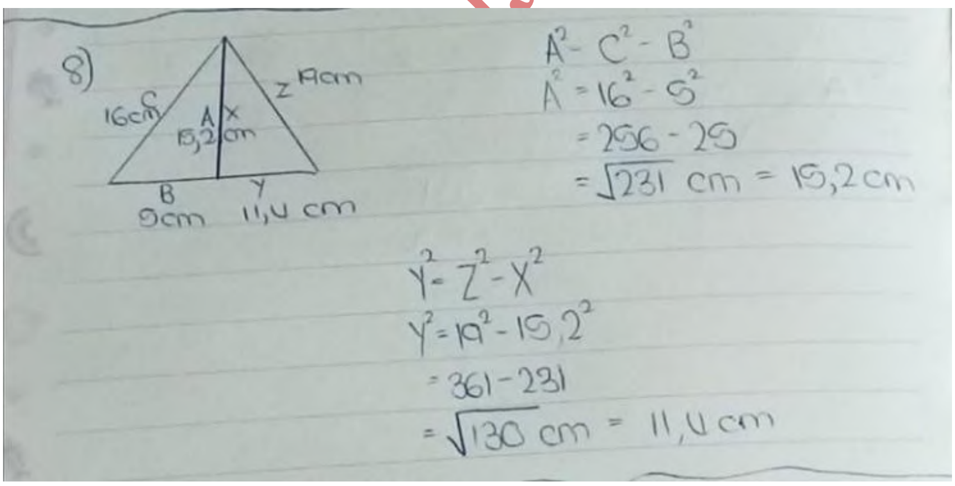
A cone is shown. Find the diameter of the cone.
Hint: the diameter is twice the length of the radius

The following responses were provided by Erry

The first learner to be interviewed was Erry. Erry a girl aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Erry the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Erry, the learner wrote the Pythagoras theorem $c^2=a^2+b^2$.According to Erry the letters were substituted by the numbers $c^2=8^2+5^2$.The analysis shows that Erry could square 8 to get 64 and square 5 to get 25.She could calculate the square root of 89.Erry explained that she used the cell phone to find the square root of 89 as shown in the excerpt below.



The next question was question 8 and the learners were expected to be able to find the missing dimensions of the triangle $=x$ *and* y as shown in the diagram below. According to the responses given by Erry the Pythagoras Theorem could be employed to get the missing dimensions. The following were the responses given by Erry for the question coded 8.The value of C is 9.4 centimetres.

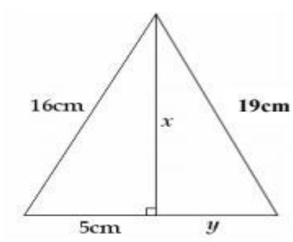


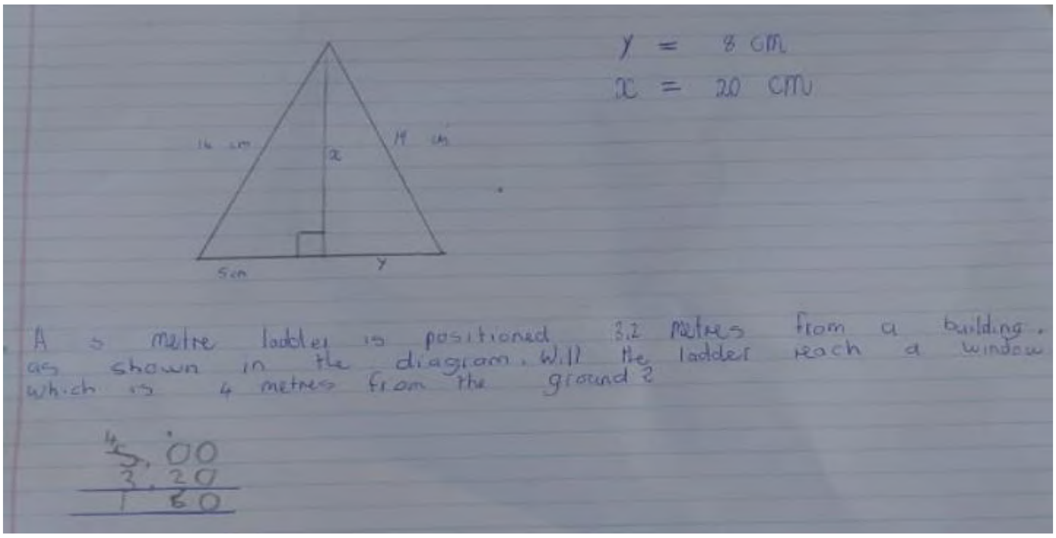
According to Erry the Pythagoras theorem $c^2=b^2+c^2$.This translated into $x^2=z^2-x^2$.The numbers were used to replace the formula and the calculations were done perfectly well.$c^2=b^2+c^2$. Then 16^2+5^2=256-25=231=15,2 cm.

The following responses were provided by Why

The second learner to be interviewed was Why,Why a boy aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Why the length of the rectangle was 8cm and the width was 5cm.According to Why he draws the correct measurements and assumes that since it is given the diagonal then should be measured by the ruler to get the diagonal.According to the explanations given by Why it was possible to understand the Pythagoras theorem for all the questions. He used the construction method and this did not yield correct answers. He draws the triangle given measurements and uses the actual measurement and this shows that he had challenges in using the given formula.

8. Find the unknown sides

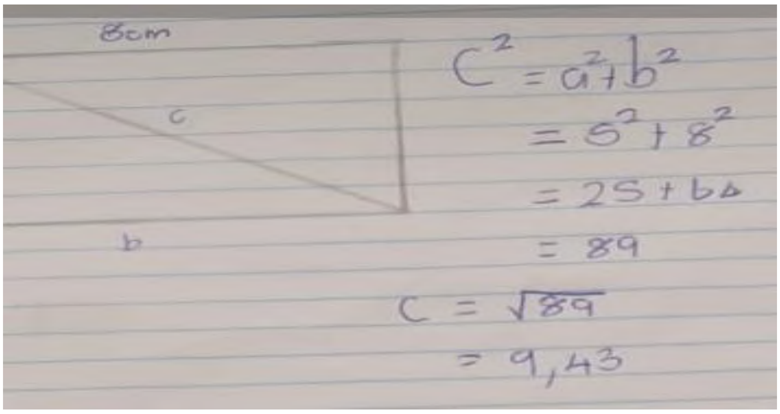




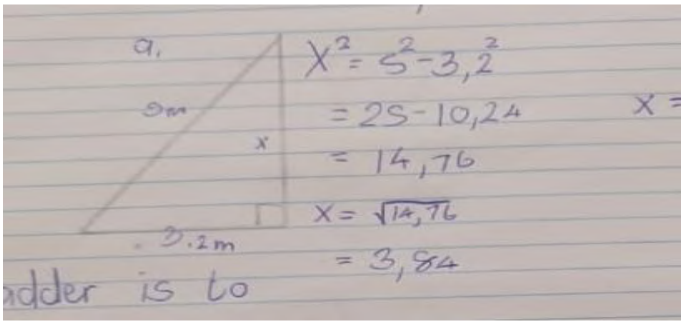
The following responses were provided by Dee

The third learner to be interviewed was Dee. Dee a boy aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According toDee the letters were substituted by the numbers c^2=$8^2 + 5^2$.The analysis shows that Dee could square 8 to get 64 and square 5 to get 25.She could calculate the square root of 89.Dee explained that she used the cell phone to find the square root of 89 as shown in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and then the answer was 9,43 but forgot to write the units of measurement.

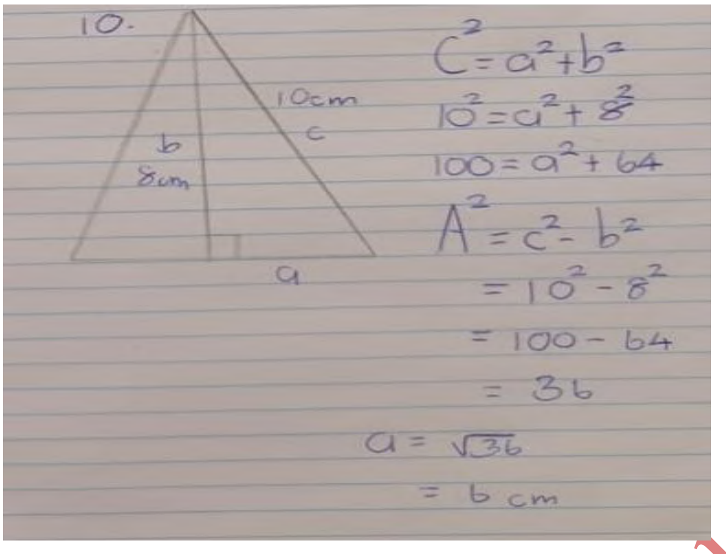
The excerpt according to Dee for number codded 7



According to the responses provided by Dee on number coded 8, the Pythagoras theorem was stated using According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According toDee the letters were substituted by the numbers x^2=$5^2 + 3{,}2^2$.The analysis shows that Dee could square 5to get 25 and square 3.2 to get 10,24. He could calculate the square root of 14,76.Dee explained that she used the cell phone to find the square root of 14,76 as shown in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and obtained 3,84 but forgot to write the units of measurement as shown below. The use of the cell phone could be used to teach the Pythagoras Theorem.



According to the responses provided by Dee on number coded 10, the Pythagoras theorem was stated using According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According toDee the letters were substituted by the numbers c^2=$a^2 + 8^2$.The analysis shows that Dee could square 10 to get 100 and square 8 to get 64.He could calculate change the subject of the formula to.Dee explained that she used the cell phone to find the square root of as shown 36 in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and obtained 6 cm but forgot to write the units of measurement as shown below. The use of the cell phone could be used to teach the Pythagoras Theorem



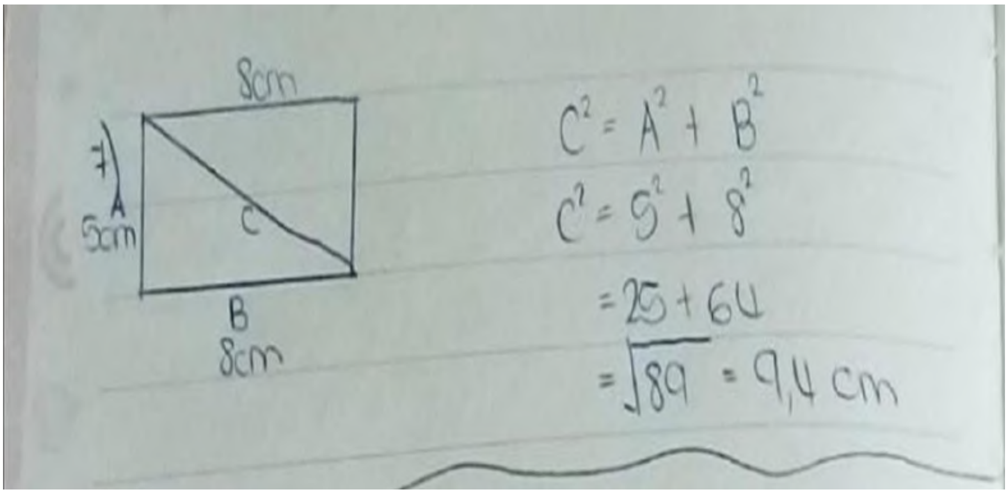
Analysis of the third session

In the third section of the interview, the learners were given statement problems related to the Pythagoras theorem. They read the questions, analyzed their question and answered the questions differently. The following are the responses provided by Dee, Erry, Mika and Why.

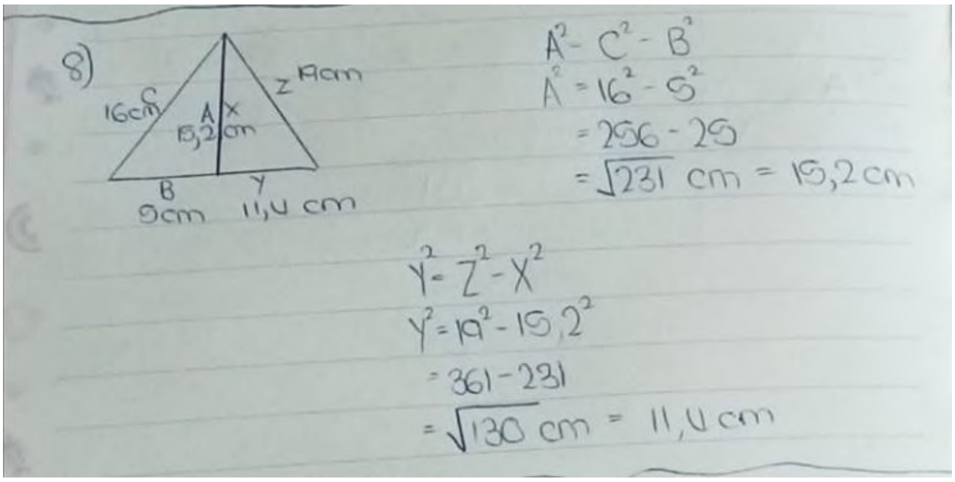
The Analysis for section 3

The learners were given statement problems that are related to the Pythagoras theorem. The first question was coded 7 and the learner was required to find the diameter of a given rectangle. The grade 7,8 and 8 learners were asked to respond to the given questions related to the Pythagoras theorem. The learners interviewed were Aids, Erry, Mika, Dee and Why. The questions given in the interview are given below coded 7,8,9 and 10 as follows:

The first learner to be interviewed was Erry. Erry a girl aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Erry the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Erry, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According to Erry the letters were substituted by the numbers c^2=$8^2 + 5^2$.The analysis shows that Erry could square 8 to get 64 and square 5 to get 25. She could calculate the square root of 89. Erry explained that she used the cell phone to find the square root of 89.

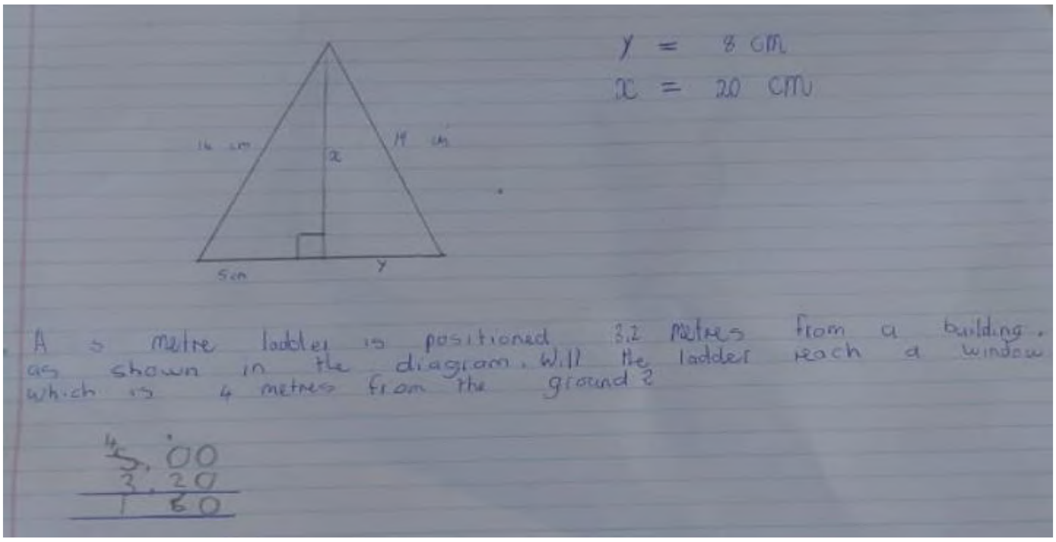


The next question was question 8 and the learners were expected to be able to find the missing dimensions of the triangle $= x$ *and* y as shown in the diagram below. According to the responses given by Erry the Pythagoras Theorem could be employed to get the missing dimensions. The following were the responses given by Erry for the question coded 8. The value of C is 9.4 centimetres.

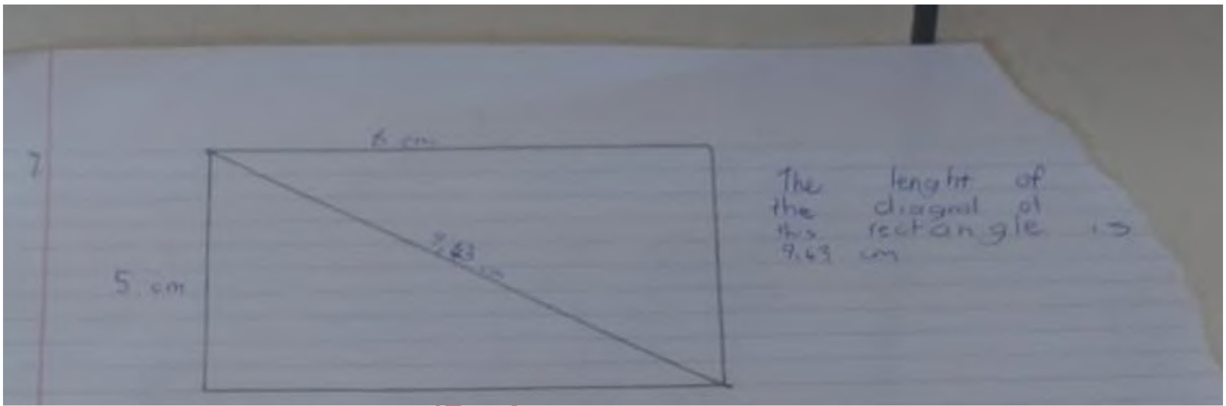


According to Erry the Pythagoras theorem c^2=$b^2 + c^2$.This translated into x^2=$z^2 - x^2$.The numbers were used to replace the formula and the calculations were done perfectly well.c^2=$b^2 + c^2$. Then $16^2 + 5^2$=256-25=231=15,2 cm.

The second learner to be interviewed was Why,Why a boy aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Why the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Why, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According Why the letters were substituted by the numbers c^2=$8^2 + 5^2$.The analysis shows that Why could square 8 get 64 and square 5 get 25. He could calculate the square root of 89.Why explained that she used the cell phone to find the square root of 89 as shown in the excerpt below.

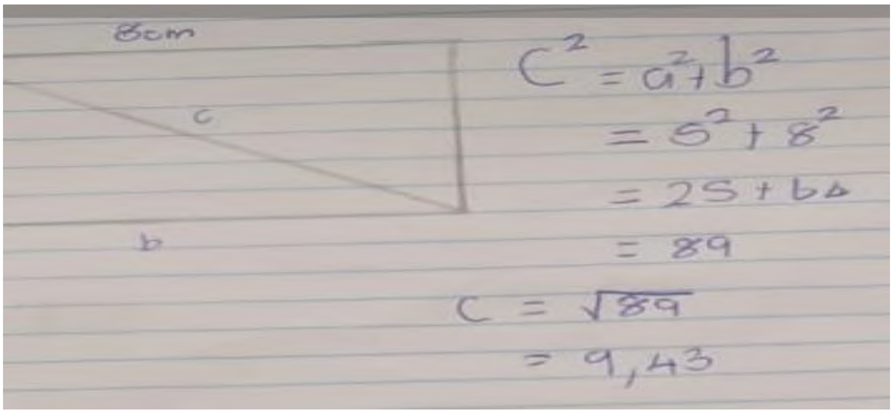


According to Why a rectangle with a length of 8 centimetres and a width of 5 centimetres will have a diagonal 9,64 and this was done by measuring and not by calculation. After a video call, this was explained by the researcher and the formula was then applied by Why to get the correct application of the Pythagoras theorem.

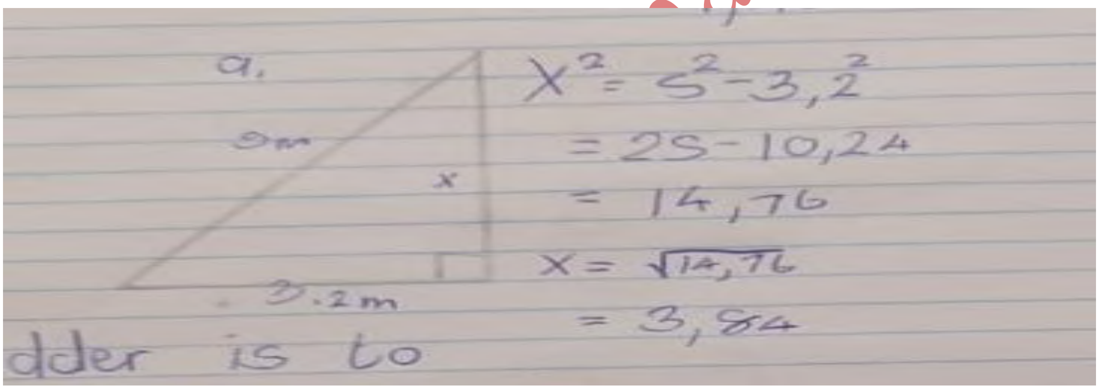


The third learner to be interviewed was Dee. Dee a boy aged 13 from grade 7 read the question and interpreted it into the diagram below. According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem $c^2=a^2+b^2$.According toDee the letters were substituted by the numbers $c^2=8^2+5^2$.The analysis shows that Dee could square 8 to get 64 and square 5 to get 25.She could calculate the square root of 89.Dee explained that she used the cell phone to find the square root of 89 as shown in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and then the answer was 9,43 but forgot to write the units of measurement.

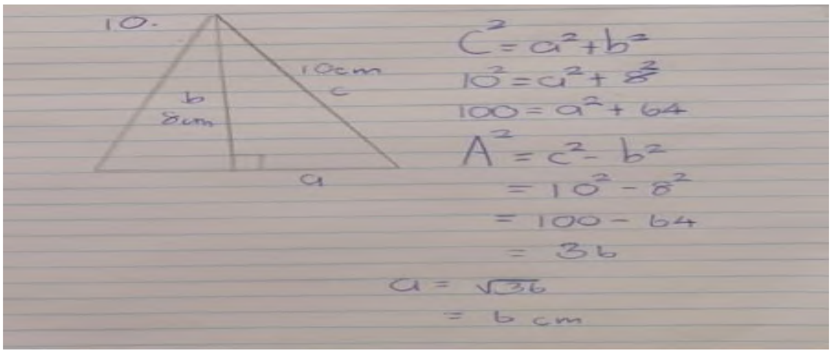
The excerpt according to Dee for number codded 7.



According to the responses provided by Dee on number coded 8, the Pythagoras theorem was stated using According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According toDee the letters were substituted by the numbers x^2=$5^2 + 3{,}2^2$.The analysis shows that Dee could square 5to get 25 and square 3.2 to get 10,24. He could calculate the square root of 14,76.Dee explained that she used the cell phone to find the square root of 14,76 as shown in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and obtained 3,84 but forgot to write the units of measurement as shown below. The use of the cell phone could be used to teach the Pythagoras Theorem.



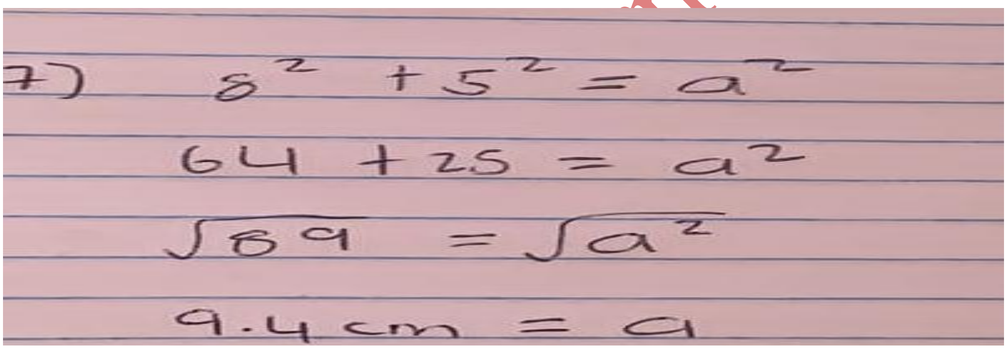
According to the responses provided by Dee on number coded 10, the Pythagoras theorem was stated using According to Dee the length of the rectangle was 8cm and the width was 5cm.The question or the task is to find the value of c which is the hypotenuse. Using the cellphone the question was given to the learner. Corresponding to the responses given by Dee, the learner wrote the Pythagoras theorem c^2=$a^2 + b^2$.According toDee the letters were substituted by the numbers c^2=$a^2 + 8^2$.The analysis shows that Dee could square 10 to get 100 and square 8 to get 64.He could calculate change the subject of the formula to.Dee explained that she used the cell phone to find the square root of as shown 36 in the excerpt below. Corresponding to the work demonstrated by Dee, the diameter of the rectangle could be calculated using the Pythagoras Theorem and obtained 6 cm but forgot to write the units of measurement as shown below. The use of the cell phone could be used to teach the Pythagoras Theorem



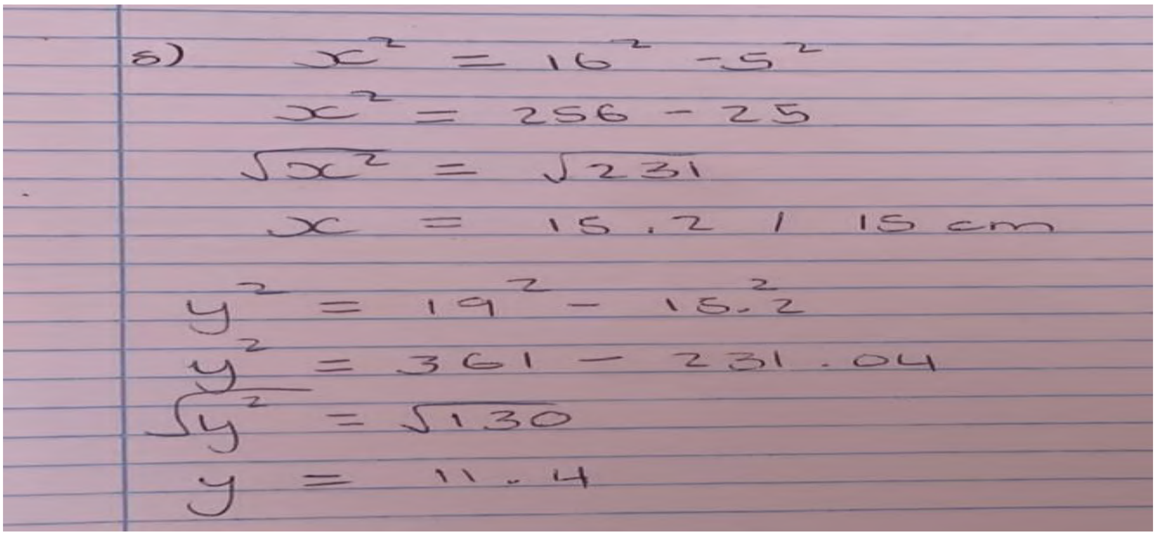
The analysis shows that the use of the cellphone was an effective means of teaching and learning mathematics in the Pythagoras Theorem context.The following was the response provided by Mika.

The responses were given by Mika

The following responses were provided by Mika in the interviews held through the phone.According to Mika,a girl from grade 8, the formula is written down on a separate paper and only the numbers are written following the formula a^2=$8^2 + 5^2$ and she added 64 and 25 finding the total 89.She continues to find the square root of 89 and she writes a is equal to 9.4 cm.According to the work presented by Mika,the Pythagoras Theorem could be taught and learnt through cellphone text and video calls.The instructions were given by the cellphone and the responses were given through the cellphone.The responses given by Mika are shown in the excerpt below for the question coded 7.Although the calculations are correct Mika could have improved her understanding of the Pythagoras theorem by inserting a drawing or illustration of the diagram.



According to the responses provided by Mika responding to the question coded 8,she still does not write the Pythagoras theorem formula and says it has been written already,writes x^2=$16^2 + 5^2$ and simplifies it by finding the square root of 231 which was then simplified to 15,2 and rounded off to the nearest whole number as 15cm as shown in the excerpt below.The question requested for two variables x *and* y.According to Mika's response in the second part of the question, the first part was recorded as y^2=$19 - 15^2$ and then $y^2 = 361 -$ 231,04 and $y^2 = \sqrt{130}$ and y=11.4, the units of measurements were left out but the Pythagoras theorem basics were mastered by Mika.



8) $x^2 = 16^2 - 5^2$

$x^2 = 256 - 25$

$\sqrt{x^2} = \sqrt{231}$

$x = 15,2 / 15 \text{ cm}$

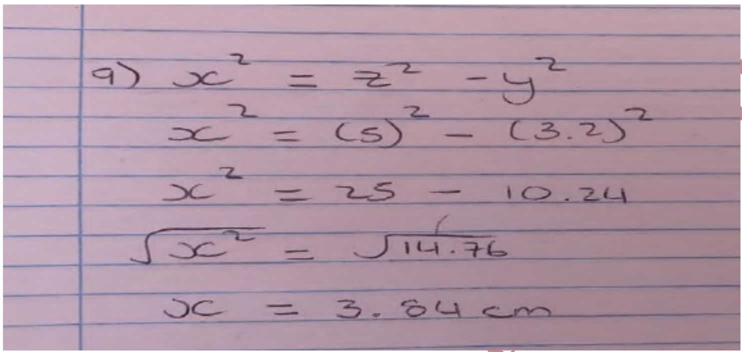
$y^2 = 19^2 - 15.2^2$

$y^2 = 361 - 231.04$

$\sqrt{y^2} = \sqrt{130}$

$y = 11.4$

According to the responses provided by Mika responding to the question coded 9, she still does not write the Pythagoras theorem formula and says it has been written already, writes x^2=$z^2 - y^2$ which was then substituted to $5^2 - 3{,}2^2$and simplified to the square root of 14,76 and x^2 =3,84 centimetres and the Pythagoras theorem basics were mastered by Mikas shown in the excerpts below in the question coded 9 as follows.



9) $x^2 = z^2 - y^2$

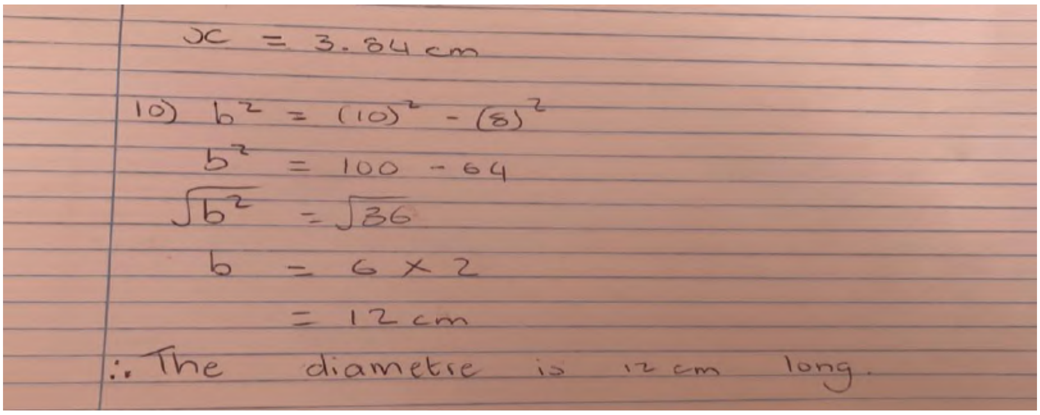
$x^2 = (5)^2 - (3.2)^2$

$x^2 = 25 - 10.24$

$\sqrt{x^2} = \sqrt{14.76}$

$x = 3.84 \text{ cm}$

According to the responses provided by Mika responding to the question coded 10, she still does not write the Pythagoras theorem formula and says it has been written already, writes x^2=$z^2 - y^2$ which was then substituted to $10^2 - 8^2$ and simplified to 100-64 which is equal to $\sqrt{36}$ =6 centimetres and the Pythagoras theorem basics were mastered by Mikas shown in the excerpts below in the question coded 10 as follows.The radius was found and the diameter is twice the radius so she multiplied the result by two to obtain 12centimeteres. According to the work produced by Mika, the Pythagoras theorem could be taught and learnt usich=ng the cellphone as a mode of teaching and learning as shown below.



The study proposes that there are a lot of benefits of using mobile phones to support learners in learning mathematics because they can facilitate learners learning anytime, anywhere, from any source, and at any pace. In other words, mobile phones can support students in learning mathematics with high flexibility and personalizing: each " specific activity " at each suitable time for a group of learners; online mode allows learners to communicate openly and fearlessly as they will be far away from the facilitator.

Findings

The study found out the properties of the right-angled triangle in geometry using the cellphone teaching method.By the end of the interviews, the learners were able to calculate the missing measurements in a right-angled triangle using the cellphone teaching method.The learners like and enjoyed working withcellphones from home as a mode of learning mathematics. The majority of the learners 100% could do all the assumed knowledge operations and 80 % could learn the Pythagoras Theorem were able to find the missing measurements of the triangles using the cellphone learning mode.

There were advantages and disadvantages to using the cell phone as a means for learning The Pythagoras Theorem during times of crisis.

Advantages:

- Social media I powerful tool used for learning the times of crisis.
- Social media can be both used asa communication tool and a recording tool for the progress of the learners.
- The cell phone was used as a transmitter of information between the facilitator and the learner.
- Social media helped the learners to work independently and communicate with the facilitator.

Disadvantages

- Some learners did not complete their work because there was no physical close supervision/monitoring.
- Some learners had problems with data.
- The other day there was no electricity and the wifi was down on the part of the researcher.

Conclusion

The results clearly show that a cellphone is a powerful tool for teaching and learning during times of crisis. The study sought to explore the potential of mobile phones to improve student's access to learning material of the school environment during and after times of crisis communication teaching. Specifically, the study sought to explore ways of increasing contact between learners and content in mathematics specifically the Pythagoras Theorem. The study was also interested in establishing the views of learners about being taught through mobile phones after the standard school hours and on the impact of these devices on the educational process. The results of the study proved that both mobile phones through texting, video calls and snapshots are viable activities to use for mobile distance teaching and learning purposes. The study also demonstrated that text messaging in the form of SMSs and instant messaging in the form of can be used as mobile applications for teaching and learning Mathematics in the senior phase in Johannesburg North District.

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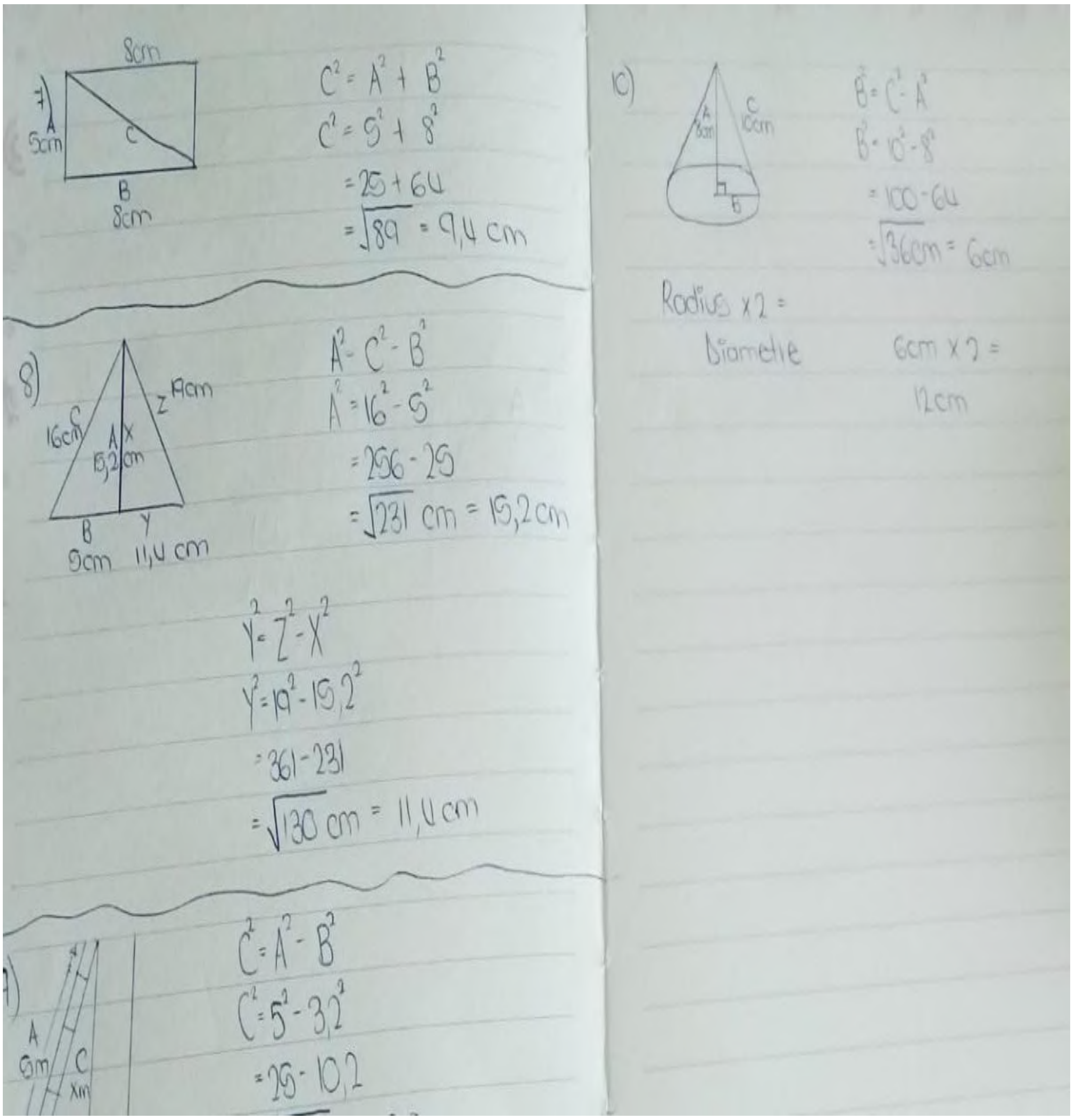
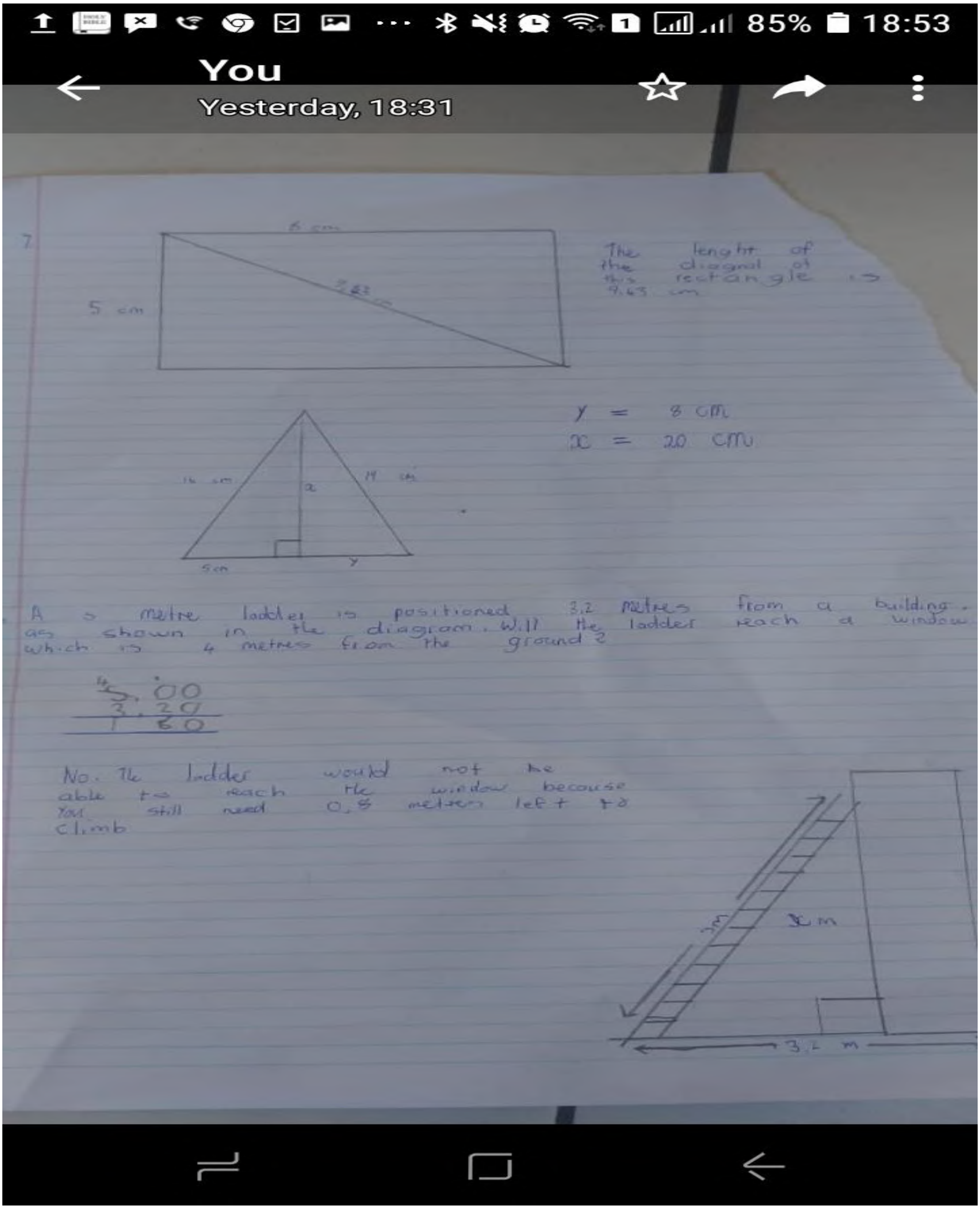
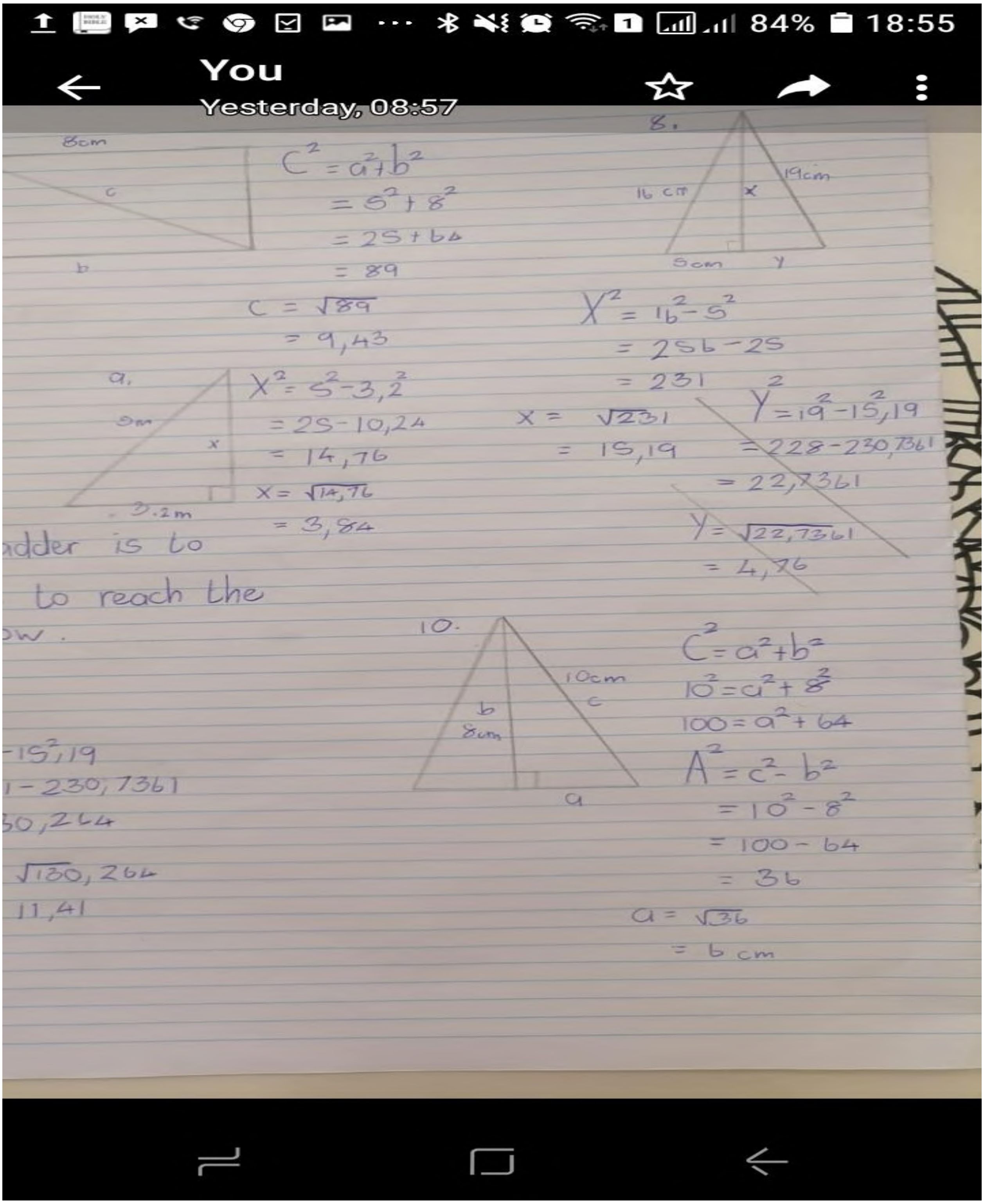
Appendix AWork produced by Erry



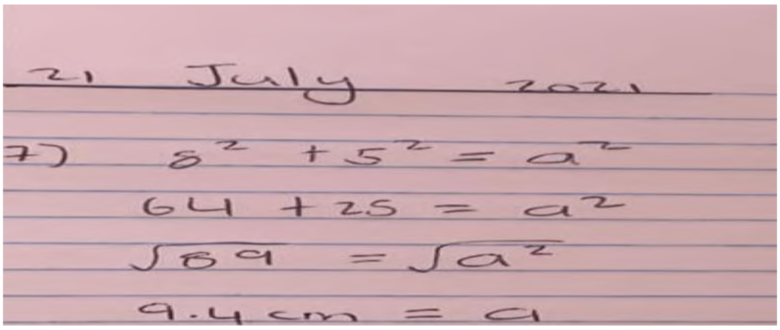
Work Produced by Why



The work produced by Dee



The responses were given by Mika



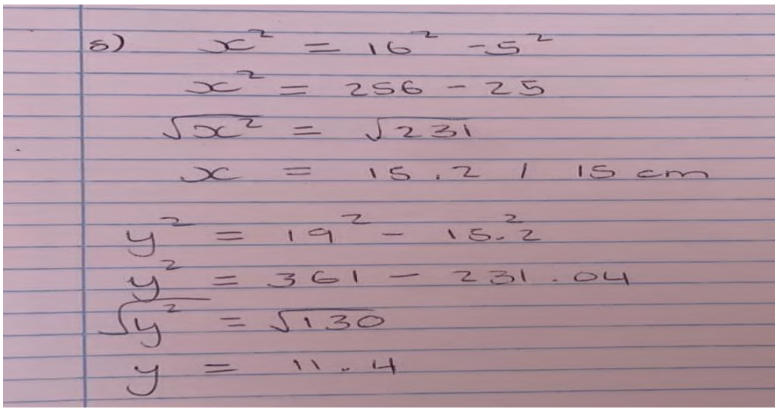
21 July 2021

7) $8^2 + 5^2 = a^2$

$64 + 25 = a^2$

$\sqrt{89} = \sqrt{a^2}$

$9.4\text{cm} = a$



8) $x^2 = 16^2 - 5^2$

$x^2 = 256 - 25$

$\sqrt{x^2} = \sqrt{231}$

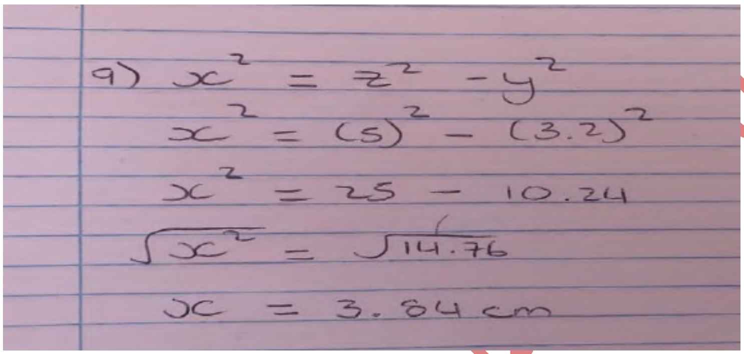
$x = 15.2$ / 15 cm

$y^2 = 19^2 - 15.2^2$

$y^2 = 361 - 231.04$

$\sqrt{y^2} = \sqrt{130}$

$y = 11.4$



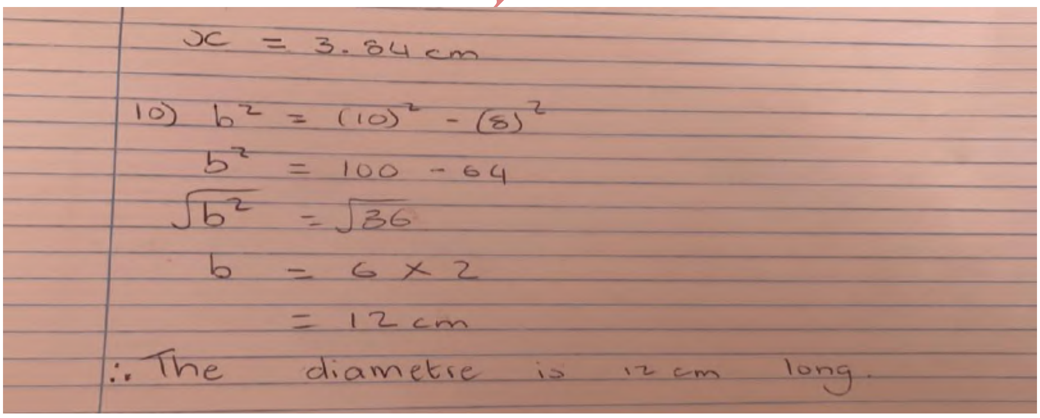
9) $x^2 = z^2 - y^2$

$x^2 = (5)^2 - (3.2)^2$

$x^2 = 25 - 10.24$

$\sqrt{x^2} = \sqrt{14.76}$

$x = 3.84$ cm



$x = 3.84$ cm

10) $b^2 = (10)^2 - (8)^2$

$b^2 = 100 - 64$

$\sqrt{b^2} = \sqrt{36}$

$b = 6 \times 2$

$= 12$ cm

$\therefore$ The diametre is 12 cm long.

The last question in the interview

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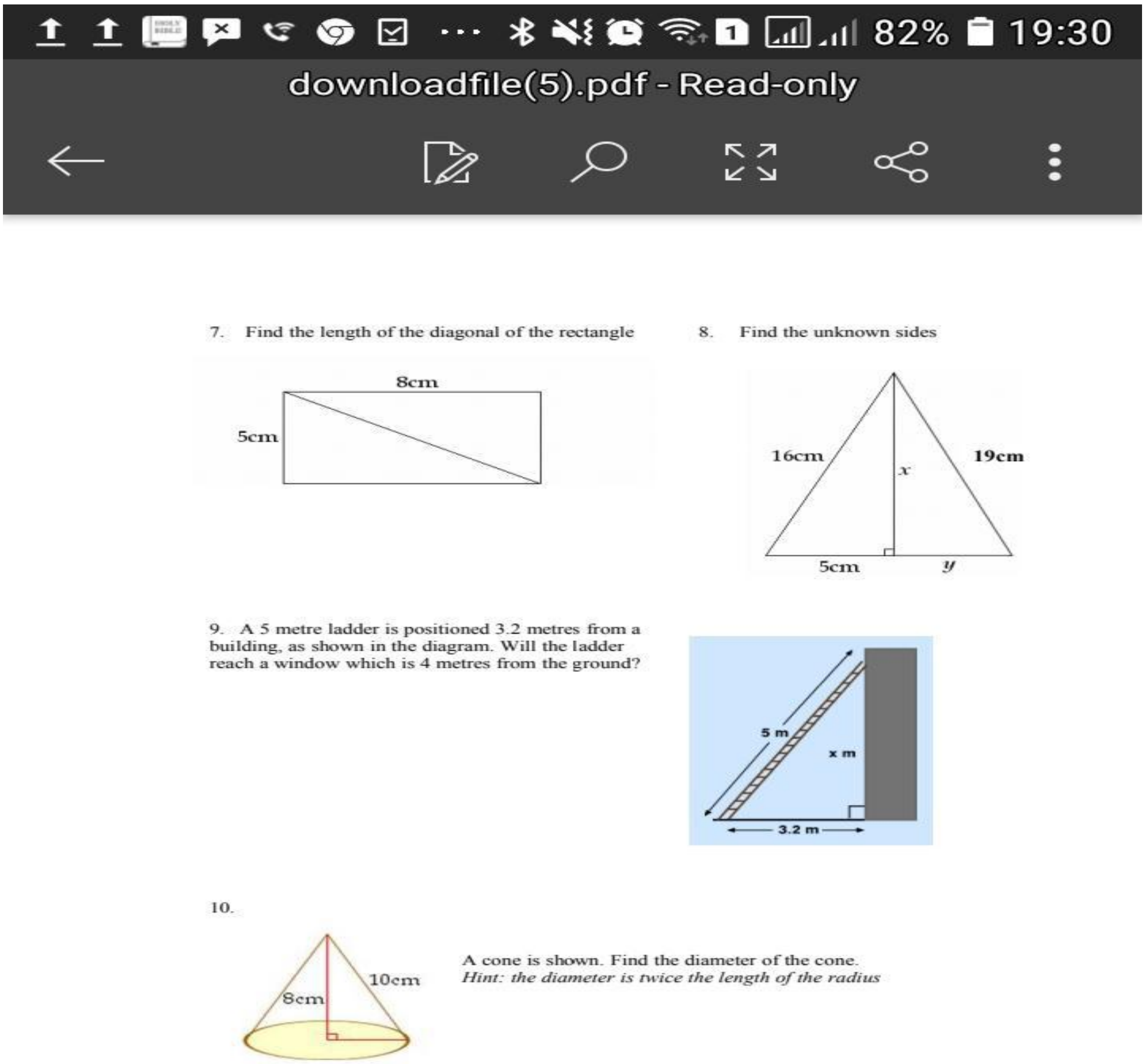


82% 19:30

downloadfile(5).pdf - Read-only

7. Find the length of the diagonal of the rectangle

8cm
5cm

8. Find the unknown sides

16cm
19cm
x
5cm
y

9. A 5 metre ladder is positioned 3.2 metres from a building, as shown in the diagram. Will the ladder reach a window which is 4 metres from the ground?

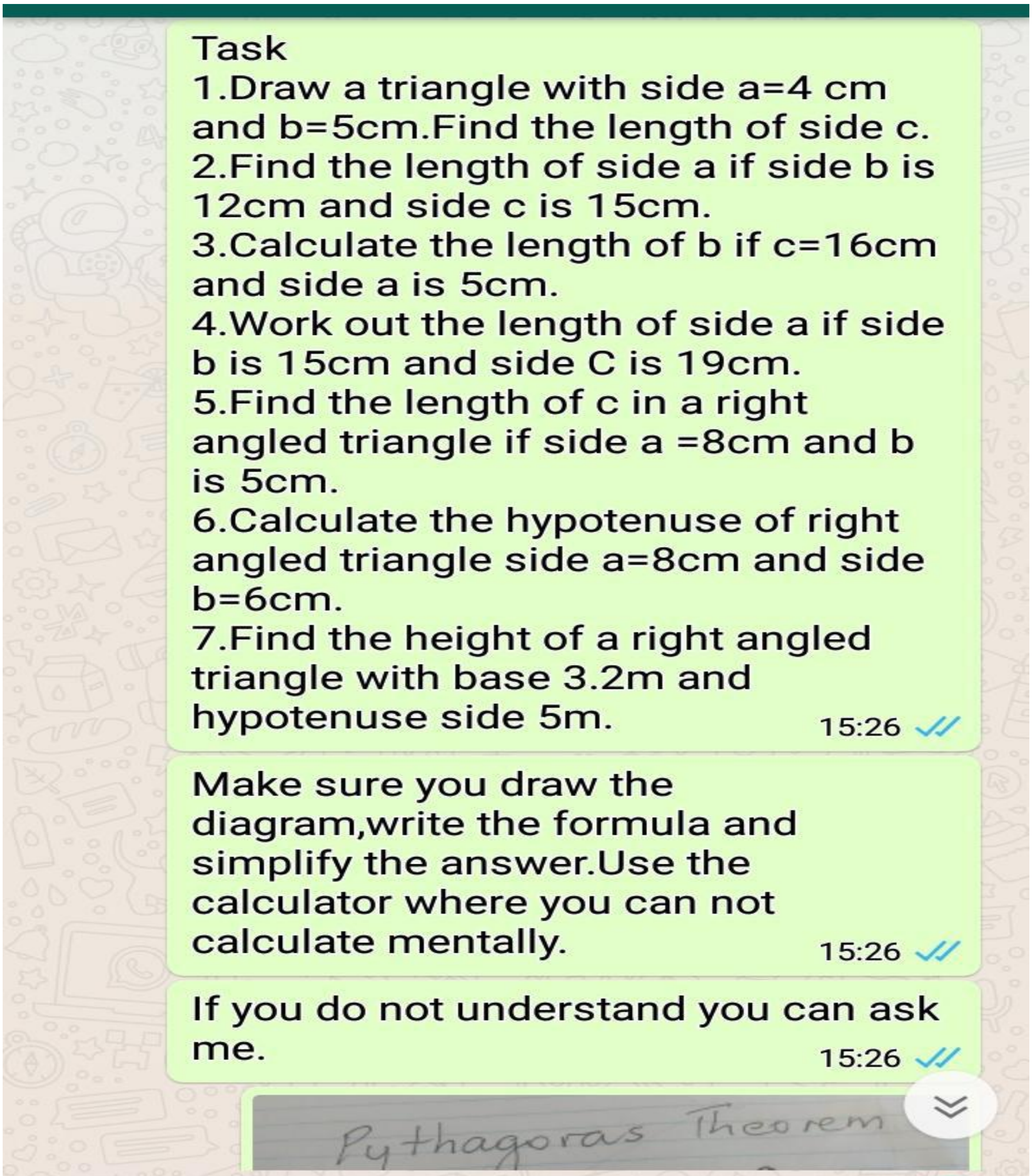
5 m
x m
3.2 m

10.

10cm
8cm

A cone is shown. Find the diameter of the cone.
Hint: the diameter is twice the length of the radius

The questions for task 1



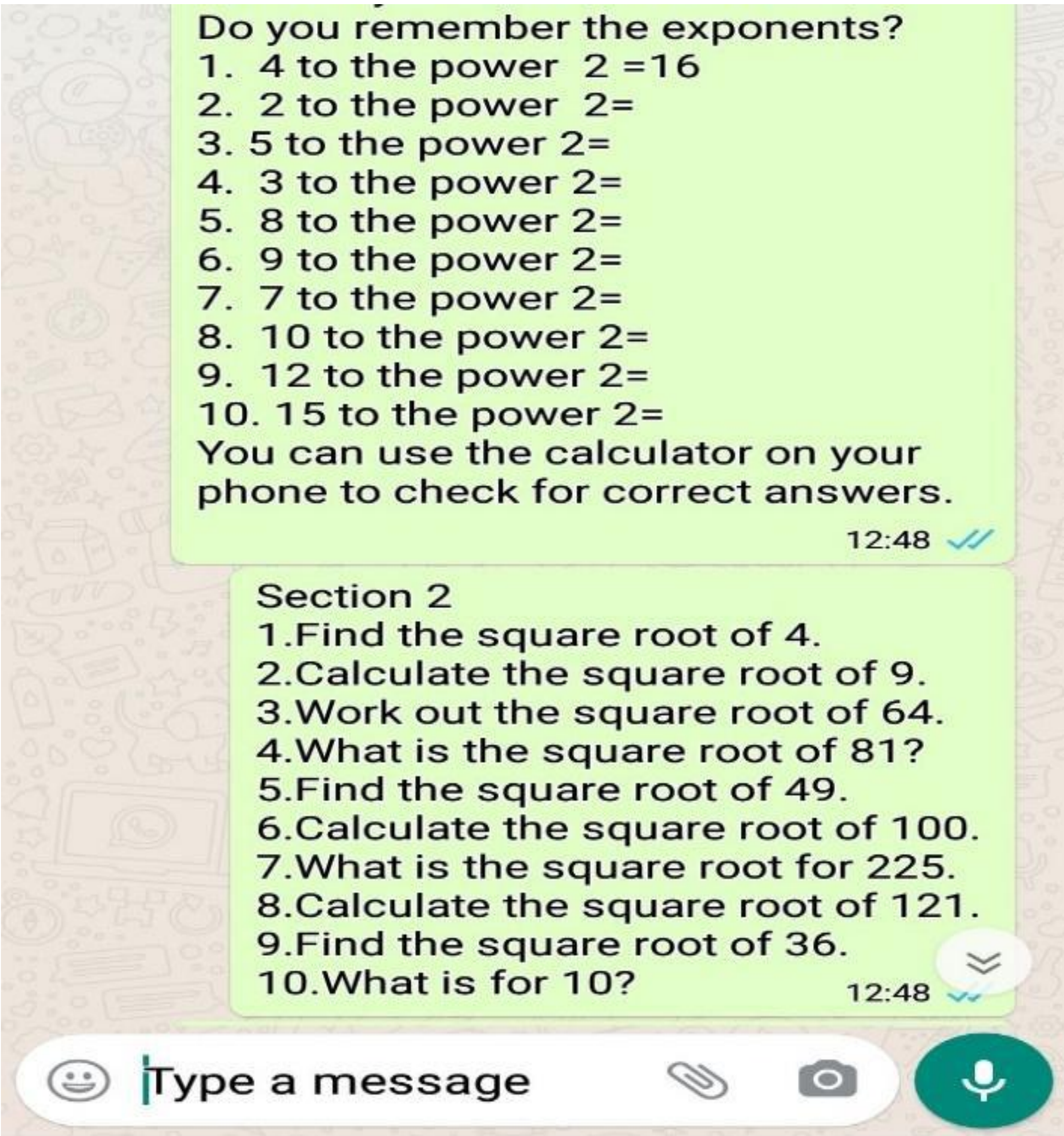
Task
1.Draw a triangle with side a=4 cm and b=5cm.Find the length of side c.
2.Find the length of side a if side b is 12cm and side c is 15cm.
3.Calculate the length of b if c=16cm and side a is 5cm.
4.Work out the length of side a if side b is 15cm and side C is 19cm.
5.Find the length of c in a right angled triangle if side a =8cm and b is 5cm.
6.Calculate the hypotenuse of right angled triangle side a=8cm and side b=6cm.
7.Find the height of a right angled triangle with base 3.2m and hypotenuse side 5m.
15:26

Make sure you draw the diagram,write the formula and simplify the answer.Use the calculator where you can not calculate mentally.
15:26

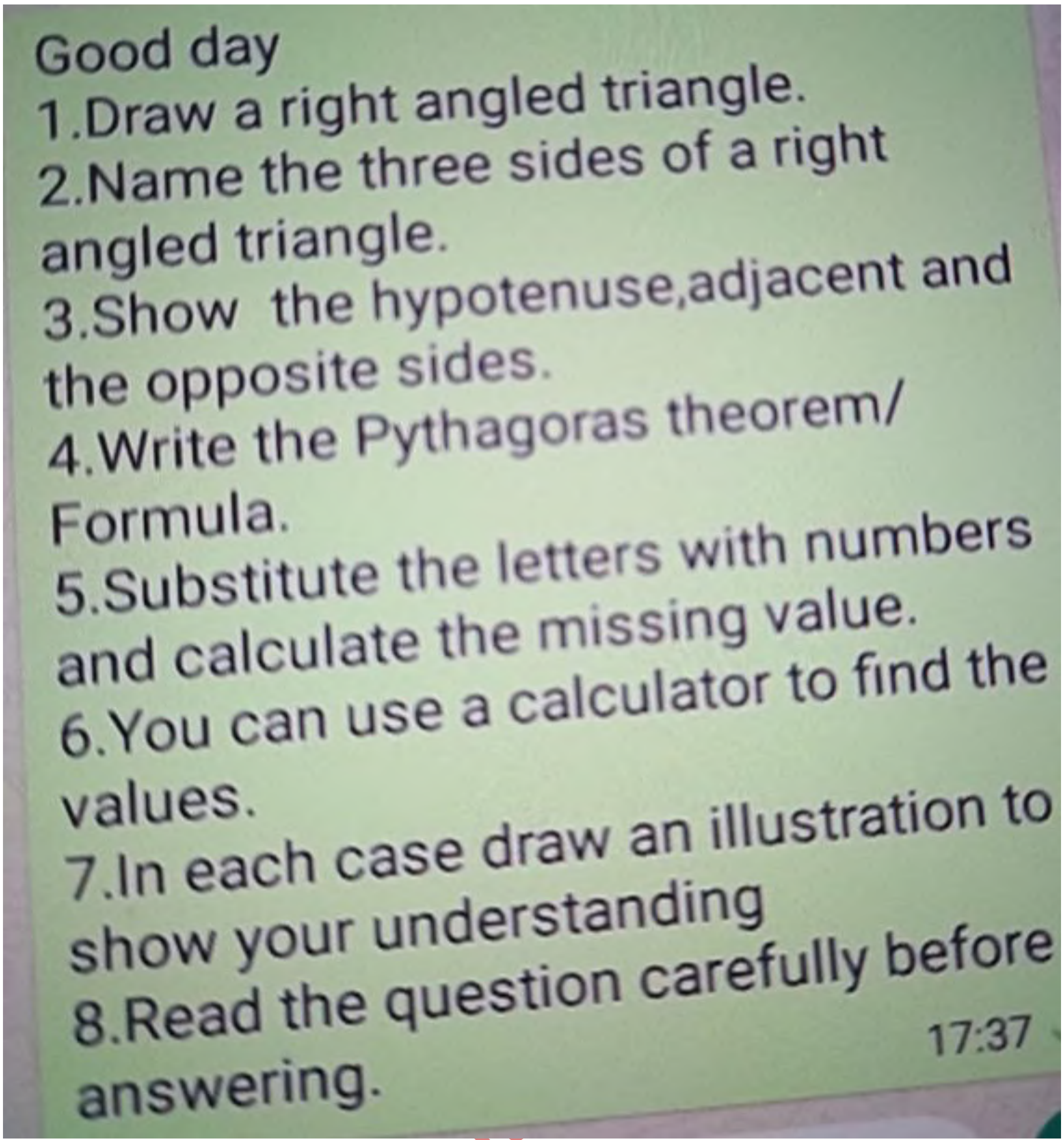
If you do not understand you can ask me.
15:26

Pythagoras Theorem

The interview questions for Assumed knowledge



Instructional level



Good day
1.Draw a right angled triangle.
2.Name the three sides of a right angled triangle.
3.Show the hypotenuse,adjacent and the opposite sides.
4.Write the Pythagoras theorem/ Formula.
5.Substitute the letters with numbers and calculate the missing value.
6.You can use a calculator to find the values.
7.In each case draw an illustration to show your understanding
8.Read the question carefully before answering.
17:37