Tutorial Letter 101/3/2018

Pre-Algebra and Algebra in Intermediate and Senior Mathematics

MAE201M

Semesters 1 and 2

Department of Mathematics Education

This tutorial letter contains important information about your module.

BARCODE

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1 INTRODUCTION

Dear Student
We are pleased to welcome you to this module and hope that you will find it both interesting and rewarding. We will do our best to make your study of this module successful. You will be well on your way to success if you start studying early in the semester and resolve to do the assignment(s) properly.

You will receive a number of tutorial letters during the semester. A tutorial letter is our way of communicating with you about teaching, learning and assessment.

This tutorial letter contains important information about the scheme of work, resources and assignments for this module. We urge you to read it carefully and to keep it at hand when working through the study material, preparing the assignment(s), preparing for the examination and addressing questions to your lecturers.

In this tutorial letter (101), you will find the assignments and assessment criteria as well as instructions on the preparation and submission of the assignments. It also provides all the information you need with regard to the prescribed study material and other resources and how to obtain them. Please study this information carefully and make sure that you obtain the prescribed material as soon as possible.

We have also included certain general and administrative information about this module. Please study this section of the tutorial letter carefully.

Right from the start, we would like to point out that **you must read all the tutorial letters** you receive during the semester **immediately and carefully**, as they always contain important and, sometimes, urgent information.

We hope that you will enjoy this module and wish you all the best!

2 PURPOSE AND OUTCOMES

2.1 Purpose

The purpose of this module, Pre-Algebra and Algebra in Intermediate and Senior Mathematics, is to:

- develop your own number skills, make you aware of number patterns, and to describe these number patterns by means of algebraic formulae. We also want to extend your teaching practice by including some fresh and exciting principles so that you will be able to develop the number and algebraic skills of your learners.

2.2 Outcomes

Outcomes of the module are to:

- to be able to explain what algebra is
- to be able to develop algebraic reasoning through numerical and geometrical patterns
- to be able to discuss linear equations and inequalities, quadratic equations and expressions
- to be able to explain, develop and represent the function concept

3 LECTURER(S) AND CONTACT DETAILS

3.1 Lecturer(s)

The following contact details are provided for your convenience (The dialling code for Pretoria is 012. (For foreign students: dial +27 12 ….)
Lecturer

Mr Gabriel Mphuthi
AJH van der Walt Building 7-19, Unisa.
012 429 4800 (Work) (08:00 - 16:00)
Email: Emphutg@unisa.ac.za

You should have your student number at hand when you contact the University by telephone.

3.2 Department

The following contact details are for the department under which this module is offered.

Department of Mathematics Education
(College of Education)
P O Box 392
Unisa
0003
Fax no. 086 762 0768

3.3 University

If you need to contact the University about matters not related to the content of this module, please consult the publication *Study@Unisa* that you received with your study material. This booklet contains information on how to contact the University (e.g. to whom you can write for different queries, important telephone and fax numbers, addresses and details of the times certain facilities are open).
Always have your student number at hand when you contact the University.
Please note that all administrative enquiries should be directed to the *Study@Unisa***.**

4 RESOURCES

4.1 Prescribed books

Your prescribed textbook for this module for this year is:

Van de Walle, JA., Karp, K.S. and Bay-Williams, J.M. (2016). *Elementary and middle school Mathematics – teaching developmentally*. 9th edition. New Jersey: Pearson Education.
You must buy the prescribed book.



This book will be used for all of the modules of this course. It is written in a user-friendly style and uses an interactive approach. It is an American textbook but, in our opinion, it deals more comprehensively with the concepts and skills of the Mathematics subject than many of the South African books currently available. The textbook is based on the problem-solving approach, which allows you to teach Mathematics in a real-world context and fits in with the ethos of CAPS.

Earlier editions of the prescribed book, if available, may still be used. There are no major differences between the 8th& 9th editions of the prescribed book *Elementary and middle school Mathematics – teaching developmentally* by Van de Walle et al and below is a table that indicates the correspondence between them.

Eighth Edition (2014)	Ninth Edition (2016)
Chapter 1 (p.1)	Chapter 1 (p.25)
Chapter 2 (p.13)	Chapter 2 (p.37)
Chapter 3 (p.33)	Chapter 3 (p.57)
Chapter 4 (p.53)	Chapter 4 (p.81)
Chapter 5 (p.81)	Chapter 5 (p.108)
Chapter 6 (p.99)	Chapter 6 (p.128)
Chapter 7 (p.119)	Chapter 7 (p.151)
Chapter 8 (p.135)	Chapter 8 (p.166)
Chapter 9 (p.157)	Chapter 9 (p.191)
Chapter 10 (p.181)	Chapter 10 (p.218)
Chapter 11(p.203)	Chapter 11(p.246)
Chapter 12(p.229)	Chapter 12(p.271)
Chapter 13 (p.251)	Chapter 13 (p.301)
Chapter 14 (p.275)	Chapter 14 (p.323)
Chapter 15 (p.309)	Chapter 15 (p.363)
Chapter 16 (p.335)	Chapter 16 (p.395)
Chapter 17 (p.359)	Chapter 17 (p.427)
Chapter 18 (p.379)	Chapter 18 (p.453)
Chapter 19 (p.397)	Chapter 19 (p.477)
Chapter 20 (p.425)	Chapter 20 (p.512)
Chapter 21(p.459)	Chapter 21(p.550)
Chapter 22 (p.481)	Chapter 22 (p.582)
Chapter 23 (p.501)	Chapter 23 (p.606)
Appendix: Standards for Mathematical Practice (p.521)	Appendix A (A-1)
Appendix: Standards for Teaching Mathematics (p.523)	Appendix B (A-5)
Appendix: Guide to Blackline Masters (p.525)	Appendix C (A-7)
	Appendix D (A-13)
References (537)	References (R-1)
Index (557)	Index (I-1)

4.2 Recommended books

There are no recommended books for this module. We recommend you to read widely in order to keep abreast with contemporary mathematics education literature.

4.3 Electronic reserves (e-reserves)

There are no e–Reserves for this module.

4.4 Library services and resources information

For brief information, go to www.unisa.ac.za/brochures/studies

For detailed information, go to http://www.unisa.ac.za/library. For research support and services of personal librarians, click on "Research support".

The library has compiled a number of library guides:

- finding recommended reading in the print collection and e-reserves – http://libguides.unisa.ac.za/request/undergrad
- requesting material – http://libguides.unisa.ac.za/request/request
- postgraduate information services – http://libguides.unisa.ac.za/request/postgrad

- finding, obtaining and using library resources and tools to assist in doing research – http://libguides.unisa.ac.za/Research_Skills
- how to contact the library/finding us on social media/frequently asked questions – http://libguides.unisa.ac.za/ask

You will be required to provide your login details, namely your student number and myUnisa password, in order to access the library's online resources and services. This will enable you to:

- view or print your electronic course material
- request library material
- view and renew your library material
- use the library's e-resources

Requesting books

Students are expected to purchase their own copies of the **prescribed books** listed in Tutorial Letters 101. A limited number of copies are housed in Unisa's libraries, subject to each branch library's lending regulations. Problems experienced in obtaining copies from booksellers should be directed to the Prescribed Book section at e-mail vospresc@unisa.ac.za or telephone +27 12 429 4152.

Electronic requests

The preferred way of requesting **recommended or additional books** is **online** via the library's catalogue. Go to http://oasis.unisa.ac.za; or via myUnisa, go to http://my.unisa.ac.za> Login > Library > Library catalogue; or for mobile access (AirPAC), go to http://oasis.unisa.ac.za/airpac.

Telephonic requests

This can be done on +27 12 429 3133.

Postal requests

Books may also be requested by completing one library book **request card** for each book. Request cards are included in your study package. These should be mailed to:
The Head: Request Services
Department of Library Services
PO Box 392
UNISA
0003

or faxed to +27 12 429 8128.

Enquiries about requested books should be sent to bib-circ@unisa.ac.za. Please note that requests should not be sent to this e-mail address, it is for enquiries.
Telephonic enquiries can be made at +27 12 429 3133/3134; there is also an after-hour voicemail service available at these numbers.

Requesting journal articles

Electronic course material or e-Reserves

Recommended material can be downloaded from the library's catalogue at http://oasis.unisa.ac.za. Under *search options*, click on *Course code search* and type in your course code, for example CST1501. Click on the *Electronic reserves* for the current year. The recommended articles are available in PDF (portable document format).

The **Adobe Reader** should be loaded on your computer so that you can view or print scanned PDF documents. This can be done free of charge at http://www.adobe.com.

Additional journal articles
The preferred way of requesting journal articles is **online** via the library's catalogue.
Go to http://oasis.unisa.ac.za; or via myUnisa, go to http://my.unisa.ac.za> Login > Library > Library catalogue; or for mobile access (AirPAC), go to http://oasis.unisa.ac.za/airpac.

Telephonic requests
Telephonic requests can be made at +27 12 429 3133/3134.

Postal requests
Journal articles may also be requested by completing an article **request card** for each item. These should be mailed to the same address as postal requests above or faxed to +27 12 429 8128.
Enquiries about requested articles should be addressed to bib-circ@unisa.ac.za and telephonic enquiries can be made at +27 12 429 3432.

Requesting literature searches
You may request a list of references on your topic from the library's information search librarians if you are enrolled for an undergraduate course which has a research essay. To request a literature search, go to the catalogue's homepage, and click on *Request a Literature Search*, fill in the form and return it to the address provided.

Unisa Library's services

The **Study @ Unisa** booklet, which is part of your registration package, lists all the services offered by the Unisa Library.
(See http://www.unisa.ac.za/contents/myStudies/docs/myStudies_unisa2018.pdf.)

5 STUDENT SUPPORT SERVICES

For information on the various student support systems and services available at Unisa (e.g. student counseling, tutorial classes, language support), please consult the publication *Study@Unisa,* which you received with your study material.

5.1 Study groups

It is advisable to have contact with fellow students. One way to do this is to form study groups. The addresses of students in your area may be obtained from the following department:
Directorate: Student Administration and Registration
PO Box 392
UNISA
0003

5.2 *my*Unisa

If you have access to a computer that is linked to the internet, you can quickly access resources and information at the University. The *MyUnisa* learning management system is Unisa's online campus that will help you to communicate with your lecturers, with other students and with the administrative departments of Unisa – all through the computer and the internet.
To go to the *my*Unisa website, start at the main Unisa website, http://www.unisa.ac.za, and then click on the "Login to *my*Unisa" link on the right-hand side of the screen. This should take you to the *my*Unisa website. You can also go there directly by typing in http://my.unisa.ac.za.
Please consult the publication *Study @ Unisa,* which you received with your study material, for more information on *my*Unisa.

5.3 Tutorials

At the moment, we offer face-to-face tutorials at regional learning centres across South Africa. A tutor can assist you to understand your study material, approach your assignments correctly, and offer you more opportunities for practicing skills, and so on. We would like to start offering this service online for students who choose this option. We would also like start offering a tutor connection to students who have no access to our learning centres or the internet, so that they at least have someone who can help them on request.
A **tutorial** is a regular meeting of students under the leadership of a tutor. The tutor leads you through aspects of the study material with which you are experiencing difficulties.
NB: Please refer to:

- Tutorial Letter MAE201M/301 for more detailed information
- https://my.unisa.ac.za for tutorials available at Unisa learning centres throughout the country — click on the link

5.4 Videoconferencing

Unisa is currently providing tutorials by means of videoconferencing at some of its learning centres. This mode of delivery will be used as and when necessary.
Videoconferencing

- provides “live” tutorial support for learners who live in remote areas (where the facilities are available)
- is a viable technology for providing quality tutorial support while reducing costs. Research has shown that there is “no significant difference” between the results obtained by distance learners and those obtained by students who have been taught in a traditional face-to-face environment

5.5 Free computer and internet access

Unisa has entered into partnerships with establishments (referred to as Telecentres) in various locations across South Africa to enable you (as a Unisa student) free access to computers and the Internet. This access enables you to conduct the following academic related activities: registration; online submission of assignments; engaging in e-tutoring activities and signature courses; etc. Please note that any other activity outside of these are for your own costing e.g. printing, photocopying, etc. For more information on the Telecentre nearest to you, please visit www.unisa.ac.za/telecentres.

6 STUDY PLAN

Use the *Study@Unisa* brochure for general time management and planning skills.

7 PRACTICAL WORK AND WORK-INTEGRATED LEARNING

This module will assist you in the planning of your relevant teaching practice lessons on mathematics in the Intermediate and Senior Phase.

8 ASSESSMENT

8.1 Assessment criteria

When assessing your assignments, we will focus on the following:

- Your understanding of the question
- Your ability to reason and accurately perform meaningful computations
- Relevance in answering the question

- Your ability to give examples that enable learners to like and understand mathematical concepts
- Mistakes in calculation or reasoning, or any mathematical error, for which marks will be deducted

8.2 Assessment plan

Assignments are seen as part of the learning material for this module. As you do the assignment, study the reading texts, consult other resources, discuss the work with fellow students or tutors or do research, you are actively engaged in learning. Looking at the assessment criteria given for assignments will help you to understand what is required of you more clearly.
In some cases, additional assessment might be available on the *my*Unisa site for your module. For students attending tutorial sessions, tutors may also set additional tasks and give feedback in class.
There are **two** (2) assignments per semester. Assignment 01 contributes 20% and assignment 02 contributes 80%to the year mark, see table below.

Assignment	Type	Marks	Marks (%)	Contribution to year mark (%)
01	Multiple Choice	10	100	20
02	Written	100	100	80

PLEASE NOTE: **VERY IMPORTANT**

- The submission of Assignment 01 is **compulsory for examination admission**.
- Please note that all assignments are **essential for your year mark** and they have to be submitted on or before their respective due dates.
- The assignments have been designed not only to guide you through the learning material, but also to address the phase you are teaching. The nature of the module requires that the students study and cover a wide spectrum of module related knowledge. The content specified in the module is delivered in a developmental format. As a result, knowledge development for this module is addressed in the form of assignments. As you do the assignments, you will get an opportunity to engage strongly with the content. However, the lecturer will sample certain questions (items) in the assignment for marking purposes, while others will not be marked. It is only the marked section of the assignment that will be used to compute the semester mark for each student. This arrangement is meant to encourage each student to study all sections (topics) of the module as the knowledge of all these sections will be required for examination purposes. You are therefore advised to develop your own study schedule (plan, organise yourself and manage your time properly) and begin assignments soon after you received your study material.

Year mark

The year mark contributes **20%** of the final mark. It is composed of the marks obtained in each assignment. Although each assignment is converted to a percentage, this mark will be converted to a mark out of 4 for assignment 01 and out of 16 for assignment 02. By handing in assignments, you can work towards a substantial year mark. The exam mark, however, carries the most weight.

Assignment	Type	Marks (%)	Weight (%)	Assignment Mark	Contribution to final mark (%)	
01	Multiple Choice	100	20	20	20	4
02	Written	100	80	80	20	16

Exam mark

The exam mark contributes **80%** of the final mark.
The mark that is obtained in the final examination will be converted to a mark out of 80.

Final mark
The final mark consists out of the year mark (20%), plus the exam mark (80%). In order to pass this course, you must obtain a final mark of at least 50%.

The summary of year mark and the examination mark is as follows:

Assignment 01 **(A1)**	4%
Assignment 02 **(A2)**	16%
Total Assignment Mark (year/semester mark) **= A1 + A2 (YM)**	20%
Examination mark **(EM)**	80%
Final Mark = EM + YM	100%

The higher your semester mark, the better chance you have to pass the module. To pass this module you need a minimum of 50% final mark. Spend time, and put a lot of effort into Assignments.
Please make sure that your assignments reach the university well before the time.

8.3 Assignment numbers

8.3.1 General assignment numbers

Assignments are numbered consecutively per module, starting from 01. This module requires two assignments which have to be submitted for the semester. You are compelled to number the assignments as they are numbered in this tutorial letter. Incorrect numbering will result in assignments being delayed and may be lost in the system.

8.3.2 Unique assignment numbers

Unique assignment numbers have to be used for multiple choice as well as for written assignments. Each assignment has a different unique number; please use the unique assignment numbers given in this tutorial letter (see the table below).

8.4 Assignment due dates

The following assignments are compulsory and must be submitted:

Semester 1	Unique number	Due date
Assignment 01 Active student : Exam admission	708962	20 February 2018
Assignment 02	713518	20 March 2018
Semester 2	Unique number	Due date
Assignment 01 Active student : Exam admission	893687	07 August 2018
Assignment 02	669445	04 September 2018

8.5 Submission of assignments

Please note: Although students may work together when preparing assignments, each student must write and submit his or her own individual assignment. In other words, you must submit your

own ideas in your own words, sometimes interspersing relevant short quotations that are properly referenced. It is unacceptable for students to submit identical assignments on the basis that they worked together. That is copying (a form of plagiarism) and none of these assignments will be marked. Furthermore, you may be penalised or subjected to disciplinary proceedings by the university.
PLEASE NOTE: Enquiries about assignments (e.g. whether or not the University has received your assignment or the date on which an assignment was returned to you) must be directed to *Study@Unisa.*
You might also find information on *my*Unisa. To go to the *my*Unisa website, start at the main Unisa website, http://www.unisa.ac.za, and then click on the 'login to *my*Unisa' link under the *my*Unisa heading on the screen. This should take you to the *my*Unisa website. You can also go there directly by typing in http://my.unisa.ac.za.
Assignments should be addressed to:
The Assignment section
PO Box 392
UNISA
0003

You may submit written assignments and assignments done on mark-reading sheets either by post or electronically via myUnisa. Assignments may not be submitted by fax or email. For detailed information and requirements as far as assignments are concerned, see the brochure Study @ Unisa, which you received with your study material.
To submit an assignment via *my*Unisa:

- Go to *my*Unisa.
- Log in with your student number and password.
- Select the module.
- Click on assignments in the menu on the left.
- Click on the assignment number you want to submit
- Follow the instructions on the screen.

IMPORTANT
When assignments are handed in electronically:

- Write or type your name and student number on the first page of the assignment. Number all questions ACCURATELY.
- Use a ruler and sharp pencil to draw diagrams. You may also draw diagrams electronically
- All assignments must be submitted in pdf format. No zip files will be accepted

8.6 The assignments

Assignments 01 and 02 are compulsory and have been added to the end of this tutorial letter. Please complete them and submit them as required.

- The corresponding chapters in your textbook for this module are chapter 1 – 7 & 14**.**
- Think of your own classroom practice and your experience when you answer the assignments. Your ideas and suggestions about classroom practice are of tremendous value and we encourage you to share them with us. You will be evaluated largely on how you teach or would teach a certain section.
- When answering the questions, take note of the mark allocation.

8.7 Other assessment methods

None.

8.8 The examination

DEMARCATION OR "SCOPING" FOR EXAMINATIONS AND ASSESSMENTS

NB: In terms of a decision reached by the College, lecturers may not demarcate or "scope" specific work for examination purposes and examination questions should be based on all the work covering the notional hours of modules. Lecturers should encourage students to learn everything. In cases where competencies or skills are assessed differently during the tuition period, the various methods of assessment will be spelled out clearly by the lecturer in Tutorial Letter 201.
According to Assessment Procedure Manual 2013, paragraph 4.5.2(e), the examination memoranda (guidelines, rubrics, and so on) shall not be made available to students.

8.8.1 Examination admission

The Department of Education requires the university to prove that a student was active during the period of tuition before the student will be subsidised by the Department of Education. Senate has approved that the submission of a compulsory assignment will be used to prove activity and also that students will be admitted to the examination by submitting the assignment. Examination admission is solely dependent on submission of Assignment 01 irrespective of the mark you obtain and whether you have passed or failed. However, should you fail this assignment it will not influence your year mark. Admission to the examination is administered by the Examination Section and not your lecturers. Please study *Study@Unisa* and contact the Examination Section should you have a problem with admission to the examination. Applications for rechecking or remarking should also be submitted to the Examination Section.

8.8.2 How will this work in practice?

In terms of Unisa's assessment policy, a sub-minimum of 40% in the written component(s) of the examination is required. The final mark of a student is a combination of the semester mark and the examination mark but in the case where a student does not obtain the required sub-minimum of 40% in the examination, the semester mark does not count. In such case, the final mark is the mark obtained in the examination.

8.8.3 Examination period

This module is offered in a semester period of 15 weeks. This means that if you are registered for the first semester, you will write the examination in May/June 2018 and the supplementary examination will be written in October/November 2018. If you are registered for the second semester, you will write the examination in October/November 2018 and the supplementary examination will be written in May/June 2019.
During the semester, the Examination Section will provide you with information regarding the examination in general, examination venues, examination dates and examination times.

8.8.4 Previous examination papers

Previous examination papers are available to students. We advise you, however, not to focus on old examination papers only as the content of modules and therefore examination papers changes from year to year. You may, however, accept that the type of questions that will be asked in the examination will be similar to those asked in the activities in your study guide and in the assignments.

9 FREQUENTLY ASKED QUESTIONS

The *Study@Unisa* brochure contains an A-Z guide of the most questions that students ask. Please refer to this brochure for frequently asked questions.

10 SOURCES CONSULTED

None

11 IN CLOSING

I wish you every success with your studies.

12 ADDENDUM

12.1 ADDENDUM A First semester assignments

Assignment 01

Due date: 20 February 2018

Remember

Make sure you fill in the following information in the space provided on the mark-reading sheet.

- **Student number:**
- **Module code: MAE201M**
- **Unique number: 708962**
- **Assignment number: 01**

Question 1

Given that n is a positive even integer, $5n + 4$ will always be divisible by**:**

[1] 5

[2] 5n

[3] 2

[4] 4

Question 2

What mathematics principle is reinforced by matching numerals with number words?

[1] Number representations

[2] Sequencing

[3] Rote counting

[4] Greater than and less than

Question 3

Which of the following equations is true for the three pairs of x and y values in the table alongside?

x	y
–1	–5
1	1
2	4

[1] $3x + 2 = y$

[2] $3x - y = 2$

[3] $2x + 3 = y$

[4] $2x - y = 3$

Question 4

$24 - 3 \times 7 + 2 =$

[1] 149

[2] 189

[3] –3

[4] 5

Question 5

The expression below represents Sthembiso's age of t, Tshepiso's age.

$$3t - 5$$

Which of the following statements must be true?

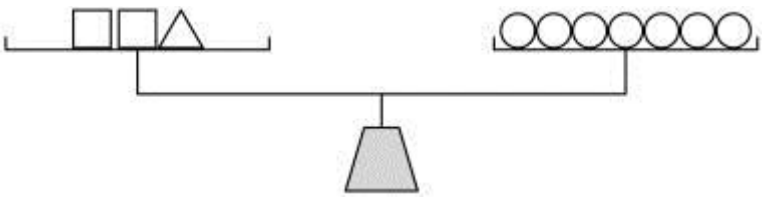
[1] Sthembiso's age is 3 less than 5 times Tshepiso's age.

[2] Sthembiso's age is 5 less than 3 times Tshepiso's age.

[3] Tshepiso's age is 3 less than 5 times Sthembiso's age..

[4] Tshepiso's age is 5 less than 3 times Sthembiso's age.

Question 6



The objects on the scale above make it balance exactly. According to this scale,

if △ balances ○○○, then □ balances which of the following?

[1] ○○

[2] ○○○○

[3] ○

[4] ○○○

Question 7

Three less than four times a number is five times the sum of that number and 6. Which equation could be used to solve this problem?

[1] $4n - 3 = 5n + 6$

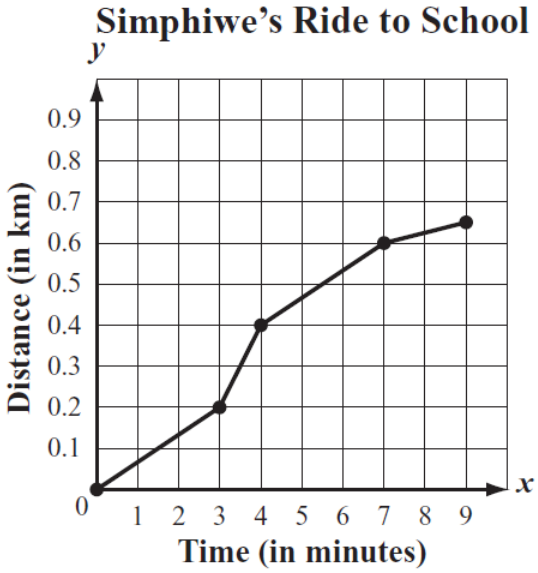
[2] $4n - 3 = 5(n + 6)$

[3] $3 - 4n = 5(n + 6)$

[4] $3 - 4n + 5n = 6$

Question 8

Simphiwe rode his bicycle from her home to school. The graph below shows the distance, in kilometres, that Simphiwe rode over time.



During which time interval was Simphiwe riding his bicycle at the greatest speed?

[1] between minute 0 and minute 3 of the ride

[2] between minute 3 and minute 4 of the ride

[3] between minute 4 and minute 7 of the ride

[4] between minute 7 and minute 9 of the ride

Question 9

If $3x + 2y = 12$ and $12x + 8y = 15$, then the solution set is

[1] $x = 2, y = 2$

[2] $x = 4, y = 4$

[3] all real numbers

[4] $\emptyset$ (empty set)

Question 10

A cooking instructor stated that 5 kilograms of roast beef is needed to serve 8 people. Based on the instructor's statement, which of the following equations can be used to find *r*, the number of kilograms of roast beef needed to serve 12 people?

[1] $\frac{5}{8} = \frac{r}{12}$

[2] $\frac{5}{8} = \frac{12}{r}$

[3] $12r = 8 \bullet 5$

[4] $12r = 8 \div 5$

TOTAL: 10

Assignment 02

Due date: 20 March 2018

Remember

Make sure you fill in the following information in the space provided on the mark-reading sheet.

- **Student number:**
- **Module code: MAE201M**
- **Unique number: 713518**
- **Assignment number: 02**

PLEASE NOTE: START EACH QUESTION ON A NEW PAGE

Question 1

Algebraic thinking
Strands of algebraic thinking:

Read the section on "strands of algebraic thinking" on page 324 of the prescribed book. Then turn to the tutorial letter 501 and read carefully through the section 1.1.2 (explaining algebra) on page 4 – 5. Four points are mentioned.

1.1 For each of those points, use your own words to show your understanding of that point. (4)

1.2 Provide your own examples to illustrate each of the four points. (4)

[8]

Question 2

Developing algebraic reasoning
Bridging the gap between arithmetic and algebra.

Read the section on "Bridging the gap between arithmetic and algebra" on page 14 in tut letter 501. Do tasks 2, 3 and 4 in activity 2.1. (17)

[17]

Question 3

3.1 What is meant by algebraic thinking? (2)

3.2 How important is algebraic thinking for the intermediate and senior phase mathematics? (2)

3.3 Nono takes a number and subtracts 9 from it. He takes the same number and subtracts 12 from it. He then takes these two new numbers and multiplies them. The result he gets is 0.

3.3.1 Translate the information to an algebraic equation. (Use the letter *x* to represent the number that Nono takes.) (2)

3.3.2 Solve the equation. Show all your working. (3)

3.3.3 What number did Nono take? (2)

3.3.4 How can this problem be used to develop algebraic concepts? (3)

3.4 You want to introduce the concept of a function to grade 8 learners. You set the following problem for your learners:

> Mpho is trying to make money to help pay for his studies at the technikon by selling hot dogs from a hot-dog cart at a soccer stadium during major games. He pays the cart owner R75 per night for the use of the cart. He sells hot dogs for R12,50 each. His costs for the hot dogs, napkins, etc. are R5,60 per hot dog on average. Calculate the number of hotdogs that Mpho has to sell to make a profit.

3.4.1 Write down thr four steps of Polya's problem-solving process. (4)

3.4.2 Now use the steps to solve the problem above, as if you will do it on the chalkboard for grade 8 learners. (7)

[25]

Question 4

Mathematical modelling

4.1 Do activity 2.3 on page 21 in tut letter 501 (7)

4.2 Carefully work through the example using pictorial representations to solve a problem on page 22 – 23 of tut letter 501

4.2.1 Solve the problem using the pictorial method (box method)
Jack and Jill carried water from the hill. Jack carried 3 times as many containers than Jill. If Jill added to more containers, they would carry the 21 containers of water together. How many containers did Jack carry? (5)

4.2.2 Now solve the problem using an algebraic approach. (3)

[15]

Question 5

The 100 chart to develop algebraic concepts

5.1 Read the section on "Pause and Reflect" on page 326 in the prescribed book. Draw a hundred chart in your script (see page 262).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

5.1.1 Do the following:

- Choose any number (the starting point) Write it down. (1)
- Move 2 up and then one right. Write down the number where you land (1)
- Write down the operations that you used to get the new number (where you "land") (1)
- Now generalise these actions, using the letter n for the starting point (2)

5.1.2 Choose any number (the starting point)

- Now move one to the right and then 2 up.
- Generalise this action, using the letter n for the starting point (2)

5.1.3 Show algebraically that the results for these two actions (4.1.1 and 4.1.2) are the same. (2)

5.2 Use the hundred chart in the previous question, and now perform the following actions.

- Choose any number (the starting point)
- Move 3 blocks diagonally upwards to the left
- Move 3 blocks diagonally downwards to the left

5.2.1 Use the letter n for the starting point, and prove that the endpoint will be $n - 6$ (2)

5.2.2 Find the relation between the starting point and endpoint if you moved right instead of left. (2)

[13]

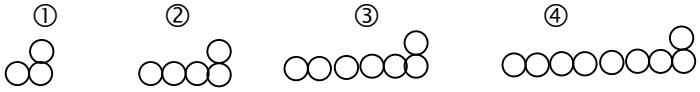
Question 6

Growing patterns

Number patterns form the basis on which algebraic generalisations are taught.
It is important that learners are given the opportunity to state the growing of a number or geometric pattern in words.
Look at the following geometric patterns (drawings, using geometrical figures like squares, triangles and circles). Always look if you can find some relation with the **number of the pattern in the row (frame number)**, and the **number of figures** in the pattern.

For example:

Frame number ① ② ③ ④

Pattern 

❶ A possible verbal description:

The top row has one circle. The bottom row has 2 × (the number of the frame) circles. *The number of circles in a frame is 1 plus two times the frame number*.

❷ Table form:

Frame number	1	2	3	4
Number of circles	3	5	7	9

❸ Numerical description:

Frame number ① ② ③ ④

Value of frame: 1+2×① = **3** 1+2×② = **5** 1+2×③ = **7** 1+2×④ = **9**

1+2×1 = 3 1+2×2 = **5** 1+2×3 = **7** 1+2×4 = **9**

Frame number

Number or circles

❹ Generalise the pattern

If n is the frame number, then we use Tn for the number of circles.

$Tn = 2n + 1$

Tn is called the general term

First term: $T_1 = 2(1) + 1 = 3$

Second term: $T_2 = 2(2) + 1 = 5$

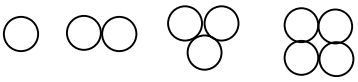
Third term: $T_3 = 2(3) + 1 = 7$

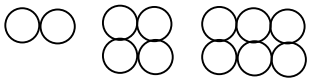
This process is very important for learners to "generalise" number patterns

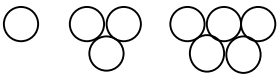
6.1 Study each of the growing geometrical patterns (and look at the example above)

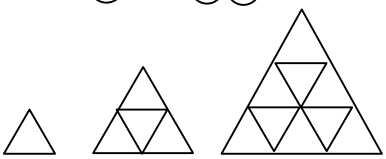
Then do the following for each pattern:

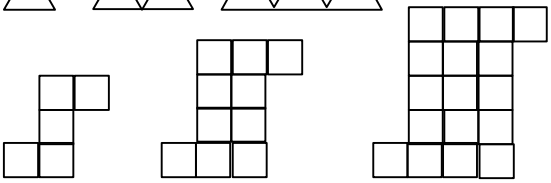
- Give a verbal description of how the pattern is growing
- Set up a table of values
- Write down a numerical description for each pattern (you must relate the number of the frame to the number of figures in the frame)
- Write down the value of the 10^{th} frame.

6.1.1 

6.1.2 

6.1.3 

6.1.4 

6.1.5 

(20)

6.2 The general term of a number sequence is given.

- Write down the first three terms
- Draw a pattern, using circles to illustrate the way you "see" the pattern. Draw the first three frames.

6.2.1 $T_n = 2n + 1$

6.2.2 $T_n = n^2 + 1$

6.2.3 $T_n = 3n - 2$ (6)

6.3 Study the table in figure 14.5 in Figure 14.5 in the text book, page 335 (copied here for your convenience)

6.3.1 Choose the correct answer from the choice given (4)

6.3.2 Explain the relationship between the "term" and the "fraction" in words (2)

6.3.3 Write down the *n*th term (2)

Term	1	2	3	4
Fraction	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{4}{5}$

If the list of fractions above continues in the same pattern, which term will be equal to 0.95?

Ⓐ The 100th
Ⓑ The 95th
Ⓒ The 20th
Ⓓ The 19th
Ⓔ The 15th

[34]

Question 7

Understanding numbers and variables

7.1 Read the section on Variables (2.1.2 on page 17) in tut letter 501. Five common misunderstandings with regards to the concept "variable" are mentioned.
Are the following true or false? Explain your answer.

7.1.1 The perimeter of a parallelogram is $2(x + y)$

7.1.2 The area of a circle is πl^2

7.1.3 If $x = 2$ and $y = 7$, then $xy = 27$

7.1.4 c is a positive number (4)

7.2 Now read the section on "the meaning of variables" in the prescribed book on page 352 – 353.

7.2.1 Give your own idea of a variable. (2)

7.2.3 Design two-word problems that will be suitable for grade 6 learners where the concept of variables can be introduced. (4)

[10]

Question 8

Using variables to generalise numerical expressions

Learners in Primary schools are taught the method of compensation to simplify operations with whole numbers. In this question, you are given the numerical explanation of compensation in three operations. You need to use algebra to explain why these methods will work.

Addition:
Numerical example:
143 + 99
= (143 – 1) + (99 + 1)
= 142 + 100
= 242

Subtract 1
Add 1

Numerical expression:
3 + 5
Algebraical expression:
$a + b$

8.1 Now use symbols a, b and c to prove that this method will work for any addition. (3)

Subtraction:
Numerical example:
183 – 99
= (183 + 1) – (99 + 1)
= 184 – 100
= 84

Add 1
Add 1

8.2 Now use symbols a, b and c to prove that this method will work for any subtraction. (3)

Division:
Numerical example:
$12 \div \frac{2}{3}$
$= (12 \times \frac{3}{2}) \div (\frac{2}{3} \times \frac{3}{2})$
$= (12 \times \frac{3}{2}) \div (1)$
$= \frac{12 \times 3}{2} = 18$

Multiply by the inverse, $\frac{3}{2}\frac{3}{2}$

Multiply by $\frac{3}{2}\frac{3}{2}$

8.3 Now use symbols a, b and c to prove that this method will work for any division by fractions. (3)

[9]

Question 9

9.1 What is meant by " Algebraic Expression"? (2)

9.2 List five different ways to develop algebraic reasoning in your learners. (10)

9.3 The number 100 can be written as the sum of **consecutive** whole numbers like this: 100 = 18 + 19 + 20 + 21 + 22

9.3.1 Is it possible to find a sequence of any number of **consecutive** whole numbers which add up to 1000? (2)

9.3.2 Can every number be written as a sum of consecutive whole numbers? Explain (3)

9.3.3 Is there a general method of writing down such a sum? Explain (3)

9.4

9.4.1 Find for consecutive odd numbers whose sum is 120 (4)

9.4.2 A pawpaw tree when planted was 90cm tall. It then grew an equal number of centimetres each year. At the end of the seventh year it was $\frac{1}{9}$ taller than at the end of the sixth year. How tall was the tree at the end of the twelfth year? (8)

[32]

Question 10

Think of a number
Use machine diagrams

10.1 Read the section 2.3.3.4 (think of a number) on page 32 – 33 in the tut letter 501. Use your own example for the activity described on page 33. Marks will be awarded for originality. (5)

10.2 You want to use the diagram machine to teach learners how to solve equations by using inverse operations. Here is an example:

Solve the equation for x: $3x - 5 = 13$

The operation:

x → ×3 → −2 → 13

The inverse operation

x ← ÷3 ← +2 ← 13

5 (15÷3) (13+2)

Use a machine diagram (as illustrated in the example) to solve the following equations:

10.2.1 $x \times 4 - 7 = 21$

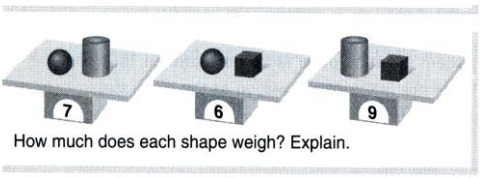
10.2.2 $(x - 4) \times 7 = 35$

10.2.3 $x \div 7 - 7 = 1$

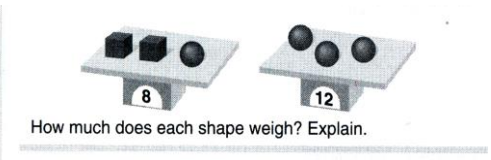
10.2.4 $(x - 7) \div 7 = 1$ (12)

10.3 Study the scale drawings on page 354 of the prescribed book. It is given here for your convenience. Answer each question. Remember to explain your answer in each case.

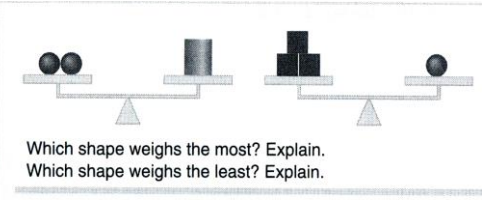
1



2



3



(7)

[24]

Question 11

Algebraic expressions and factorisation

11.1 Read the section on Algebraic expressions and factorisation on pages 36 – 46 in tutorial letter 501.

Answer the following questions in full sentences.

11.1.1 What is a trinomial? Give an example. (2)

11.1.2 What is the difference between an exponent and a constant in an algebraic expression? Illustrate with an example. (2)

11.1.3 What does it mean to "remove brackets" in algebra? Give an example. (2)

11.1.4 What does it mean to factorise an algebraic expression? Give an example. (2)

11.1.5 What is a common factor in an algebraic expression? Give an example. (2)

11.1.6 What is the difference between an algebraic expression and an algebraic equation? Give an example. (2)

11.1.7 What does it mean when we talk about a perfect square trinomial? Give an example. (2)

11.1.8 What relationship sign(s) do we use in inequalities? (1)

11.2 Do the following activities from tut letter 501

11.2.1 Activity 3.5 (page 42), numbers 1, 2, 3 (6)

11.2.2 Activity 3.6 (page 44), numbers 2, 3, 4, 6 (8)

11.3 Factorise the following trinomials

11.3.1 $x^2 - 6x + 5$ (2)

11.3.2 $x^2 - 4x - 5$ (2)

11.3.3 $x^2 + 4x - 5$ (2)

11.3.4 $x^2 - 19x - 42$ (2)

11.3.5 $x^2 - 13x + 42$ (2)

11.4 Factorise the following

11.4.1 $x^2 + 4$ (1)

11.4.2 $x^4 - 64$ (2)

11.4.3 $x^4y^4 - y^6$ (2)

11.5 Read section 3.5 on Formulae on pages 53 – 57 in tut letter 501. Do the following numbers of Activity 3.14 on page 56

11.5.1 Numbers 1a, b, c (3)

11.5.2 Number 5 (2)

11.6 Read section 3.6 on "Forming equations to solve problems" on pages 57 – 59 in tut letter 501. Pay attention to the 7 point strategy for solving problems on page 59. Work through example 2 on page 58. Now use this strategy to solve the following problems in Activity 3.16 on page 59.

11.6.1 Numbers 2a, b, c (6)

11.6.2 Numbers 3b, d, (6)

11.6.3 Numbers 4 (7)

11.7 Read section 3.7 on "Linear inequalities" on pages 61 – 62 in tut letter 501

11.7.1 Do activity 3.17 (5)

[65]

Question 12

Quadratic Equations

12.1 Work through the examples on page 64 – 68 in tutorial letter 501. Now do the following activities:

12.1.1 Activity 4.3, numbers 5 , 7 , 10 (6)

12.1.2 Activity 4.4, numbers 2, 5 (6)

12.1.3 Activity 4.5, numbers 2, 3 (7)

12.1.4 Activity 4.7, numbers 2, 3 (7)

12.2 On page 75 in tut letter 501, the four-step problem solving process of Polya is described. Work through example 1 to get an idea how to use this strategy. Then do the following

12.2.1 Activity 4.11, numbers 2, 3, 5 (12)

[38]

Question 13

Functions Drawing graphs

Work through Chapter 5 on Functions in Tutorial letter 501. You will find various ways in which functions are described.

13.1 Draw a diagram to show your understanding of each of the following concepts. Also give a brief description of each:

- Output
- Domain
- Dependent variable
- Input
- Range
- Independent variable
- Rule (10)

13.2 Do the following:

13.2.1 Activity 5.3 on page 87, numbers 1 and 5 (10)

13.2.2 Activity 5.6 on page 97 (6)

13.3 A ball is thrown into the air. Its height (in metres) at time t(in seconds) is given by the function $h(t) = 10t - 2t^2$.

13.3.1 Complete the following table to find the height of the ball after 5 seconds. (4)

Time	Height
0	
1	
2	
3	
4	
5	

13.3.2 Plot the points that you found in 3.1 on a system of axes and connect them to form a smooth curve. (4)

13.3.3 Use your graph to answer the following questions:

(a) At what times is the ball on the ground? (1)

(b) At what time is the ball at its highest point? (1)

(c) How high does the ball go? (1)

13.4 Learners in grade 7 are taught how to draw linear graphs by plotting points. You want to introduce the "gradient – intercept" method to draw linear graphs. Draw up a list of activities that are sequenced so that learners understand the process of drawing graphs using this method. Give a detailed description of the purpose of each activity. Provide a memorandum (there should be at least 5 activities). (15)

[52]

Question 14

A ball is thrown into the air. Its height (in metres) at time t(in seconds) is given by the function $h(t) = 9t - t^2$.

14.1 Complete the following table to find the height of the ball after 6 seconds. (6)

Time	Height
0	
1	
2	
3	
4	
5	
6	

14.2 Plot the points that you found in 3.2.1 on a system of axes and connect them to form a smooth curve. (4)

14.3 Use your graph to answer the following questions:

(a) At what times is the ball on the ground? (1)

(b) At what time is the ball at its highest point? (1)

(c) How high does the ball go? (1)

14.4 Plan an activity on number patterns for the intermediate phase. (5)

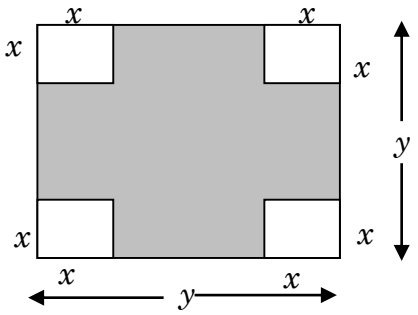
14.4.1 Write down the instructions you will give the learners. It must be clearly stated what the leaners must do. (2)

14.5 Design a rubric that you will use to assess the learners' answers. (4)

14.6 What resources/learning support materials will you use? (1)

[25]

Question 15



Consider the adjacent diagram.

15.1 If four congruent square corners are cut off from the large square of cardboard to make a box, write down the area of the shaded figure in terms of x and y. (5)

15.2 Use this result to find this area when y = 11.8 *cm* and x = 1.4 *cm* (3)

15.3 The sides are folded up to form a box. Draw the box and indicate all its dimensions. (5)

15.4 Write down an expression in terms of x and y for the volume of the box. (2)

15.5 Use the values of x and y from your answer to question 15.2 and determine the volume of the box. (3)

[18]

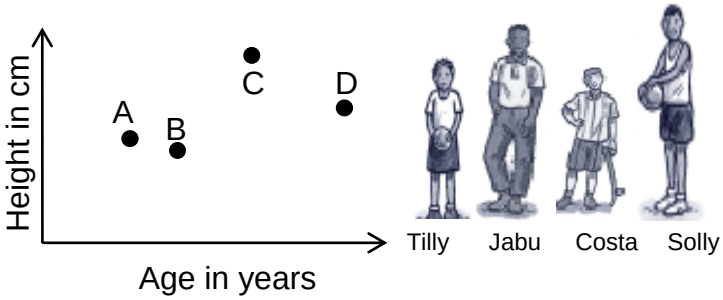
Question 16

Interpreting graphs

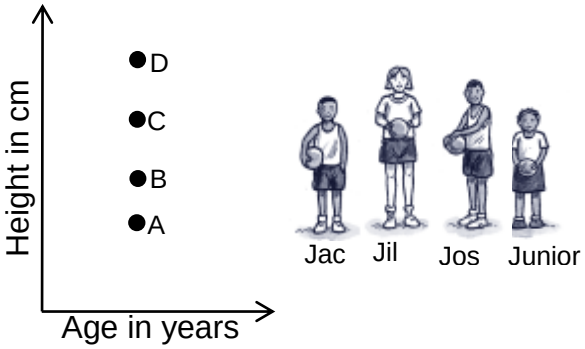
When we look at a graph, we can always read some information from it. To do this, we need to understand how to read this information from the graph. A graph always tells us a story about the relation between two "things". To find the relationship between the two "things", we need to look at the two axes and what they stand for. Each axis represents something that is related to something else on the other axes.

16.1 Look at the labelling on the graphs, and the pictures of the children, and answer the questions. A, B, C or D represents a child on the graph.

16.1.1 Arrange from old to young (4)



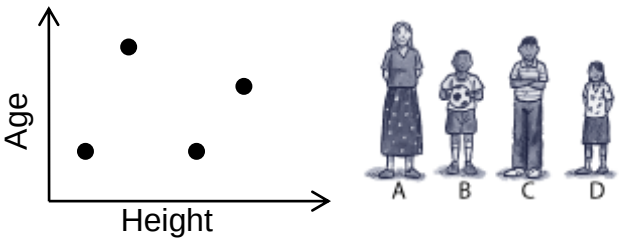
16.1.2 Who is who? Who is the oldest? (4)



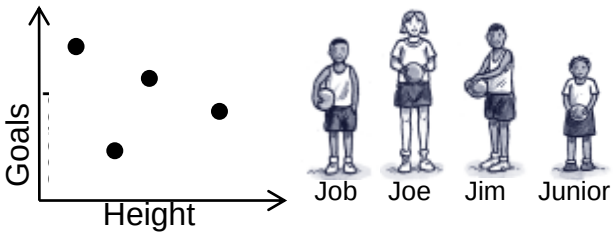
16.1.3 This graph shows the heights and ages of Agnes, Bob, Cat and Dolly.

a) Who is the second oldest?

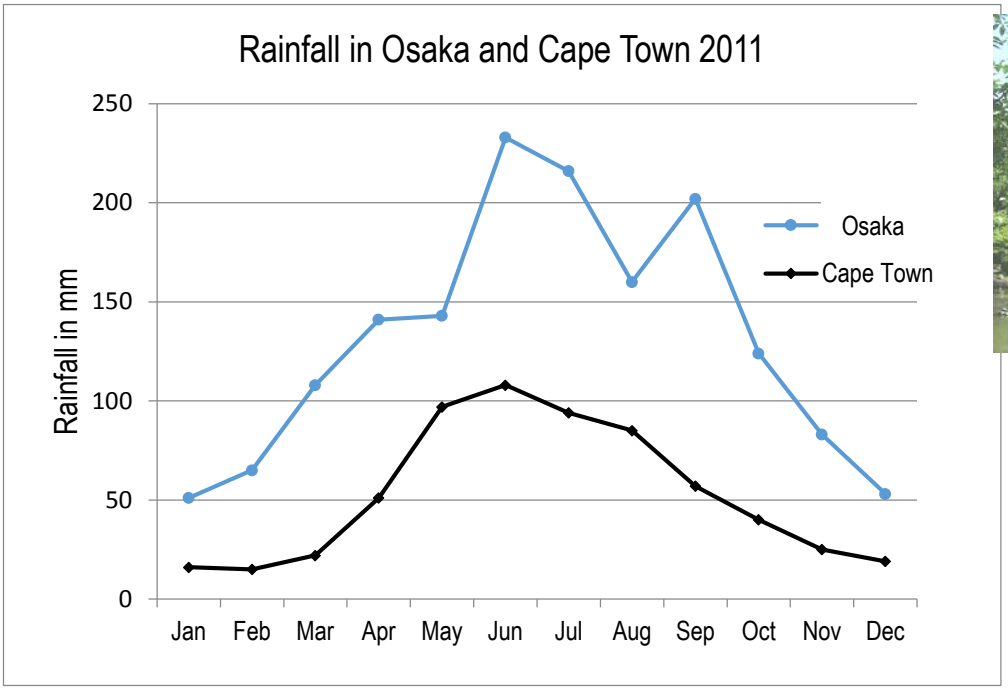
b) Which two are the same age? (2)



16.1.4 At a school's soft ball game, who scored the least goals. Who had the next highest score? (2)



16.2 The graphs below show the rainfall between the two cities. Osaka is a city in Japan.





Study the graph and answer the following questions:

a) What is this graph about? (1)

b) Which two cities are compared? (1)

c) What is the scale on the vertical axis? (Each unit represents ____mm) (1)

d) Which month was the driest in Osaka? (1)

e) Which month was the wettest in Cape Town? (1)

f) Which of the two cities do you think was the driest? (1)

g) What was the highest rainfall in Osaka and Johannesburg? (1)

h) Can you see an unusual pattern in the rainfall in Osaka? In which month did it occur? (1)

i) There was a sharp increase in rainfall between two months in Kyoto. Which months are referred to? (1)

j) Which are the driest month(s) in Cape Town? (1)

k) In which months was the rainfall more than 150mm in Osaka? (2)

l) In which months was the rainfall less than 50mm in Cape Town? (2)

[26]

TOTAL: 421

12.2 ADDENDUM B Second semester assignments

Assignment 01

Due date: 07 August 2018

Remember

Make sure you fill in the following information in the space provided on the mark-reading sheet.

- **Student number:**
- **Module code: MAE201M**
- **Unique number: 893687**
- **Assignment number: 01**

Question 1

Which trinomial is equivalent to $(3x - 2)(x + 4)$?

[1] $3x^2 + 10x + 8$

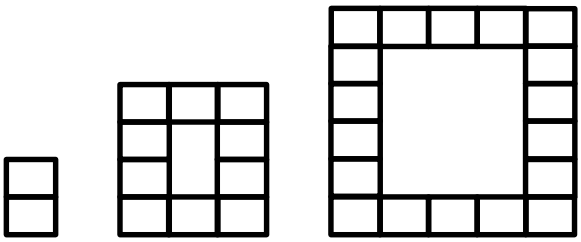
[2] $3x^2 - 10x + 8$

[3] $3x^2 + 10x - 8$

[4] $3x^2 - 10x - 8$

Question 2

There are two blocks in Pattern 1, and 10 blocks in Pattern 2.



Pattern 1 **Pattern 2** **Pattern 3** **Pattern 4**

How many blocks will there be in Pattern 5?

[1] 20
[2] 26
[3] 34
[4] 40

Question 3

What is the sum of $5\sqrt{7}$ and $3\sqrt{28}$?

[1] $9\sqrt{7}$

[2] $60\sqrt{7}$

[3] $11\sqrt{7}$

[4] $8\sqrt{35}$

Question 4

Sibongile has thrice as many books as Tebogo. Lerato has six more books than Tebogo. If Tebogo has x books which of the following gives the total number of books belonging to the three girls?

[1] $3x + 6$

[2] $4x + 9$

[3] $3x + 9$

[4] $5x + 6$

Question 5

If $a = \frac{3}{2}$ and $b = \frac{3}{4}$

Which of the following has the greatest value?

[1] ab

[2] $(ab)^2$

[3] $\frac{b}{a}$

[4] $\frac{a}{b}$

Question 6

The graph of $y = (2x - 3)(3x - 2)$ cuts the y-axis at P. The coordinates of P are

[1] (2; 0)

[2] (6; 0)

[3] (0; 6)

[4] (3; 0)

Question 7

The total length of a spring after 1 kg, 2 kg, 3 kg and 4 kg weights have been attached to the spring are 1 cm, 5 cm, 9 cm and 13 cm respectively. The length (L) of the spring after weight (w) is

[1] L = 3 + 4w

[2] L = –3 + 4w

[3] L = 4 – w

[4] L = 4 + w

Question 8

If a, b and c are natural numbers, which of the following statements is not correct?

[1] $(a \div b) + c = a \div (b + c)$

[2] $a \times (b + c) = ab + ac$

[3] $(a \times b) \times c = a \times (b \times c)$

[4] $a \times b = b \times a$

Question 9

The amount, A, in rands, remaining in a prepaid cell phone account is represented by the function $A = 50 - 0.29t$, where t is the time in minutes. In this function, what does 50 represent?

[1] cost per minute

[2] starting amount in account

[3] time remaining in account

[4] amount left in account when all the time is used up

Question 10

Which function below is represented by the phrase "the output is equal to 3 less than double a number"?

[1] $y = 2x - 3$

[2] $y = 3 - 2x$

[3] $y = x - 6$

[4] $y = 6 - x$

TOTAL: 10

Assignment 02

Due date: 04 September 2018

Remember

Make sure you fill in the following information in the space provided on the mark-reading sheet.

- **Student number:**
- **Module code: MAE201M**
- **Unique number: 669445**
- **Assignment number: 02**

Question 1

Algebraic thinking
Strands of algebraic thinking:

Read the section on "strands of algebraic thinking" on page 324 of the prescribed book. Then turn to the tutorial letter 501 and read carefully through the section 1.1.2 (explaining algebra) on page 4 – 5. Four points are mentioned.

1.1 For each of those points, use your own words to show your understanding of that point. (4)

1.2 Provide your own examples to illustrate each of the four points. (4)

[8]

Question 2

Developing algebraic reasoning
Bridging the gap between arithmetic and algebra.

Read the section on "Bridging the gap between arithmetic and algebra" on page 14 in tut letter 501. Do tasks 1 and 2 of activity 2.1. (16)

[16]

Question 3

Mathematical modelling

3.1 Do activity 2.3 on page 21 in tut letter 501 (7)

3.2 Carefully work through the example using pictorial representations to solve a problem on page 22 – 23 of tut letter 501

3.2.1 Solve the problem using the pictorial method (box method)

Gugu had 3 times as many stamps as Nomsa. After Gugu used 130 stamps, and Nomsa used 10 stamps, they have the same number of stamps. How many stamps did Gugu have in the beginning? (5)

3.2.2 Now solve the problem using an algebraic approach. (3)

[15]

Question 4

The 100 chart to develop algebraic concepts

4.1 Read the section on "Pause and Reflect" on page 326 in the prescribed book. Draw a hundred chart in your script (see page 262).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

4.1.1 Do the following:

- Choose any number (the starting point) Write it down. (1)
- Move 2 down and then one right. Write down the number where you land (1)
- Write down the operations that you used to get the new number (where you "land") (1)
- Now generalise these actions, using the letter n for the starting point (2)

4.1.2 Choose any number (the starting point)

- Now move one to the right and then 2 down.
- Generalise this action, using the letter n for the starting point (2)

4.1.3 Show algebraically that the results for these two actions (4.1.1 and 4.1.2) are the same. (2)

4.2 Use the hundred chart in the previous question, and now perform the following actions.

- Choose any number (the starting point)

- Move 3 blocks diagonally upwards to the right
- Move 3 blocks diagonally downwards to the right

4.2.1 Use the letter n for the starting point, and prove that the endpoint will be $n + 4$ (2)

4.2.2 Find the relation between the starting point and endpoint if you moved left instead of right. (2)

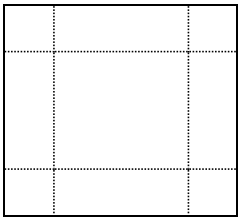
[13]

Question 5

5.1 What is a variable? (2)

5.2 List five different ways to develop algebraic reasoning in your learners. (10)

5.3 Refer to the figure below.



A box with a rectangular base and no top is formed by cutting squares out of the corners of a piece of cardboard and then folding up the sides. If the cardboard measures 16 cm by 22 cm and the edge of each cut-out square is *x* cm, write an expression that expresses the volume of the box in terms of *x*. (6)

5.4 A rectangular garden is 3 m longer than it is wide. If the perimeter of the garden is 18 m, find the length and the width (6)

[24]

Question 6

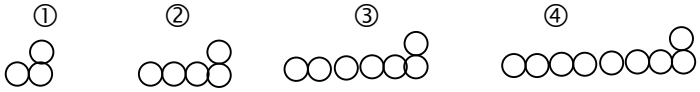
Growing patterns

Number patterns form the basis on which algebraic generalisations are taught.
It is important that learners are given the opportunity to state the growing of a number or geometric pattern in words.

Look at the following geometric patterns (drawings, using geometrical figures like squares, triangles and circles). Always look if you can find some relation with the **number of the pattern in the row (frame number)**, and the **number of figures** in the pattern.

For example:

Frame number ① ② ③ ④

Pattern 

❶ A possible verbal description:

The top row has one circle. The bottom row has 2 × (the number of the frame) circles. *The number of circles in a frame is 1 plus two times the frame number*.

❷ Table form:

Frame number	1	2	3	4
Number of circles	3	5	7	9

❸ Numerical description:

Frame number ① ② ③ ④

Value of frame: 1+2×① = **3** 1+2×② = **5** 1+2×③ = **7** 1+2×④ = **9**

1+2×1 = 3 1+2×2 = **5** 1+2×3 = **7** 1+2×4 = **9**

Frame number

Number or circles

❹ Generalise the pattern

If n is the frame number, then we use Tn for the number of circles.

$T_n = 2n + 1$

Tn is called the general term

First term: $T_1 = 2(1) + 1 = 3$

Second term: $T_2 = 2(2) + 1 = 5$

Third term: $T_3 = 2(3) + 1 = 7$

This process is very important for learners to "generalise" number patterns

6.1 Study each of the growing geometrical patterns (and look at the example above)

Then do the following for each pattern:

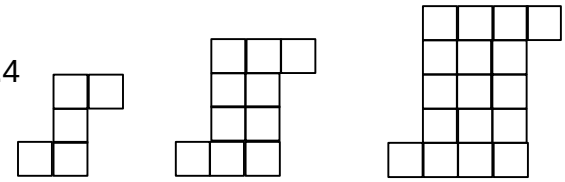
- Give a verbal description of how the pattern is growing
- Set up a table of values
- Write down a numerical description for each pattern (you must relate the number of the frame to the number of figures in the frame)

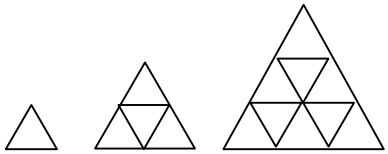
- For each one of the number patterns write down a formula that can be used to calculate the number of building blocks in any term
- Write down the value of the 10th frame.
- Use your formula to determine how many building blocks there are in the 100th frame of each one of the growing patterns.

6.1.1 

6.1.2 

6.1.3 

6.1.4 

6.1.5 

(24)

6.2 The general term of a number sequence is given.

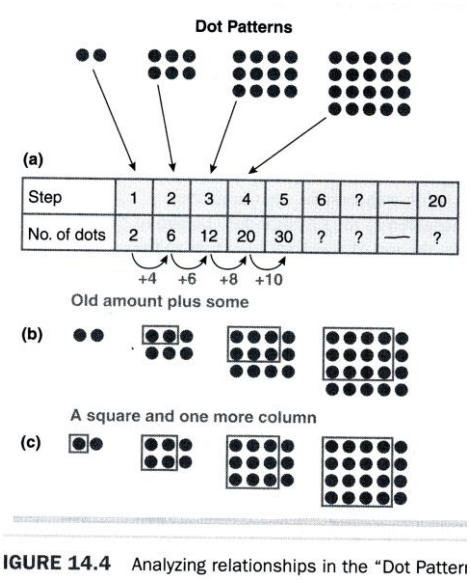
- Write down the first three terms
- Draw a pattern, using circles to illustrate the way you "see" the pattern. Draw the first three frames.

6.2.1 Tn = 2n – 1

6.2.2 Tn = n^2

6.2.3 Tn = 3n + 1 (6)

6.3 Study the explanations of the dot patterns in Figure 14.4 in the text book, page 335 (copied here for your convenience)



IGURE 14.4 Analyzing relationships in the "Dot Patter

6.3.1 Copy and complete the table (3)

6.3.2 Explain in your own words how the pattern is growing (2)

6.3.3 Write down the number of dots in the nth step (2)

[37]

Question 7

Understanding of algebraic concepts depends on the development number patterns. Learners should be able to generalise the rule which connect two numbers in a sequence of numbers. This generalisation plays an important role in the understanding of variables.

Design a lesson for grade 7 learners in which you will be dealing with the derivation of the rule when working with number patters.

7.1 Discuss the importance of planning in the teaching of mathematics. Give at least five valid arguments (10)

7.2 Write an introduction for the lesson (3)

7.3 Draw up an activity, consisting of at least three examples that can be used in your lesson (6)

7.4 Write down the questions that the teacher will ask his/her learners in the classroom (4)

[23]

Question 8

Understanding numbers and variables

8.1 Read the section on Variables (2.1.2 on page 17) in tut letter 501. Five common misunderstandings with regards to the concept "variable" are mentioned.

Are the following true or false? Explain your answer.

8.1.1 The formula for the area of a rectangle xy

8.1.2 The circumference of a circle is $2a\pi$

8.1.3 If $x = 3$ and $y = 4$, then $xy = 34$

8.1.4 $-pq$ is a negative number (4)

8.2 Now read the section on "the meaning of variables" in the prescribed book on page 352 – 353.

8.2.1 Give your own idea of a variable. (2)

8.2.3 Design two word problems that will be suitable for grade 6 learners where the concept of variables can be introduced. (4)

[10]

Question 9

Using variables to generalise numerical expressions

Learners in Primary schools are taught the method of compensation to simplify operations with whole numbers. In this question you are given the numerical explanation of compensation in three operations. You need to use algebra to explain why these methods will work.

Addition:
Numerical example:
178 + 99
= (178 – 1) + (99 + 1)
= 177 + 100
= 277

Subtract 1

Add 1

Numerical expression:
3 + 5
Algebraical expression:
$a + b$

9.1 Now use symbols a, b and c to prove that this method will work for any addition. (3)

Subtraction:
Numerical example:
183 – 99
= (183 + 1) – (99 + 1)

Add 1

Add 1

= 184 – 100

= 84

9.2 Now use symbols a, b and c to <u>prove</u> that this method will work for any subtraction.

(3)

Division:
Numerical example:

$12 \div \frac{2}{3}$

$= (12 \times \frac{3}{2}) \div (\frac{2}{3} \times \frac{3}{2})$

$= (12 \times \frac{3}{2}) \div (1)$

$= \frac{12 \times 3}{2} = 18$

Multiply by the inverse, $\frac{3}{2}\frac{3}{2}$

Multiply by $\frac{3}{2}\frac{3}{2}$

9.3 Now use symbols a, b and c to <u>prove</u> that this method will work for any division by fractions. (3)

[9]

Question 10

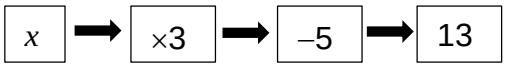
Think of a number
Use machine diagrams

10.1 Read the section 2.3.3.4 (think of a number) on page 32 – 33 in the tut letter 501. Use your own example for the activity described on page 33. Marks will be awarded for originality. (5)

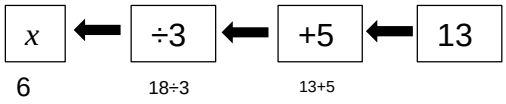
10.2 You want to use the diagram machine to teach learners how to solve equations by using inverse operations. Here is an example:

Solve the equation for x: $3x - 5 = 13$

The operation:



The inverse operation



Use a machine diagram (as illustrated in the example) to solve the following equations:

10.2.1 $x \times 2 - 3 = 20$

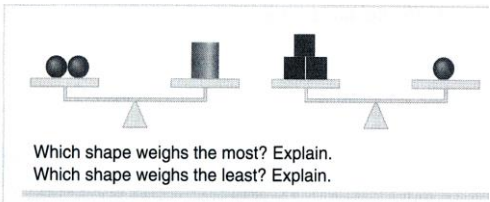
10.2.2 $(x + 3) \times 4 = 20$

10.2.3 $x \div 9 - 9 = 1$

10.2.4 $(x - 9) \div 9 = 1$ (12)

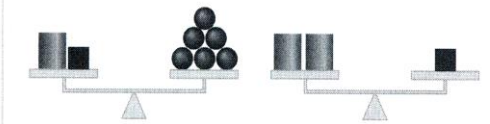
10.3 Study the scale drawings on page 354 of the prescribed book. It is given here for your convenience. Answer the questions below. Remember to explain your answer in each case.

1



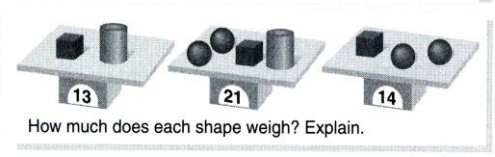
Which shape weighs the most? Explain.
Which shape weighs the least? Explain.

2



What will balance 2 spheres? Explain.

3



How much does each shape weigh? Explain.

(7)

[24]

Question 11

Algebraic expressions and factorisation

11.1 Read the section on Algebraic expressions and factorisation on pages 36 – 46 in tutorial letter 501.

Answer the following questions in full sentences.

11.1.1 What is a polynomial? Give an example. (2)

11.1.2 What is the difference between a coefficient and a constant in an algebraic expression? Illustrate with an example. (2)

11.1.3 What does it mean to factorise a number? Give an example. (2)

11.1.4 What does it mean to factorise an algebraic expression? Give an example. (2)

11.1.5 What is a common factor in an algebraic expression? Give an example. (2)

11.1.6 Why do we sometimes group terms to factorise an algebraic expression? Give an example. (2)

11.1.7 What does it mean when we talk about the difference of squares? Give an example. (2)

11.1.8 What is an inequality? (1)

11.2 Do the following activities from tut letter 501

11.2.1 Activity 3.5 (page 42), numbers 1, 2, 4 (6)

11.2.2 Activity 3.6 (page 44), numbers 1, 3, 4, 5 (8)

11.3 Factorise the following trinomials

11.3.1 $x^2 - 7x - 8$ (2)

11.3.2 $x^2 - 9x + 8$ (2)

11.3.3 $x^2 + 3x - 18$ (2)

11.3.4 $x^2 - 7x - 18$ (2)

11.3.5 $x^2 + 11x + 18$ (2)

11.4 Factorise the following

11.4.1 $x^2 + 4$ (1)

11.4.2 $x^4 - 81$ (2)

11.4.3. $x^4y^2 - y^2$ (2)

11.5 Read section 3.5 on Formulae on pages 53 – 57 in tut letter 501. Do the following numbers of Activity 3.14 on page 56

11.5.1 Numbers 3a, b, c (3)

11.5.2 Number 4 (2)

11.6 Read section 3.6 on "Forming equations to solve problems" on pages 57 – 59 in tut letter 501. Pay attention to the 7 point strategy for solving problems on page 59. Work through example 2 on page 58. Now use this strategy to solve the following problems in Activity 3.16 on page 59.

11.6.1 Numbers 1a, b, c (6)

11.6.2 Numbers 3a, c, (6)

116.3 Numbers 4 (7)

11.7 Read section 3.7 on "Linear inequalities" on pages 61 – 62 in tut letter 501

11.7.1 Do activity 3.17 (5)

[73]

Question 12

Quadratic Equations

12.1 Work through the examples on page 64 – 68 in tutorial letter 501. Now do the following activities:

12.1.1 Activity 4.3, numbers 6 , 7 , 9 (6)

12.1.2 Activity 4.4, numbers 1, 4 (6)

12.1.3 Activity 4.5, numbers 1, 4 (7)

12.1.4 Activity 4.7, numbers 1, 4 (7)

12.2 On page 75 in tut letter 501, the four-step problem solving process of Polya is described. Work through example 1 to get an idea how to use this strategy. Then do the following

12.2.1 Activity 4.11, numbers 1, 4, 5 (12)

[38]

Question 13

Functions
Drawing graphs

Work through Chapter 5 on Functions in Tutorial letter 501. You will find various ways in which functions are described.

13.1 Draw a diagram to show your understanding of each of the following concepts. Also give a brief description of each:

- Output
- Domain
- Dependent variable
- Input
- Range
- Independent variable
- Rule (10)

13.2 Do the following:

13.2.1 Activity 5.3 on page 87, numbers 3 and 5 (10)

13.2.2 Activity 5.6 on page 97 (6)

13.3 Learners in grade 7 are taught how to draw linear graphs. You want to teach the relationship between the gradients of parallel and perpendicular lines. Draw up a list of activities that are sequenced so that learners understand the process of drawing graphs using this method. Give a detailed description of the purpose of each activity. Provide a memorandum (there should be at least 4 activities). (15)

[41]

Question 14

If a ball is thrown into the air, its height (in metres) at time t (in seconds) is given by the function $h(t) = 9t - t^2$.

14.1 Complete the following table of values to find the height of the ball at the various time intervals. (7)

Time	Height
0	
1	
2	
3	
4	
5	
6	

14.2 Plot the points that you found in 2.1 on a system of axes and connect them to form a smooth curve. (7)

14.3 Use your graph to answer the following questions:

14.3.1 At what times is the ball on the ground? (2)

14.3.2 At what time is the ball at its highest point? (2)

14.3.3 How high does the ball go? (2)

14.4 What is meant by **a problem - centred** approach in the teaching and learning of mathematics? What role is played by the teacher in this kind of approach (6)

[26]

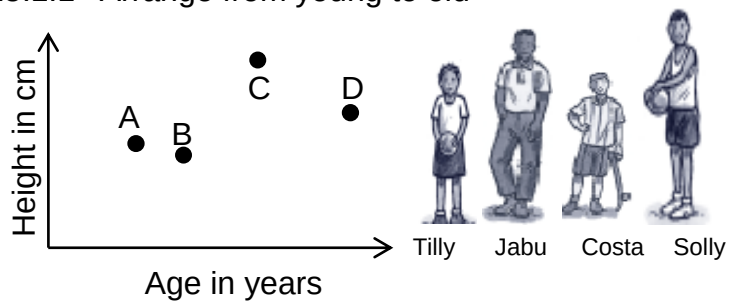
Question 15

Interpreting graphs

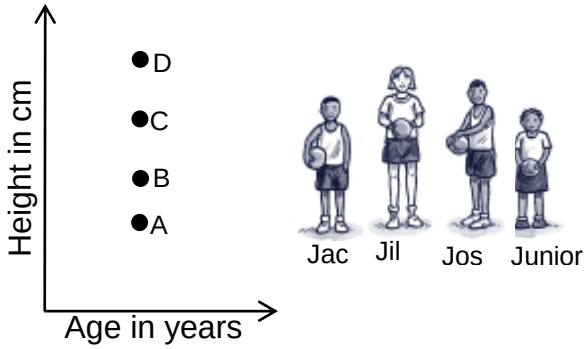
When we look at a graph, we can always read some information from it. To do this, we need to understand how to read this information from the graph. A graph always tells us a story about the relation between two "things". To find the relationship between the two "things", we need to look at the two axes and what they stand for. Each axis represents something that is related to something else on the other axes.

15.1 Look at the labelling on the graphs, and the pictures of the children, and answer the questions. A, B, C or D represents a child on the graph.

15.1.1 Arrange from young to old (4)



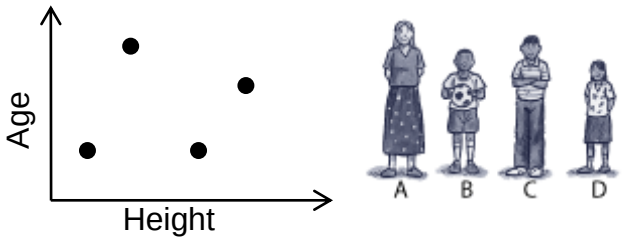
15.1.2 Who is who? Who is the youngest? (4)



15.1.3 This graph shows the heights and ages of Agnes, Bob, Cat and Dolly.

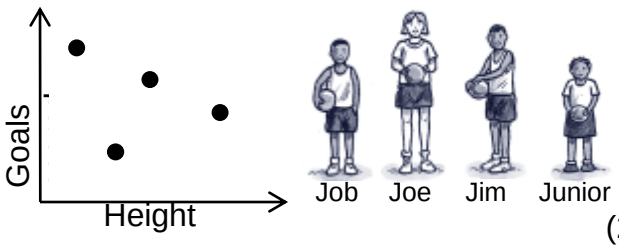
a) Who is the oldest?

b) Which two are the same age?



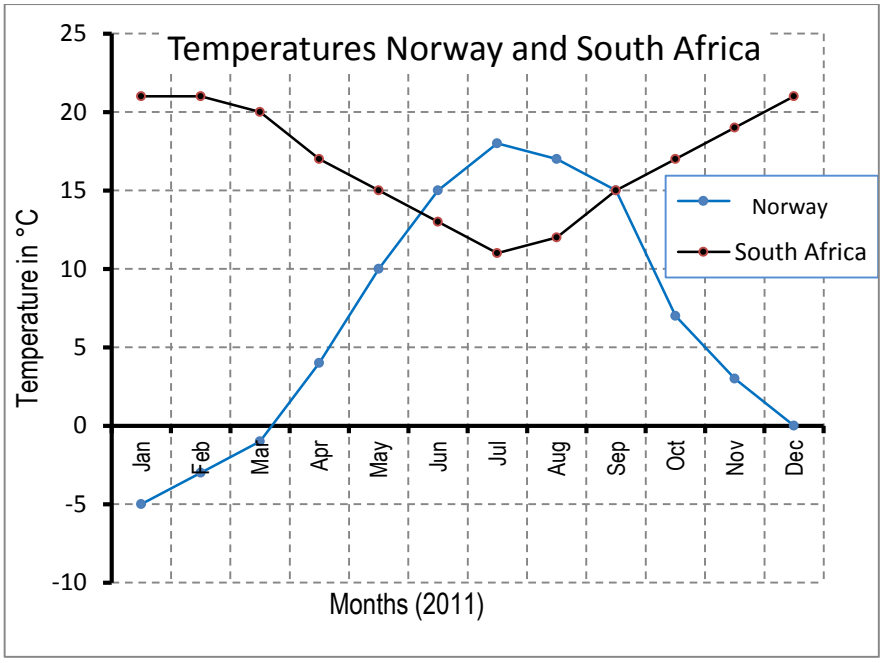
(2)

15.1.4 At a school's soft ball game, Junior scored the most goals. Who had the next highest score?



(2)

15.2 The graphs below show the average monthly temperatures of Norway and South Africa for the year 2011. The map shows you the two countries.





Carefully study the two graphs, and then answer the following questions:

a) In which hemispheres do the two countries lie? (1)

b) Explain in words the monthly change in temperatures of each country. (2)

c) What was the coldest month in Norway, and the coldest month in South Africa? Why do you think was the coldest month of the two countries not the same? (2)

d) Which country is generally warmer? (1)

e) Which month was the coldest in South Africa? (1)

f) Which month was the warmest in Norway? (1)

g) Use the graph to find the difference in temperature in the countries in the month of July. (2)

h) What was the temperature in January in Norway? (1)

i) In which month(s) was/were the average temperature the same? (2)

j) Did the temperature in South Africa increase or decrease from January to June? (1)

[26]

TOTAL: 383