Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2016

MATHEMATICS P1

MARKS: **150**

TIME: **3 hours**

* M A T H E 1 *

This question paper consists of 14 pages, including an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
3. Answers only will not necessarily be awarded full marks.
4. You may use an approved scientific calculator (non-programmable and non- graphical), unless stated otherwise.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. An information sheet, with formulae, is included at the end of the question paper.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

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QUESTION 1

1.1 Solve for *x*, in each of the following:

1.1.1 ς ώ· طي χ ώ سي π (3)

1.1.2 τ ώ طى τ ώ طى ρ ρ سي π η ώ شى π (correct to TWO decimal places) (4)

1.1.3 ς ώ طي ρ ώ طي σ حي π (3)

1.1.4 σ ذ 8 σ ذ ٨ ° سي ς χ ذ (4)

1.2 Solve simultaneously for *x* and *y* in the following equations:

σ طى ώ سي ς ώ Á Î Ä τ ώ· طى ώ· سي ς ώ ώ طى χ (6)

1.3 Given: ΄Ω ώ سي ώ١ طي τ ώ· طي ς ώ طى ς π سي ώ طى ς ώ· طي φ ώ طى ρ π
Prove that ΄Ω ώ has only one real root. (3)

[23]

QUESTION 2

2.1 Given: **0 ; -1 ; 1 ; 6 ; 14 ; . . .**

2.1.1 Show that this sequence has a constant second difference. (2)

2.1.2 Write down the next term of the sequence. (1)

2.1.3 Determine an expression for the nth term of the sequence. (4)

2.1.4 Calculate the 30th term. (2)

2.2 In the arithmetic series: ╪طى ٥ ٧طى╫طى ٦ طور 888

2.2.1 Prove that ὤسي φΆ Ῑ ᾯسي ς πϐ (2)

2.2.2 Determine which term of the series will be equal to 230. (3)

2.3 For which value(s) of *k* will the series:

ρطيΏΩ/υ ... ρطيΏΩ/υ ... ρطيΏΩ/υ ... 888 converge? (3)

2.4 Given: **16 + 3 + 8 + 3 + 4 + 3 + 2 + . . .**

2.4.1 Determine the sum of the first 40 terms of the series, to the nearest integer. (4)

2.4.2 Write the series: **16 + 8 + 4 + 2 + . . .** in the form ῎Ὺ

where ῎Ὺ سي ὤὶ and *a* and *r* are rational numbers. (2)

2.4.3 Determine ῟Ὺ of the series in QUESTION 2.4.2. (2)

[25]

QUESTION 3

Given: ῞Ω ὼ سي σ / ὼ، ط ρ طي ς

3.1 Write down the equation of the:

3.1.1 horizontal asymptote of *f*. (1)

3.1.2 vertical asymptote of *f*. (1)

3.2 Determine the *x*- and *y*-intercepts of *f*. (3)

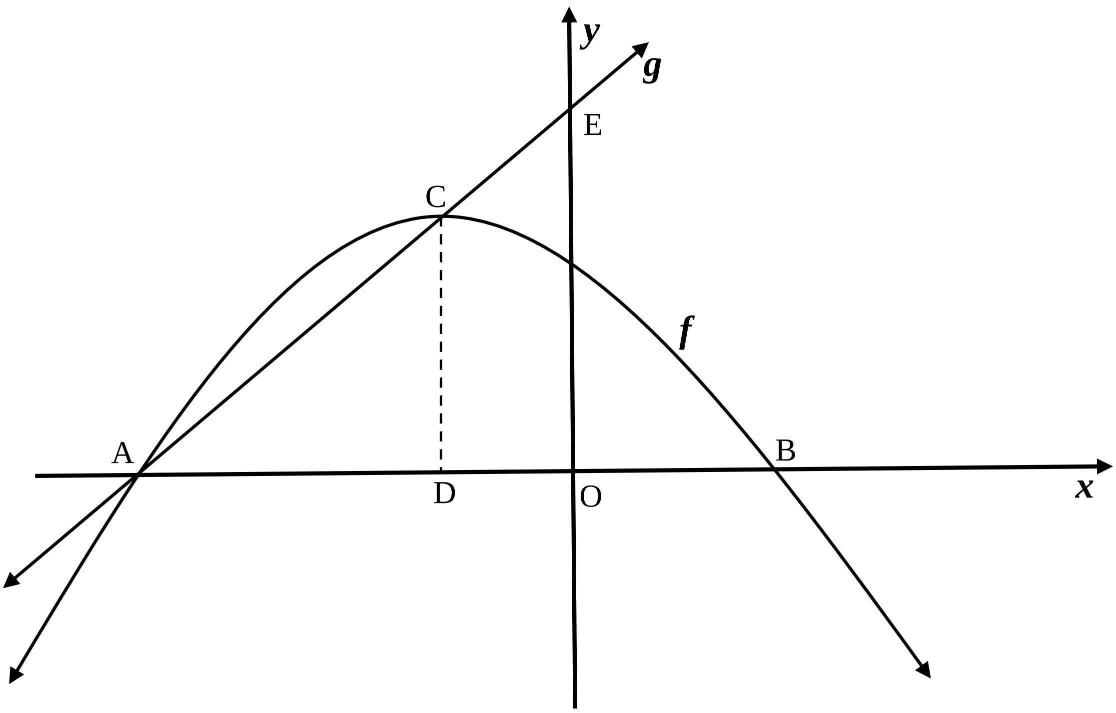
3.3 Sketch the graph of *f* , showing clearly the asymptotes and the intercepts with the axes. (3)

3.4 If another function *g* is defined as $g(x) = f(x\ \text{ï}3) + 7$, determine the coordinates of the point of intersection of the asymptotes of *g*. (2)

[10]

QUESTION 4

The functions ῝Ωὼ سيطيὼ˙ طي ϛὼطσΆ Ὶ῝Ἂὼ سي ά ὼطῶ are drawn below, with *g* passing through E, C and A. A and B are the *x*-intercepts of *f*, and CD is the axis of symmetry of *f*. E is the *y*-intercept of *g*.



4.1 Determine the coordinates of C, the turning point of the graph of *f*. (3)

4.2 Determine the coordinates of A and B. (3)

4.3 Determine the values of *m* and *c*. (2)

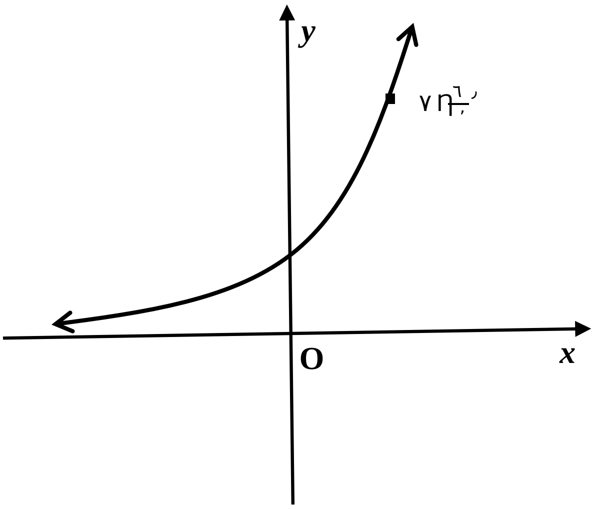
4.4 Calculate the length of CE. (leave your answer in surd form) (3)

4.5 Determine the values of *x*, for which ῝Ωὼ 8Ωὼ حى π. (2)

[13]

QUESTION 5

5.1 The graph of ῞Ωὼ سي ὤ , where ὤحي πΆ Ἰ Ä ὤشى ϼ passes through the point σ∩ ؏ ٥ .



Use the sketch and the given information to answer the following questions.

5.1.1 Determine the value of ὤ (2)

5.1.2 Write down the equation of ῞Ω ˚ in the form $y = \ldots$ (2)

5.1.3 Determine the value(s) of x for which ῞Ω ˚ ὼ سيطي ϼ (2)

5.1.4 If ῞Ωὼ سي῞Ωὼطي υ , write down the domain of ῞Ω (1)

5.2 Draw a clear sketch graph of the function ῞Ω defined by the equation ῞Ωὼ سي ὤ8ὤ طى ή, where ὤحى π∏ὤحي ρΆ Ἰ ή Ä حى π8 (a, b and q are real numbers). Indicate all the intercepts with the axes and the asymptotes. (3)

[10]

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QUESTION 6

6.1 Jerry receives R12 000 to invest for a period of 5 years. He is offered an interest rate of 8,5% p.a. compounded quarterly.

6.1.1 Determine the effective interest rate. (3)

6.1.2 What is the amount that Jerry will receive at the end of the 5 years? (3)

6.2 A company bought office furniture that cost R120 000. After how many years will the furniture depreciate to a value of R41 611,57 according to the reducing-balance method, if the rate of depreciation is 12,4% p.a.? (4)

6.3 Andrew plans to save R20 000 for a deposit on a new car. He decided to use a part of his annual bonus to pay three even annual deposits into a savings account at the beginning of every year. Calculate how much money he must deposit to save up R20 000 after three years. Interest on the savings account is 8% p.a. compounded quarterly. (4)

[14]

QUESTION 7

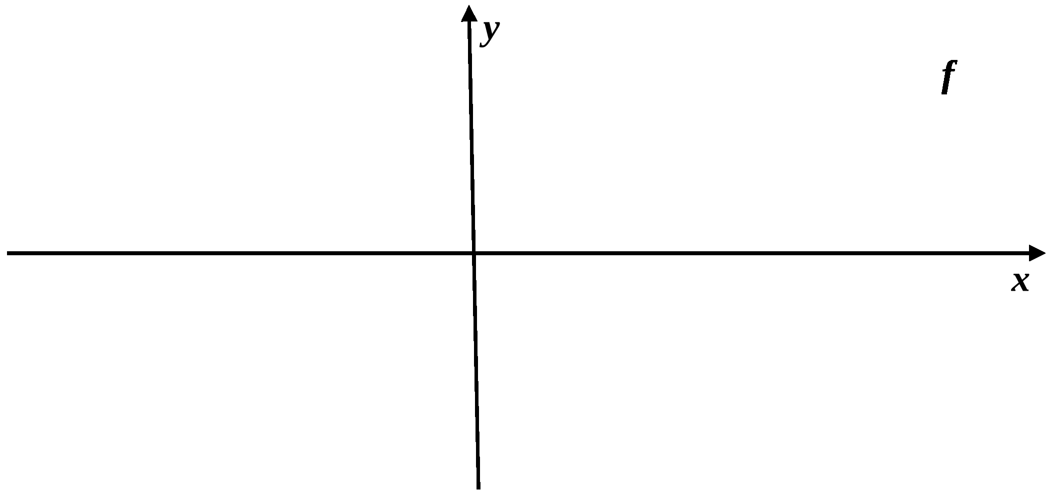
7.1 Determine the derivative of ῚΩὼ سي ςὼ˙ طي σὼ from first principles. (5)

7.2 Determine $\frac{\text{ὈΩ ά}}{\text{ὈΩ ἀ}}$ É Æ6ὼ سي ςὋὦ طي $\frac{\text{σὼ}}{\text{υὼ˙}}$ (4)

[9]

QUESTION 8

8.1 The graph of ˇΩὼ سي ὼ ̓ طي τὼ ̇ طي ρ ῤὼطي σ πis drawn below. A and B are turning points of ˇΩ



8.1.1 Determine the coordinates of A and B. (5)

8.1.2 Determine the *x*-coordinate of the point of inflection of ˇΩ8 (2)

8.1.3 Determine the equation of the tangent to ˇΩΆ ῷسي ς, in the form ώسي ά ὼطي ῶ8 (4)

8.1.4 Explain how the graph of ˇΩcan be shifted for it to have two equal roots. (2)