α-MATHEMATICS

Alpha Mathematics

Final examination 2019

Grade 9 **Time: 2 hours**

Examiner: L Liebenberg **Total: 100 marks**

Moderator: R Grobler

INSTRUCTIONS AND INFORMATION

Read the instructions carefully before answering the questions.

1. This question paper consists of 9 pages and an answer sheet of 3 pages.
2. Answer ALL 9 questions.
3. Number the answers exactly the way the questions are numbered.
4. Non-programmable calculators may be used.
5. Unless otherwise indicated, all answers, where necessary, must be given correct to two decimal figures.
6. Clearly indicate all calculations, diagrams, graphs et cetera that you have used in determining your answers.
7. Full marks will not necessarily be awarded to answers only.
8. The diagrams in the question paper are not necessarily drawn to scale.
9. Write neatly and legible.

Question 1 [10 marks]

This question must be answered on the **answer sheet**, provided.

Each question has **ONLY** one correct answer and is worth one (1) mark. Indicate the correct answer with an **X** on the answer sheet.

1.1 $|-20| = \cdots$

(A) ± 20

(B) 20

(C) -20

(D) No solution.

1.2 $i^3 = \cdots$

(A) -1

(B) 1

(C) $-i$

(D) i

1.3 $(2x^3 - x^2 + 4) \div (x + 1)$ has a remainder of:

(A) 1

(B) 0

(C) 7

(D) 5

1.4 The following 3 statements are all facts.

- Pictures can tell a story.
- All story books have pictures in.
- Some story books have words in.

Which of the following statements must also be a fact?

1. Pictures can tell a story better than words can.
2. The stories in story books are very simple.
3. Some story books have both pictures and words in.

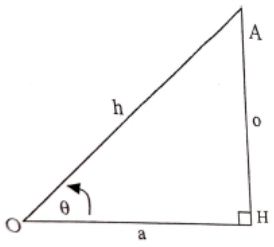
(A) Only 1.

(B) Only 2.

(C) Only 3.

(D) None of the statements are true.

1.5 In the diagram $Tan\theta = \cdots$



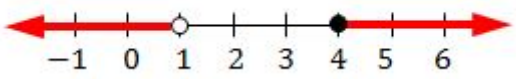
(A) $\frac{o}{h}$

(B) $\frac{a}{o}$

(C) $\frac{a}{h}$

(D) $\boldsymbol{\frac{o}{a}}$

1.6 The inequality represented below can be written algebraically as:



(A) $x < 1$ or $x \geq 4$

(B) $1 < x \leq 4$

(C) $x \leq 1$ or $x > 4$

(D) $1 \leq x \geq 4$

1.7 A Linear model has an objective function $W = 4x + 3y$ that has to be a maximum.
The possible optimum points are given as: $A(4;5)$, $B(6;0)$ and $C(0\,;3)$.
The maximum is:

(A) 35

(B) 9

(C) 31

(D) 24

1.8 A cafe has 4 different flavours of ice-cream with 8 different types of sauces. If a customer chooses 1 sauce and 1 flavour of ice-cream there will be _____ different combinations to choose from.

(A) 12

(B) 65536

(C) 4096

(D) 32

1.9 Negate the following statement:

x is smaller than 6.

(A) $x < 6$

(B) $x \leq 6$

(C) $x \geq 6$

(D) $x > 6$

1.10 $\sqrt{-16} + \sqrt[3]{-27} = \cdots$

(A) 1

(B) $-3 + 4i$

(C) $7i$

(D) $4 + 3i$

Question 2 [15 marks]

2.1 If $a = 3 - 2i$ and $b = 2 + 3i$, determine the values of the following:

2.1.1 a^2 (3)

2.1.2 $-b + 2a$ (3)

2.1.3 $\frac{b}{i}$ (3)

2.1.4 a^*, that is the conjugate of a. (1)

2.2 Represent $(5 + 2i) + (-3 - 4i)$ graphically on a system of axis. Make use of **DIAGRAM SHEET 1.** (4)

2.3 Write $\sqrt{-49}$ in terms of i. (1)

Question 3 [9 marks]

3.1 Given: $x^3 - 2x^2 - 5x + 6$

3.1.1 Show that $(x - 1)$ is a factor of the polinomial. (2)

3.1.2 Factorise the polynomial fully. (4)

3.2 Factorise the following expression fully $5x^4 - 80y^4$ (3)

Question 4 [11 marks]

Simplify each of the following as far as possible by making use of the laws of exponents.

4.1 $125^{\frac{2}{3}}$ (2)

4.2 81×3^{-5} (3)

4.3 $\frac{2.6^2 + 4.6^2}{6^2}$ (2)

4.4 $8^2 + 3.4^3$ (4)

Question 5 [10 marks]

5.1 Simplify the expression without the use of a calculator: (3)

$-3|2-6|$

5.2 Calculate the value(s) of x if: (3)

$|3x-2|=4$

5.3 Given:

$|x-3|<4$

5.3.1 Represent the inequality on a number line. Make use of **DIAGRAM SHEET 2**. (2)

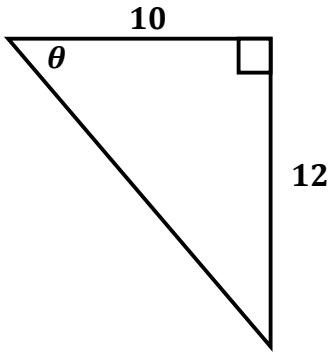
5.3.2 Give the solution of the inequality algebraically. (2)

Question 6 [11 marks]

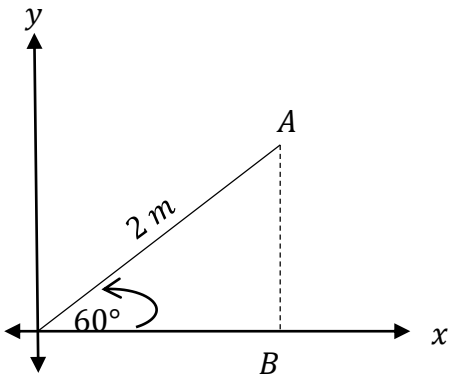
6.1 Determine the value of: (1)

$tan225°$

6.2 Calculate the magnitude of θ in the diagram below to the nearest integer. (2)

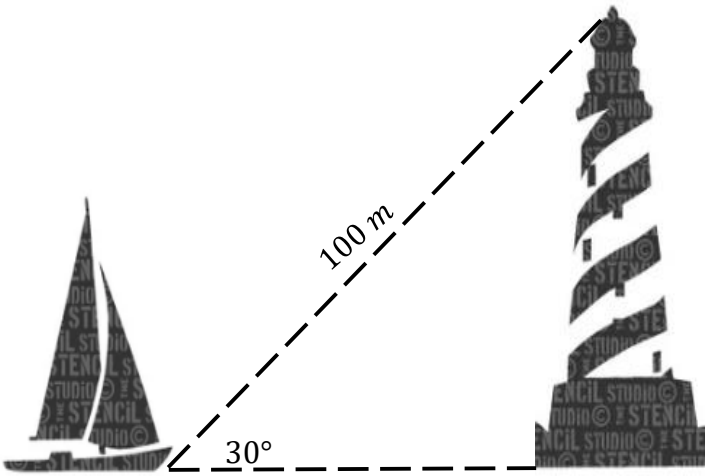


6.3 The following Cartesian plane is given. Calculate the coordinates of B. (3)

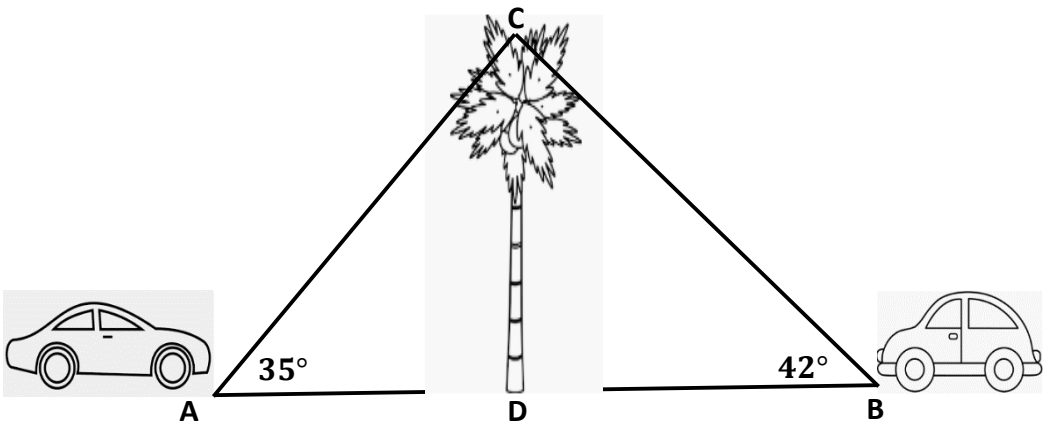


6.4 A boat is sailing towards a lighthouse. The angle of elevation from the boat to the top of the lighthouse is $30°$. The distance from the boat to the top of the lighthouse is $100\ m$. Determine the height of the lighthouse. Make use of the diagram below.

(1)



6.5 Two vehicles are stationary on different sides of a tree CD, in line with the tree. The angle from vehicle A to the top of the tree is $35°$. The angle from vehicle B to the top of the tree is $42°$. Vehicle B is $15\ m$ from the base of the tree.



6.5.1 Determine the height of the tree CD to the nearest integer. (1)

6.5.2 Determine the distance between the two vehicles, that is AB, to the nearest integer. (3)

Question 7 [10 marks]

Henry has to create a 6-character password for his email account. The password must start with 3 letters followed by 3 digits.

How many possible passwords can be formed in each of the following scenarios? (Show all calculations)

7.1 Repetition is permitted. (2)

7.2 Repetition is not permitted. (2)

7.3 The first letter must be a vowel and repetition is not permitted. (3)

7.4 The number formed cannot start with a 0 or an even number repetition is not permitted. (3)

Question 8 [10 marks]

A small factory makes dresses (x) and trousers (y).

8.1 It takes 30 minutes to cut a dress and 15 minutes to cut a trouser. The factory operates for a maximum of 8 hours a day. (3)

Write down an inequality for the cutting time in minutes and simplify your answer.

8.2 The time taken to stitch a dress and a trouser is given by the following inequality: $2x + 3y \leq 48$. (3)

Draw the inequalities on **DIAGRAM SHEET 3** and indicate the feasible region. (Note that there cannot be a negative number of dresses or trousers.)

8.3 The profit on a dress is R40,00 and R50,00 on a trouser. This is given by the function $P = 40x + 50y$. (4)

Calculate how many dresses and trousers the factory has to make to show a maximum profit.

Question 9 [14 marks]

9.1 Prove by negation that: $a^3 + 2a^2b - b^3 = (a - b)(a^2 + ab - b^2)$ (4)

9.2 Complete the table below on **DIAGRAM SHEET 4.** Also indicate if the statement is true or false.

	Statement A	Opposite of statement A'	True	False	
9.2.1	$\pi \in \mathbb{Q}$				(2)
9.2.2	All $\mathbb{Q}$ are also $\mathbb{R}$.				(2)
9.2.3	$\frac{25}{5} \geq 7$				(2)
9.2.4	$\frac{13+1}{7} = 2$				(2)

9.3 Apples cost more than bananas. (2)

Apples cost less than oranges.

Oranges cost more than bananas and apples.

If the first two statements are true, is the third statement true, false or uncertain?

- END OF THE PAPER -

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Answer sheet

Name and Surname: _____

Question Total	1 [10]	2 [15]	3 [9]	4 [11]	5 [10]	6 [11]	7 [10]	8 [10]	9 [14]	TOTAL 100
Learners mark										

Question 1

1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D

DIAGRAM SHEET 1 [Question 2.2]

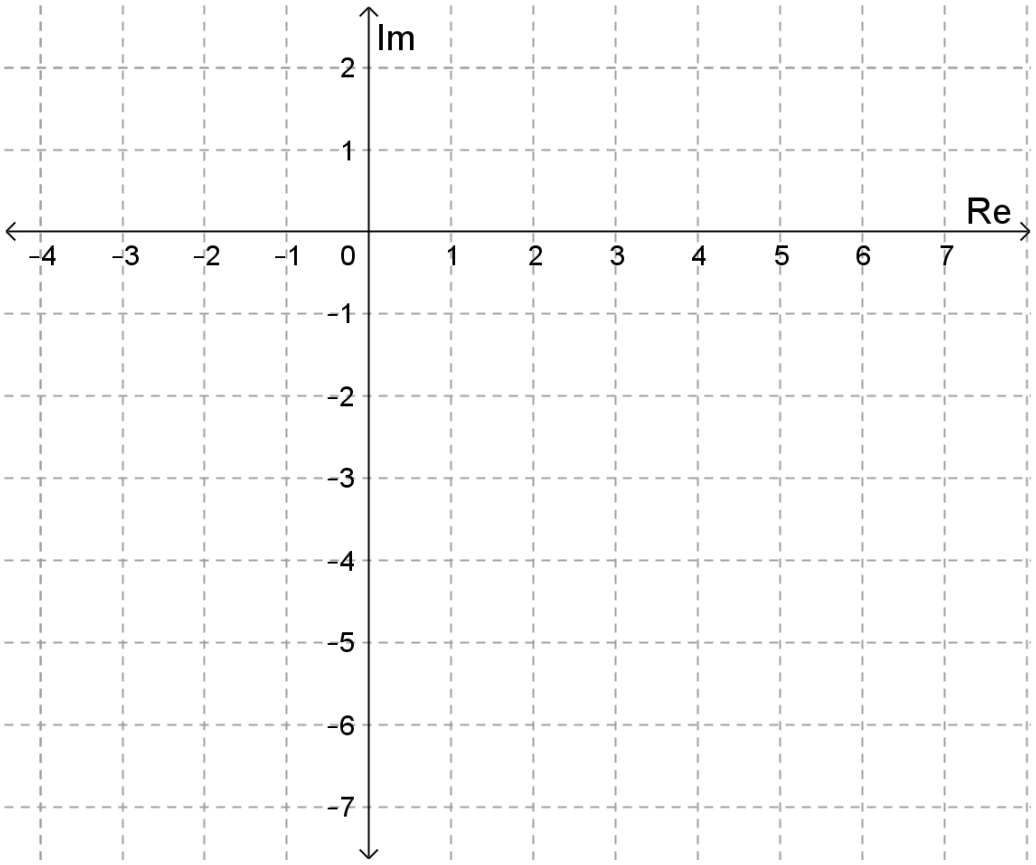

DIAGRAM SHEET 2 [Question 5.3.1]

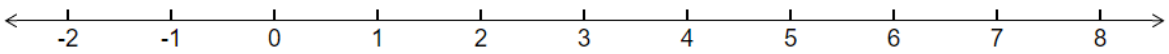

DIAGRAM SHEET 3 [Question 8.2]

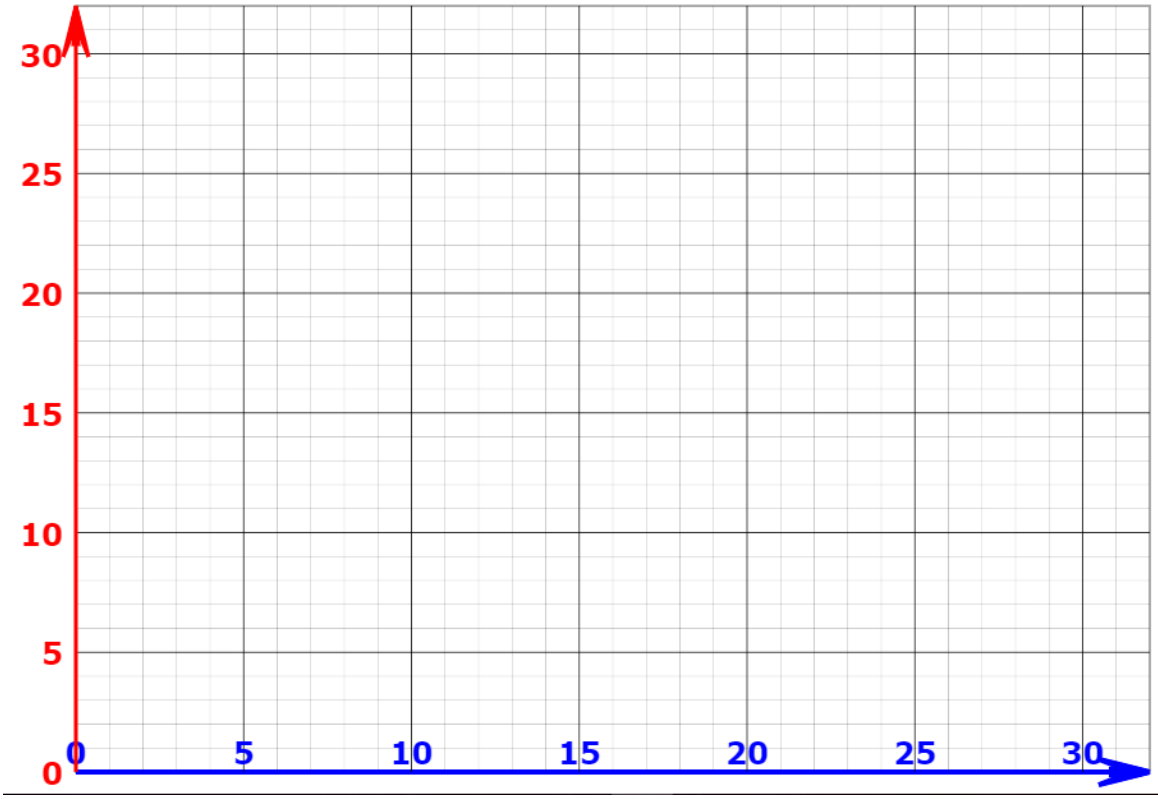

DIAGRAM SHEET 4 [Question 9.2]

	Statement A	Opposite of statement A'	True	False
9.2.1	$\pi \in \mathbb{Q}$			
9.2.2	All $\mathbb{Q}$ is also $\mathbb{R}$.			
9.2.3	$\frac{25}{5} \geq 7$			
9.2.4	$\frac{13+1}{7} = 2$			