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education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

MATHEMATICS P1

SEPTEMBER 2024

MATHEMATICS P1

12611B

TIME: 3 HOURS

MARKS: 150

This question paper consists of 8 pages and 1 information sheet.

X05

N2

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

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QUESTION 1

1.1 Solve for x:

1.1.1 $(7-x)(10+x)=0$ (2)

1.1.2 $3x(2x+1)=1$ (correct to TWO decimal places) (4)

1.1.3 $6x^2+7x+2\geq 0$ (3)

1.1.4 $\sqrt{\sqrt{2x}+x}=2$ (5)

1.2 Solve simultaneously for x and y:

$-2y+x=4$ and $x^2+xy-2y^2=0$ (5)

1.3 Given: $4^m=p\left(2^{2m-1}\right)+p$.

Show that for $p\neq 2$ the above equation can be written in the form

$m=\frac{1}{2}\log_2\left(\frac{2p}{2-p}\right)$. (4)

[23]

QUESTION 2

Given: 0; 7 and 12 are the third, fourth and fifth terms of a quadratic number pattern.

2.1 Calculate the first term of the sequence. (2)

2.2 Determine an expression for the n^{th} term of the pattern. (4)

2.3 Determine which term of the pattern will have the highest value. (3)

[9]

QUESTION 3

3.1 Given the arithmetic sequence: $10x+6; 2x+4; 4x-8$

3.1.1 Determine the value of x. (2)

3.1.2 Determine the 10^{th} term of the sequence. (3)

3.1.3 Determine the sum of the first 99 terms of the sequence. (2)

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3.2 Consider the infinite geometric series:
$2(k-5)+2(k-5)^2+2(k-5)^3+\cdots$

3.2.1 For which value(s) of k, is the series convergent? (3)

3.2.2 If $k=4\frac{1}{2}$, calculate S_∞ (3)

3.3 Three numbers are in the ratio 1:3:10. If 20 is subtracted from the third number, the numbers form a geometric sequence. Determine the three numbers. (4)
[17]

QUESTION 4

Given the functions defined by: $f(x)=-\frac{2}{x}-1$ and $g(x)=k^x$.
The point $(1;3)$ lies on g.

4.1 Determine the value of k. (2)

4.2 Write down the equations of the asymptotes of f. (2)

4.3 Write down the equation of g^{-1}, the inverse of g. (2)

4.4 Determine the x-intercept(s) of f. (2)

4.5 Draw neat sketches of f and g^{-1} on the same system of the axes, clearly indicating all asymptotes and intercepts with the axes. (5)

4.6 For which values of x will the axis of symmetry of f, which has a negative gradient, intersect with the graph of f? (4)

4.7 Consider the graph of h, where $h(x)=g^{-1}(x+2)$. Determine the value(s) of x for which $g^{-1}(x+2)\leq 1$. (2)
[19]

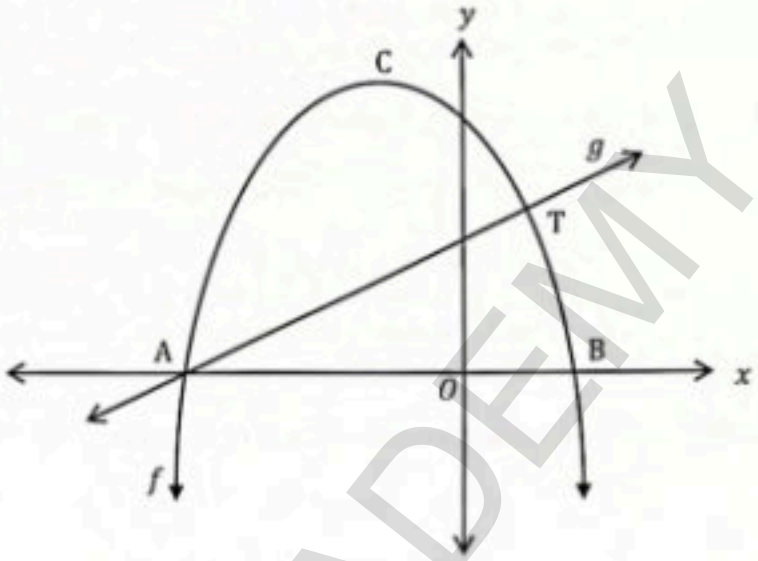
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QUESTION 5

The sketch shows the graphs of the functions $f(x) = -x^2 - x + 12$ and $g(x) = x + 4$.
A and B are the x-intercepts of f, while C is the turning point of f. The functions intersect at A and T.



5.1 Determine the x-coordinates of A and B. (3)

5.2 Determine the range of $f(x)$. (3)

5.3 Determine the maximum value of $k(x) = 3^{f(x)-12}$ (2)

5.4 Determine for which value(s) of x will $x.f(x) > 0$. (2)

5.5 For which real value(s) of k will $-x^2 - x + 12 = k$ have two negative unequal roots? (2)

5.6 Write down the equation of h in the form $h(x) = a(x + p)^2 + q$ if h is the reflection of f in the straight line $x = 1$. (2)
[14]

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QUESTION 6

6.1 The value of a vehicle worth R150 000 depreciate at 13% p.a. Calculate the value of the vehicle in 6 years if depreciation is calculated on the reducing-balance method. (3)

6.2 A loan of R300 000 is taken out at an interest rate of 5,3% p.a. compounded quarterly. The loan was taken out on the 1st of March 2016. The first payment was made on 1 December 2016 and is repaid in 72 equal quarterly payments.

6.2.1 What is the outstanding balance of the loan on 1 September 2016? (3)

6.2.2 Determine the quarterly repayments required to pay back the loan. (3)

6.3 Gert landed a job which remunerated him R27 562,50 quarterly. He then decided to open an investment account and deposit 11% of his salary at the end of every quarter into the investment account, earning an interest of 7,9% p.a. compounded monthly for eight years.

What amount will be in the account at the end of eight years? (6)
[15]

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QUESTION 7

7.1 Determine $f'(x)$ from first principles if it is given that $f(x) = -1 + 4x^2$. (5)

7.2 Determine:

7.2.1 $D_x[(2x^3 + 5)^2]$ (3)

7.2.2 $\frac{dy}{dx}$ if $y = 3x^4 - \frac{7}{x} + 2.\sqrt[3]{x^2}$ (4)

7.3 Determine the coordinates of the point on the curve of $y = 2x^2 + 3x + 1$, where the tangent at the point is perpendicular to $y + 5x = 4$. (4)
[16]

QUESTION 8

The equation of the cubic function f is given as
$f(x) = -3x^3 + 15x^2 - 21x + 9$

8.1 Determine the x- and y-intercepts of the graph. (4)

8.2 Determine the coordinates of the turning points of f. (4)

8.3 Sketch the graph of f clearly indicating the intercepts with the axes and the turning points. (4)

8.4 For which value(s) of:

8.4.1 x is $f'(x) > 0$? (2)

8.4.2 k will $f(x) = k$ have exactly three different real roots? (2)
[16]

QUESTION 9

At a price of R400 per bag, 200 bags are sold. For every R20 increase in the price of the bags, four fewer bags are sold. At what price must the bags be sold to maximise the profit? **[7]**

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QUESTION 10

10.1 A and B are two events in a sample space. $P(A \text{ or } B) = 0.8$ and $P(B) = 0.4$.

10.1.1 Determine the $P(A)$ if events A and B are mutually exclusive. (2)

10.1.2 Determine the $P(A)$ if events A and B are independent. (2)

10.2 A medical screening is performed to test for the presence of a disease in a population.
The test is not 100% accurate. 10% of those who have the disease will test negative, and 5% of those who don't have the disease will test positive. If the test is performed on the entire population and 6,7% test positive, what percentage of the population has the disease? (6)

10.3 In the Free State, license plates are designed with three letters of the alphabet, excluding vowels, next to one another and then any three digits from 0 to 9 next to one another. FS is constant in all Free State license plates, for example, DNV 295 FS. Letters and digits may be repeated in a license plate.

10.3.1 How many unique license plates will be available if the letters and the numbers are not repeated? (1)

10.3.2 Hence, determine the probability that the license plates will start with a 6, in keeping with the order above. (3)
[14]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1+ni) \quad A = P(1-ni) \quad A = P(1-i)^n \quad A = P(1+i)^n$$

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left[2a + (n-1)d\right]$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r-1} \; ; \quad r \neq 1 \qquad S_\infty = \frac{a}{1-r} \; ; \; -1 < r < 1$$

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right) \qquad y = mx + c$$

$$y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta \qquad (x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A$

$$area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

$$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\cos\alpha$$

$$\bar{x} = \frac{\sum x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n} \qquad P(A) = \frac{n(A)}{n(S)} \quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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Enq: Paper 1 Sep 2024

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Colleagues,

Grade 12 Mathematics September 2024

Questions Removed.

PAPER 1 English and Afrikaans

Question	Marks	Reason for removal
1.3	4	The logarithmic laws will be applied, only in the context of real-life problems related to finance, growth and decay.
9	7	The calculation of profit is impossible with the given information in the question.

Conclusion: The paper will be marked of 139

Afrikaans only:

Question	Marks	Reason for removal
5.5	2	The question was incorrectly phrased.

Conclusion: Afrikaans paper will be marked out of 137

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