# MATHEMATICS – P1

# LAST PUSH

Province of the EASTERN CAPE EDUCATION

education Department of Education FREE STATE PROVINCE

KWAZULU-NATAL PROVINCE EDUCATION REPUBLIC OF SOUTH AFRICA

LIMPOPO PROVINCIAL GOVERNMENT REPUBLIC OF SOUTH AFRICA

# TRIAL PAPERS

# ALL PROVINCES – 2026

education MPUMALANGA PROVINCE REPUBLIC OF SOUTH AFRICA

Northern Cape Department of Education

education Department: Education North West Provincial Government REPUBLIC OF SOUTH AFRICA

SACAI

Compiled by

Western Cape Government FOR YOU

GAUTENG PROVINCE EDUCATION REPUBLIC OF SOUTH AFRICA

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# Algebra

## Eastern Cape

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $2x(x-3)=0$ (2)

1.1.2 $5x=-2x^2-1$ (correct to TWO decimal places) (4)

1.1.3 $-x^2+2x+3>0$ (4)

1.1.4 $25^x - 26.5^x = -25$ (4)

1.2 Solve simultaneously for $x$ and $y$, if:

$2x-y=1$ and $x^2-y^2=xy-11$ (6)

1.3 Given that $m(x)=\frac{3x-2}{4x}$ and $n(x)=\frac{x+2}{\sqrt{x+5}}$

Determine the value(s) of $x$ if $m(n(x))=\frac{1}{2}$ (5)

**[25]**

## Free State

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $(x+2)(x-2)=5$ (2)

1.1.2 $\frac{1}{2}x^2-2x-1=0$ (correct to TWO decimal places) (3)

1.1.3 $5<x(7-2x)$ and $x>2$ (5)

1.1.4 $3^x-1=\sqrt{2.3^{x+1}+10}$ (4)

1.2 The roots of a quadratic equation $x^2+bx+c=0$ are $x=\pm\sqrt{p^2-2p+1}$

1.2.1 For which value(s) of $p$ will the roots be real and equal? (2)

1.2.2 Hence, determine the value(s) of $b$ and $c$ for the value of $p$ in QUESTION 1.2.1 (3)

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1.3 Solve for $x$ and $y$ in the following simultaneous equations:

$$\frac{4^y}{2^x} = 0,5 \text{ and } x^2 + y^2 = 29$$ (7)

**[26]**

**Gauteng**

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $3x^2 - x + 2 = x + 2$ (3)

1.1.2 $7x^2 - x - 2 = 0$ (Correct to TWO decimal places) (3)

1.1.3 $\left(\frac{x}{2}\right)^2 - 5x + 24 \leq 0$ (5)

1.1.4 $2^{-x+2} - 2^{-x} = 48$ (3)

1.2 Solve for $x$ and $y$ simultaneously:

$$\sqrt{2x+1} - 2 = y \text{ and } x = 4y$$ (6)

1.3 Given the quadratic equation $ax^2 + bx + c = 0$ with solutions:

$$x = 7 \text{ and } x = \frac{5 - \sqrt{25 + 56a}}{2a}$$

1.3.1 Determine the values of $a$, $b$ and $c$. (5)

1.3.2 Hence determine the other solution to the quadratic equation. (1)

**[26]**

**KZN**

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $2x - 4x^2 = 0$ (3)

1.1.2 $x^2 - 5 = -8x$ (correct to TWO decimal places). (4)

1.1.3 $3x^2 - 16x \leq -5$ (4)

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1.1.4 $\left(\sqrt{x-1}-3\right)\left(\sqrt{x-1}+2\right)=-6$ (5)

1.2 Solve simultaneously for $x$ and $y$:

$x-2y=3$

$3x^2-5xy=24+16y$ (5)

1.3 Given: $\left(\sqrt{7}\right)^x+\left(\sqrt[3]{5}\right)^y=54$; where $x$ and $y\in$ N. Determine the value of P, where $P=x\times y$. (4)

**[25]**

## Limpopo

**QUESTION 1**

1.1 Given: $y+\frac{1}{y}=2$

1.1.1 Solve for $y$. (2)

1.1.2 Hence, solve for $x$ (round off to TWO decimal places if necessary)

$$(2x^2+3x)+\frac{1}{(2x^2+3x)}=2$$ (4)

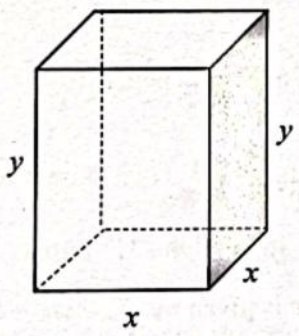
1.2 Solve for $x$:

1.2.1 $x^2+x-6<0$ (3)

1.2.2 $5+\sqrt{x+5}=\frac{14}{\sqrt{x+5}}$ (5)

1.2.3 $9^{x+1}-10.3^x+1=0$ (4)

1.3 A closed box has the shape of a rectangular prism with a square base. The sides of the base are $x$ cm long. The height is $y$ cm long. The surface area of the box is $288\,cm^2$. The height of the edges are such that $y=21-2x$.




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1.3.1 Show that: $x^2+2xy-144=0$. (2)

1.3.2 Hence, calculate the values of $x$ and $y$. (4)

**[24]**

## Mpumalanga

**QUESTION 1**

1.1 Solve for $x$ if:

1.1.1 $2x(x-1)+5(x-1)=0$ (2)

1.1.2 $-4x-3x^2=-5$ Correct to 2 decimal places. (4)

1.1.3 $9^x-3^x=6$ (4)

1.1.4 $\sqrt[3]{32}=8^{3x}.2^{6x}$ (3)

1.1.5 $-(x+2)(x-3)\leq 0$ (3)

1.2 Solve for $x$ and $y$ simultaneously:

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

1.3 Prove that the roots of $3x^2+2kx-k=2x$ are never equal, for any real number $k$. (4)

1.4 Determine the value of: $\frac{5^{2006}-5^{2004}+24}{5^{2004}+1}$ (3)

**[28]**

## Northern Cape

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $2x(x-2)=0$ (2)

1.1.2 $-x^2+7x=-5$ (correct to TWO decimal places) (4)

1.1.3 $(x+1)(2-x)<0$ (3)

1.1.4 $\sqrt{x-3}+1=\frac{x}{2}$ (4)

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1.2 Solve for $x$ and $y$ simultaneously:

$y - x^2 = -3x + 2$
$y = 2x - 4$ (5)

1.3 Given the quadratic equation $2x^2 - mx + 2 = 0$

The equation is known to have equal real roots.

Furthermore, the quadratic equation $x^2 - (m-2)x + k = 0$ also has equal roots that are reciprocals of the roots of the first equation.

Determine the possible value(s) of $m$ and $k$. (7)
**[25]**

**North-West**

**QUESTION 1**

1.1 Solve for $x$:

1.1.1 $(3-x)(2x+8) = 0$ (2)

1.1.2 $3x^2 - 7x - 2 = 0$ (correct to TWO decimal places) (3)

1.1.3 $x^2 - x - 6 \geq 0$ (4)

1.1.4 $12^{2x} = 8(36^x)$ (5)

1.1.5 $6\sqrt{x-5} + x = 5$ (5)

1.2 Solve for $x$ and $y$ simultaneously:

$x + y = -2$ and $x^2 - 4x + y^2 + 8y + 2 = 0$ (5)

1.3 Determine two numerical values of $k$ for which $x^2 + k(2x-4) + 5$ is a perfect square. (4)
**[28]**

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## SACAI

### QUESTION 1

Solve for $x$:

1.1 $x^2 - 1 = 7x$ (Correct to TWO decimal places) (3)

1.2 $(x+1)^2 \geq 0$ (2)

1.3 $\sqrt{x+3} - 2x = 0$ (5)

1.4 $5 \cdot 3^{1-x} = 135$ (3)

**[13]**

### QUESTION 2

2.1 Without solving for $x$, discuss the nature of $x$ if:

$$x^2 - 2kx + k^2 - 3 = 0 \quad (3)$$

2.2 Solve for $x$ in terms of $p$:

$$16^{p^2} = \frac{2^{x^2}}{16^{x-1}} \quad (5)$$

2.3 Solve for $x$ and $y$ simultaneously:

$$y + \frac{1}{2}x - 3 = 0 \quad \text{and} \quad y = x^2 - 6x \quad (5)$$

**[13]**

## Western Cape

### QUESTION 1

1.1 Solve for $x$:

1.1.1 $x^2 + 3x = 10$ (3)

1.1.2 $2x^2 = 7x + 3$ (correct to TWO decimal places) (4)

1.1.3 $3x^2 + 13x + 10 \geq 0$ (3)

1.1.4 $2\sqrt{x+9} + 6 = x$ (4)

1.2 Solve for $x$ and $y$ simultaneously if
$\log_2(x+y)=3$ and $x^2+5xy+6y^2=0$ (6)

1.3 If $a$ and $b$ are nonzero real numbers such that $a^2=b(b+1)$ and $b^2=a+1$ determine the value of $\frac{1}{a}+\frac{1}{b}$. (4)

**[24]**

# Number Patterns

**Eastern Cape**

**QUESTION 2**

2.1 Given the arithmetic series: $7+16+25+34+\ldots$

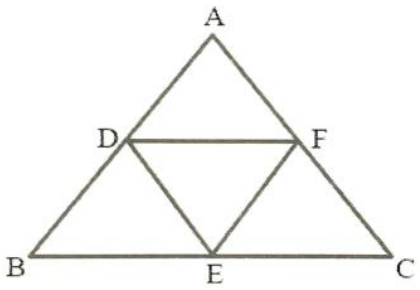
2.1.1 Determine the expression for the general term of the series. (2)

2.1.2 Calculate $T_{35}$ (1)

2.1.3 Calculate $S_{35}$, i.e. the sum of the first 35 terms of the series. (2)

2.1.4 Determine the maximum number of terms for which the sum of this series will be less than 8 600. (4)

2.2 An equilateral triangle, $\Delta ABC$ has each of its sides 1 unit long with an area of $\frac{\sqrt{3}}{4}$ units$^2$. The midpoints of the sides are joined to form a new equilateral triangle, $\Delta DEF$. This process of joining midpoints to form new equilateral triangles is continued indefinitely.




2.2.1 Determine the length of the sides of ΔDEF. (1)

2.2.2 Determine the area of ΔDEF. (2)

2.2.3 Calculate the sum of the areas of all the triangles if new triangles are formed indefinitely. (4)

2.3 Determine the value of $T_4$ if $\sum_{k=1}^{n} T_k = n(n+1)(2n+3)$ (4)

**[20]**

**Free State**

**QUESTION 2**

**2.1 Consider the number pattern: 9; 18; 31; 48; ...; 864**

**2.1.1 Determine the $n^{th}$ term, $T_n$, of the above number pattern. (4)**

**2.1.2 How many terms are there in the number pattern? (3)**

**2.2 A quadratic number pattern has the following properties:**

**The first term is $p$**
**The second term is 14**
**The fourth term is seven times the first term**
**$T_3 - T_2 = 10$**

**Determine the value $p$ (4)**

**[11]**

**Gauteng**

**QUESTION 2**

Given the number pattern: $7\sin30°$ ; 7 ; $23\sin30°$ ; 17 ; ...

2.1 Show that the pattern is quadratic. (3)

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2.2 The $n^{th}$ term of the number pattern can be written as $T_n = \frac{1}{2}n^2 + pn + q$.

Show that $p = 2$ and $q = 1$. (2)

2.3 Determine which term of the sequence will have a value of 49. (4)

2.4 A Grade 12 learner claims that the minimum value of this pattern can be obtained by determining the turning point of the relevant quadratic function.

By using a valid calculation, explain why this learner is incorrect. (3)

**[12]**

**KZN**

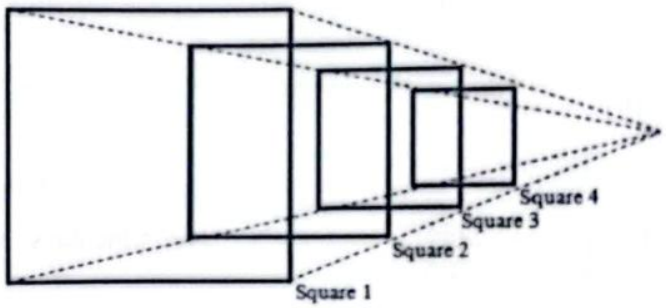
**QUESTION 2**

2.1 The fourth term of an arithmetic sequence is 15 and the twelfth term is 47. Determine the first two terms of the sequence. (4)

2.2 The areas of the first three squares in the sketch below are as follows:

- Area of Square 1: 18 cm²
- Area of Square 2: 9 cm²
- Area of Square 3: $\frac{9}{2}$ cm²

The pattern continues indefinitely.




2.2.1 Write down the area of Square 4. (1)

2.2.2 Calculate the total area of all the squares that are smaller than Square 6. (6)

2.2.3 Which square will have a side length of $\frac{3}{8}$ cm? (5)

**[16]**

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## Limpopo

**QUESTION 2**

2.1 Given the series: $(x-3)+(x-3)^2+(x-3)^3+.....$

2.1.1 If the series converges, calculate the value(s) of $x$. (3)

2.1.2 Calculate the sum to infinity in terms of $x$. (2)

2.1.3 Hence, calculate $S_\infty$ for the following series:

$(2,5-3)+(2,5-3)^2+(2,5-3)^3+.....$ (2)

2.2 Given that: $\sum_{p=1}^{n}(2p+2)=990$

2.2.1 Determine the value of $n$. (4)

2.2.2 If $n=30$, show that $T_n=S_n-S_{n-1}$. (4)

**[15]**

## Mpumalanga

**QUESTION 2**

2.1 Given the finite arithmetic sequence: $-2\,;2\,;6\,;10\,;\ldots;262$

2.1.1 Write down the fifth term of the sequence. (1)

2.1.2 Determine the formula for the general term of the sequence. (2)

2.1.3 Determine the sum of all the terms in the above sequence. (4)

2.2 Consider the quadratic sequence $m\,;5\,;n\,;19$.

2.2.1 Calculate the values of $m$ *and* $n$ if the second difference is 2 (4)

2.2.2 Hence determine the $n^{th}$ -term of the quadratic sequence. (3)

**[14]**

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## Northern Cape

**QUESTION 2**

The first term of a quadratic number pattern is 5. The general term of the first differences of the pattern is $T_p = 6p + 2$.

2.1 Determine the next TWO terms of the quadratic number pattern. (2)

2.2 Hence, or otherwise, show that the general term of the quadratic number pattern is given by $T_n = 3n^2 - n + 3$. (3)

2.3 What is the position of the next consecutive term greater than 2327? (4)

2.4 The quadratic number pattern has two consecutive terms of which the difference is 902. Determine the positions of these consecutive terms. (2)

**[11]**

## North-West

**QUESTION 2**

2.1 Given: $\sum_{k=4}^{p}(2k - 5)$

2.1.1 Write down the first THREE terms of the series. (1)

2.1.2 Determine the general term of the series. (2)

2.1.3 Calculate $T_{50}$ of this series. (1)

2.1.4 For which values of $p$ will $\sum_{k=4}^{p}(2k - 5) < 5\,000$? (6)

2.2 A number $k$ must be added to each term of the sequence $-1;\ 2;\ 8$ such that the sequence that is formed, will be a geometric sequence.

2.2.1 Determine the value of $k$. (3)

2.2.2 Calculate the sequence if $k = 4$. (1)

2.2.3 Give a reason why this is NOT a converging sequence. (1)

2.2.4 Calculate the sum of the first 15 terms. (2)

**[17]**

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## SACAI

### QUESTION 3

3.1 Calculate the following:

$$\sum_{k=0}^{3} \frac{2^{k-1}}{k+1} \quad (2)$$

3.2 $-2; x; -32$ are the first three terms of an infinite sequence:

3.2.1 Calculate the value(s) of $x$ if the sequence is geometric. (2)

3.2.2 Calculate the sum of the first 11 terms of the geometric sequence if $r < 0$. (3)

3.2.3 If $x = -17$ calculate the 100th term of the sequence. (3)

3.3 Below are the first four terms of the sequence which represents the first differences of the quadratic number pattern with general term $T_n = an^2 + bn + 16$

$2; 16; 30; 44; \ldots$

Calculate the first term of the quadratic number pattern. (5)

**[15]**

## Western Cape

### QUESTION 2

2.1 The first three terms of an arithmetic sequence are

$2k-7\ ;\ k+8$ and $2k-1$.

2.1.1 Determine the value of $k$. Show ALL calculations. (3)

2.1.2 If $k=12$, determine the sum of the first 30 EVEN terms in the sequence. (4)

2.2 A geometric series has a constant ratio of $\frac{1}{2}$ and a sum to infinity of 6.

2.2.1 Determine the 7th term of the series. (4)

2.2.2 Given: $\sum_{k=2}^{p} 3(2)^{1-k} = \frac{45}{16}$, determine the value of $p$. (5)

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2.2.3 If $\sum_{k=2}^{20} 3(2)^{1-k} = m$, write down $\sum_{k=2}^{20} 24(2)^{-k}$ in terms of $m$. (3)

**[19]**

## Eastern Cape

**QUESTION 3**

Given the quadratic number pattern: $-3\ ;\ -6\ ;\ -11\ ;\ \ldots$

3.1 Write down the next TWO terms of the quadratic number pattern. (1)

3.2 Show that the general term of the quadratic number pattern is given as $T_n = -n^2 - 2$ (3)

3.3 Calculate the value of $n$ if $T_n = -2603$ (2)

**[6]**

## Free State

**QUESTION 3**

3.1 The fourth term of an arithmetic series is 55, and the tenth term is 45.

3.1.1 Determine the first term and constant difference. (3)

3.1.2 Calculate the sum of the positive terms in the series. (4)

3.2 If $a; b; \ldots$ is a geometric sequence where $a$ and $b$ are non-zero real numbers, write down the third term in terms of $a$ and $b$. (1)

3.3 Given: $\sum_{r=1}^{\infty} 3.n^{1-r} = 6$

3.3.1 Calculate the value of $n$. (3)

3.3.2 Hence, calculate the sum of the first 10 terms. (2)

**[13]**

## Gauteng

**QUESTION 3**

3.1 The first three terms of an infinite series are given by: $3 + 2x + \frac{4}{3}x^2 + \ldots$

3.1.1 Determine the value(s) of $x$ for which the series is convergent. (2)

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3.1.2 If $x=\frac{1}{2}$, determine $S_\infty$. (3)

3.2 Two different series, A and B are given as follows:

$$A_m=\sum_{p=1}^{m}(7p-22) \quad \text{and} \quad B_n=\sum_{k=1}^{n}24\left(\frac{3}{2}\right)^k$$

3.2.1 Show that $B_n=72\left[\left(\frac{3}{2}\right)^n-1\right]$. (2)

3.2.2 Given: $A_{18}-B_n=\frac{423}{8}$.

Hence or otherwise, calculate the value of $n$. (6)

**[13]**

**KZN**

**QUESTION 3**

3.1 Calculate: $\sum_{k=10}^{25}(7-5k)$. (4)

3.2 The following information of a quadratic pattern is given:

- $T_n=an^2+bn+6$
- $T_4=26$
- $T_3-T_2=7$

Determine the values of $a$ and $b$. (4)

**[8]**

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## Limpopo

**QUESTION 3**

The following sequence of numbers forms a quadratic pattern:

3 ; 2 ; 3 ; 6 ; 11 ; .....

3.1 Determine the $10^{th}$ term of the first difference. (3)

3.2 Calculate the difference between the $30^{th}$ and the $31^{st}$ terms of quadratic pattern. (2)

3.3 The general term of quadratic pattern is given by $T_n = an^2 + bn + c$. Determine the values of $a$, $b$ and $c$. (3)

3.4 Explain why the given quadratic pattern will never contain a negative value. (1)

**[9]**

## Mpumalanga

**QUESTION 3**

3.1 Given $\sum_{k=3}^{19}(-2)^k$

3.1.1 Write down the value of the constant ratio. (1)

3.1.2 Will $\sum_{k=3}^{19}(-2)^k$ converge? Explain your answer. (2)

3.1.3 Evaluate $\sum_{k=3}^{21}(-2)^k x$ in terms of $x$. (3)

3.2 Shoba's annual salary is 150 000 and her expenses total R105 000.Her salary increases by R13 500 each year while her expenses increase by R17 000 each year. Each year she saves the excess of her income.

3.2.1 Represent her total savings as a series. (4)

3.2.2 If she continues to manage her finances this way, after how many years will she have nothing left to save? (3)

**[13]**

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## Northern Cape

**QUESTION 3**

3.1 Given the geometric series $\frac{6}{10}+\frac{6}{20}+\frac{6}{40}+\ldots=S$

3.1.1 If the series has 18 terms, determine the value of S. (3)

3.1.2 Determine the largest value of $n$ for which $T_n > \frac{6}{4096}$. (4)

3.2 Prove that the following sum is a convergent geometric series. Show ALL calculations.

$T_n=5\left(\frac{1}{3}\right)^n$ (2)

3.3 Given $\sum_{k=p}^{\infty} 5\left(\frac{1}{3}\right)^k = \frac{5}{18}$

Calculate the value of $p$. (5)

**[14]**

## North-West

**QUESTION 3**

A quadratic sequence, $T_n = an^2 + bn + c$, has the following properties:

- $T_3 = T_7$
- The smallest term of the quadratic sequence is 10.
- The first term of the sequence of first differences is – 14.

Determine the general term of this quadratic sequence.

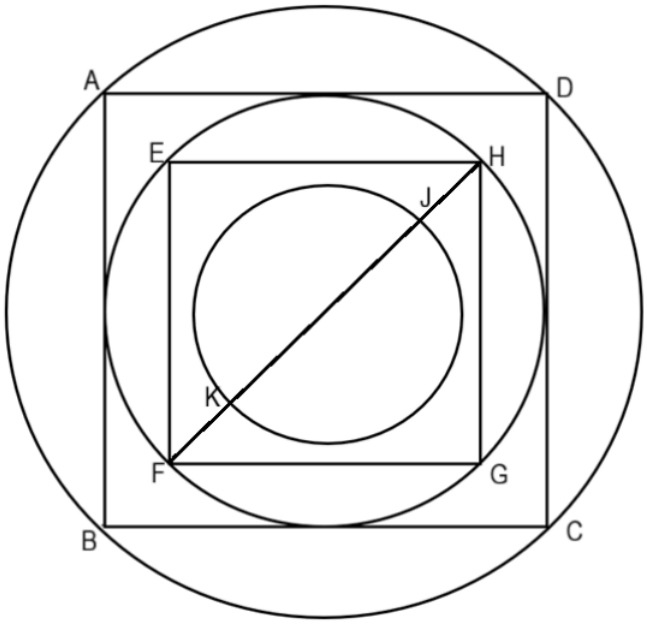
**[6]**

## SACAI

## QUESTION 4

In a circle, square ABCD, is drawn with the vertices on the circumference of the circle. A second circle is drawn inside square ABCD touching the sides of the square and touching the vertices of square EFGH.

- The sides of the square ABCD are $4\sqrt{2}$ units.
- Diagonal FH is 4 units.
- JH = KF = 1 unit.
- KJ is the diameter of the smallest circle in the diagram.




Leave your answers in terms of $\pi$.

4.1 Show that the area of the largest circle is $16\pi$ square units. (3)

4.2 Calculate the area of the circle touching the points E, F, G and H.
Leave your answer in terms of $\pi$. (2)

4.3 Calculate the area of the smallest circle in the diagram.
Leave your answer in terms of $\pi$. (2)

4.4 If the areas of the circles form a geometric sequence which continues indefinitely, calculate the total sum of the areas of all circles formed. (3)

**[10]**

**Western Cape**

**QUESTION 3**

A quadratic sequence is given:

$$-14\ ;\ 0\ ;\ 10\ ;\ 16\ ;\ \ldots$$

3.1 Determine the general term of the sequence in the form $T_n = an^2 + bn + c$. (3)

3.2 For which values of $n$ will $T_n$ be smaller than $-110$. (4)

**[7]**

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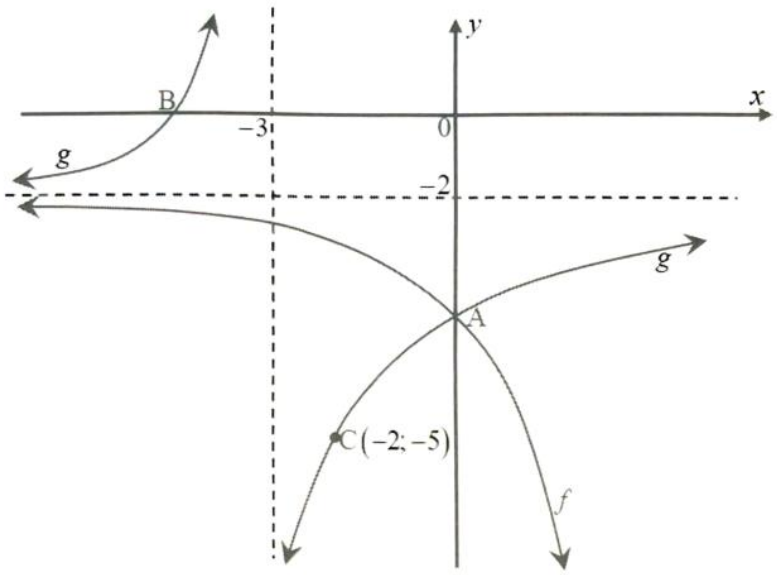
# Functions

**Eastern Cape**

**QUESTION 4**

The sketch below shows the graphs of $f(x)=-2^x+k$ and $g(x)=\frac{-3}{x+3}+q$

- A is the common $y$-intercept of $f$ and $g$
- B is the $x$-intercept of $g$
- The graph of $g$ passes through $C(-2;-5)$
- The graphs of $f$ and $g$ have a common horizontal asymptote of $y=-2$




4.1 Write down the value of $q$. (1)

4.2 Calculate the coordinates of B, the $x$-intercept of $g$. (3)

4.3 Determine the equation of $h$, the axes of symmetry of g with a positive gradient. (2)

4.4 Determine the coordinates of $C'$, the reflection of C along the axes of symmetry with a positive gradient i.e. $y=h(x)$ (2)

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4.5 Determine the equation of the inverse of $p$ in the form $p^{-1}(x) = \ldots$ , if the function of $p$ is formed by shifting $f$ , 2 units up and reflecting $f$ about the $x$-axis. (3)

4.6 For which values of $x$ will:

4.6.1 $g(x) \geq 0$ (2)

4.6.2 $p^{-1}(x) < 1$ (2)

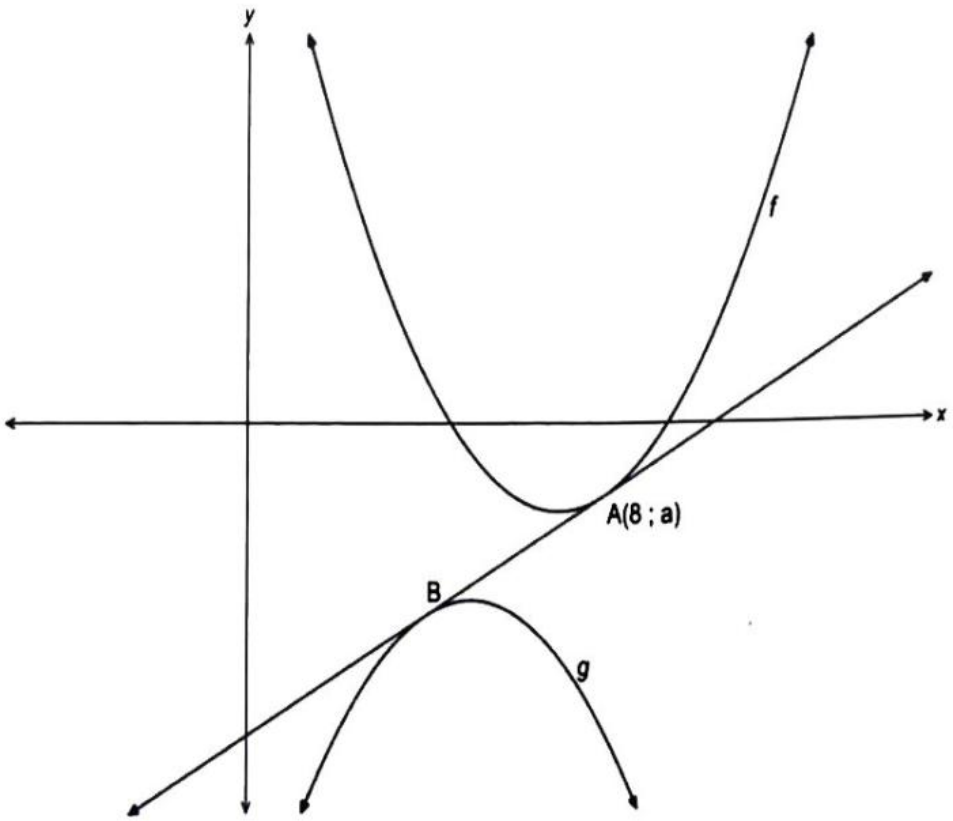
**[15]**

**Free State**

## QUESTION 4

4.1 There are two functions represented by $f$ and $g$ with a common tangent at A(8; a) and B, respectively, in the diagram below.

- $f(x) = x^2 - 14x + 43$
- $g(x) = -x^2 + 10x - 19 + k$




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4.1.1 Determine the equation of the common tangent. (5)

4.1.2 Determine the value of $k$. (5)

4.2 Consider the function $f(x)=4^{-x}-2$

4.2.1 Sketch the graph of $f$ on a set of axes. Show the intercepts with the axes as well as the asymptotes. (4)

4.2.2 Describe the transformation of $f$ to $g$ if $g$ is given by $g(x)=2\left(\frac{1}{4}\right)^x$ (3)

4.2.3 Write down the equation of $h^{-1}$ in the form $h^{-1}=K$ if $h$ is the transformation of $g$ to $h(x)=\left(\frac{1}{4}\right)^x$ (2)

4.2.4 State the range of the graph of $y=h(x)-2$ (2)

**[21]**

**Gauteng**

**QUESTION 4**

Given $f(x)=q-\frac{2}{x+p}$ with the following essential properties:

- $x\in R;\ x\neq 2$
- $y\in R;\ y\neq 3$
- $y=x+t$ is the equation for ONE of the axes of symmetry of $f$.

4.1 Write down the values of $p$ and $q$. (2)

4.2 Calculate the value of $t$. **(2)**

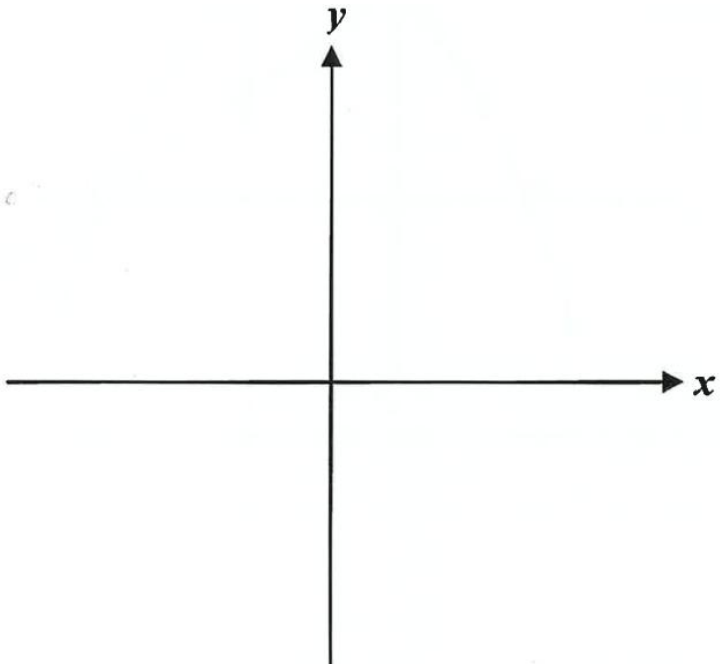
4.3 $f$ is translated 2 units to the left and 3 units upward to obtain $h$.
Determine the equation of $h^{-1}$. Write your answer in the form $y=...$ **(2)**

4.4 Given: $g(x)=\log_2 x$

4.4.1 Write down the equation of $g^{-1}$ in the form $y=...$ **(2)**

4.4.2 Sketch the graphs of $g$ and $g^{-1}$ on the same set of axes.
Clearly indicate the intercepts with the axes, and ONE additional point on each graph.

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(4)

4.4.3 Write down the value(s) of $x$ for which $x.g(x) \leq 0$. (2)

**[15]**

**KZN**

**QUESTION 4**

Given: $f(x) = \frac{-9}{x-3} + 2$

4.1 Write down the equations of the asymptotes of $f$. **(2)**

4.2 Calculate the

4.2.1 $x$-intercept of $f$. **(2)**

4.2.2 $y$-intercept of $f$. **(1)**

4.3 Sketch the graph of $f$, showing all the intercepts with the axes and the asymptotes. **(3)**

4.4 Describe in words the single transformation of $f$ to $g$, where $g(x) = \frac{9}{x+3} + 2$. **(2)**

4.5 For which values of $p$ will $f(x) + p = 0$ have one negative root? **(2)**

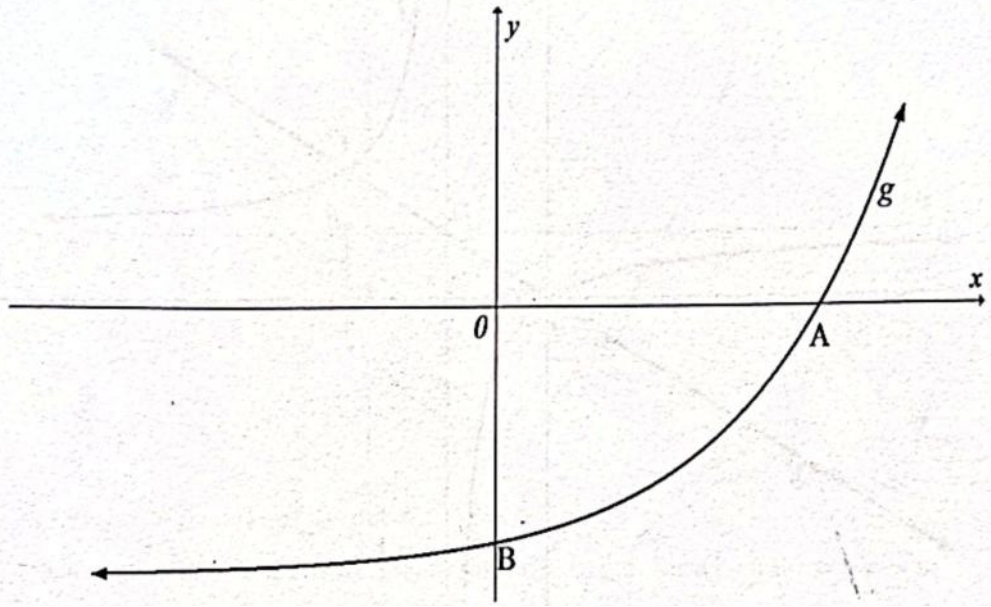
**[12]**

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**Limpopo**

**QUESTION 4**

The graph of $g(x) = 3^x - 9$ is sketched below. The graph cuts the $x$ – axis and y – axis at A and B respectively.




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

4.2. Determine the equation of $k$ if $k(x) = g(2x) + 9$ (2)

4.3 Determine the equation of $k^{-1}$ in the form $y = .....$ (2)

4.4 If $k^{-1}$ is defined by $p(x)$, sketch the graph of $p$. (2)

4.5 Write down the domain of $p$. (1)

4.6 Determine the equation of $h$ if $h$ is the reflection of $p$ about the $x$ – axis. (2)

4.7 Calculate : $\sum_{x=0}^{2} 9^x - \sum_{x=3}^{4} g(x)$ (3)

**[15]**

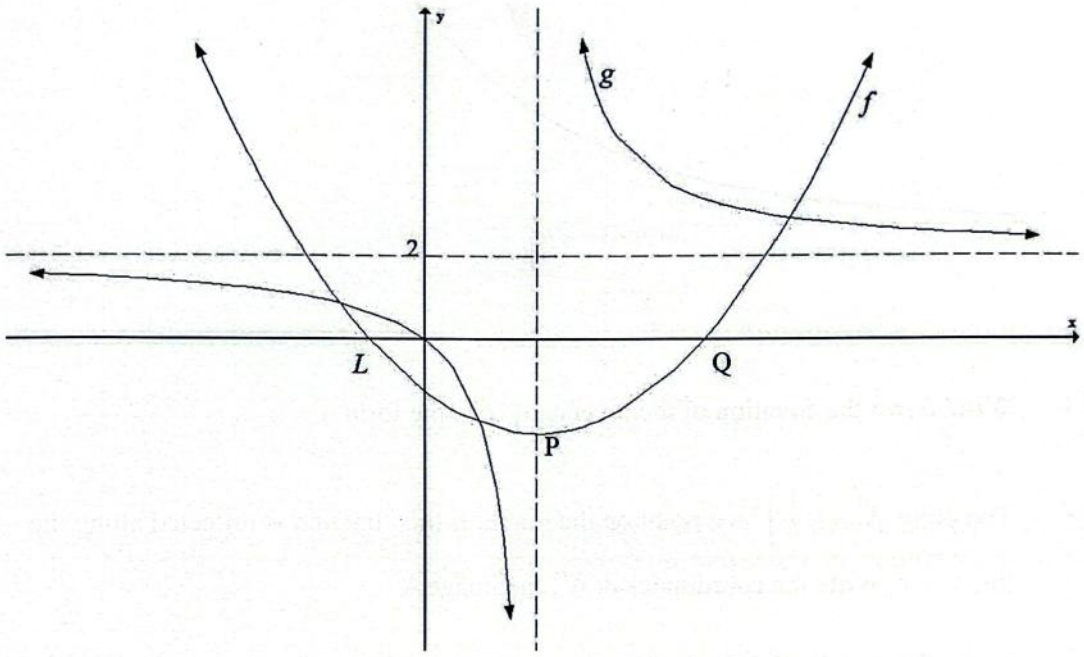
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**Mpumalanga**

**QUESTION 4**

Sketched below are the graphs of $f(x)=(x-p)^2+q$ and $g(x)=\frac{a}{x-b}+c$.

$Q(\frac{5}{2};0)$ is a point on the graph of $f$. P $(1;y)$ is the turning point of $f$. The asymptotes of $g$ are represented by the dotted lines. The horizontal asymptote intersects the $y$ – axis at 2. The graph of $g$ passes through the origin.




4.1 Determine the equation of $g$. (4)

4.2 Determine the $y$-coordinate of $P$, the turning point of $f$. (2)

4.3 Write down the equations of the asymptotes of $g(x-1)-3$. (2)

4.4 If L is the other $x$ - intercept of $f$, calculate the length of LQ. (2)

4.5 Write down the equation of $h$ if $h$ is the reflection of $f$ in the $x$-axis. (1)

4.6 For which values of $x$ is $g(x)>0$? (2)

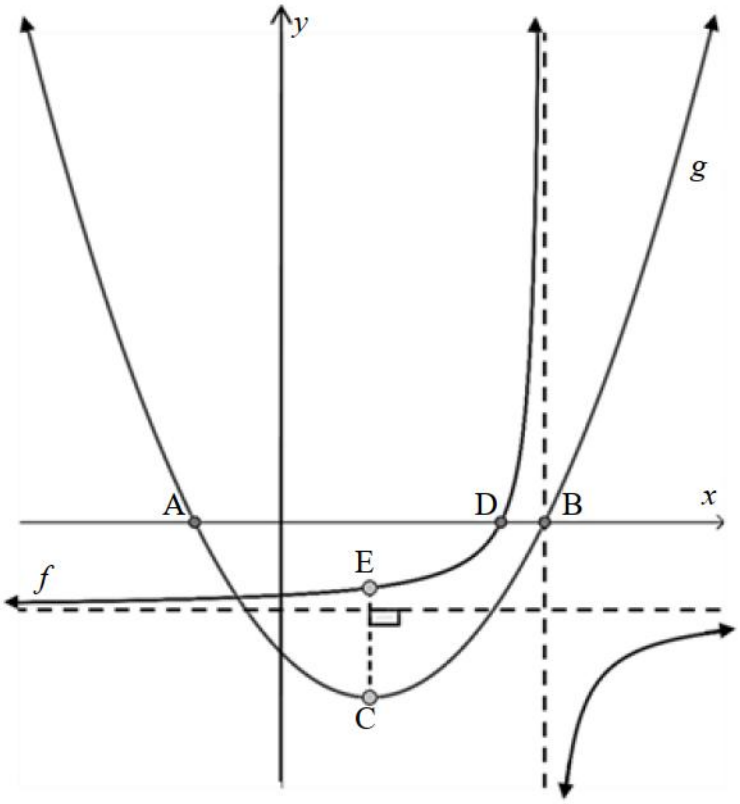
**[13]**

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**Northern Cape**

**QUESTION 4**

The graphs of $g(x) = (x+1)(x-3)$ and $f(x) = -\frac{1}{x-p} + q$ are drawn below.
A and B are the $x$-intercepts of $g$. C is the turning point of $g$.
D $\left(\frac{5}{2}; 0\right)$ is the $x$-intercept of $f$.
EC is perpendicular to the horizontal asymptote of $f$.




4.1 Write down the coordinates of A and B. (2)

4.2 Determine the coordinates of C, the turning point of $g$. (3)

4.3 Determine the equation of $f$. (3)

4.4 Write down the equation of the horizontal asymptote of $f$. (1)

4.5 Determine the positive $x$-values for which $g(x) > f(x)$. (2)

4.6 Determine the equation of $h$ if $h(x) + 5 = g(x)$. (2)

4.7 Write down the range of $h(x)$. (2)

4.8 Calculate the length of EC. (3)

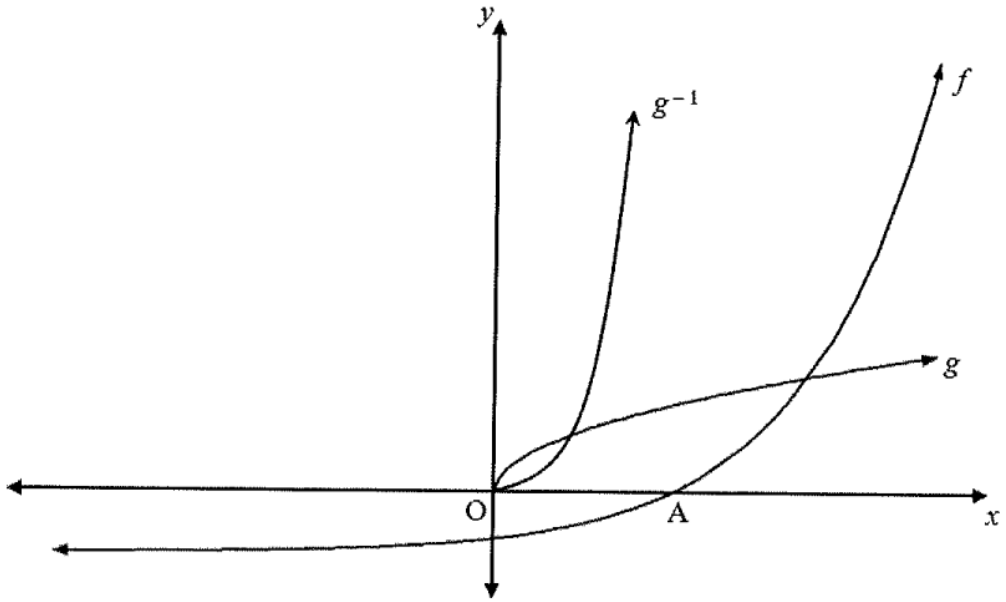
4.9 Determine the value of $p$ for which $h(x) = p$ will have at least one real root. (3)

**[21]**

**North-West**

**QUESTION 4**

The graphs of $g(x) = 2\sqrt{x}$ for $x \geq 0$, $g^{-1}$ and $f(x) = 2^{x-1} - 2$ are drawn below.
A is the $x$-intercept of $f$.




4.1 Write down the range of $f$. (1)

4.2 Calculate the coordinates of A. (2)

4.3 Determine the equation of $g^{-1}$ in the form $y = \ldots$ (2)

4.4 Determine the value of $x$, for which the distance between $g$ and $g^{-1}$ will be a maximum. (4)

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4.5 Determine the values of $k$ where $\left[g(x)^{-1}+k\right]-g(x)$ will be positive for $x \geq 0$. (2)

4.6 It is further given that $h(x)=\left(\frac{1}{2}\right)^x$. Describe the transformation from $f$ to $h$. (3)

**[14]**

**SACAI**

## QUESTION 6

Given the following information:

$f(x)=3^x$ and $g(x)=\frac{2}{x}+1$.

For $x>0$, the graphs intersect at $(1;3)$.

6.1 On the same set of axes, sketch the graphs of $f$ and $g$. Show all intercepts with the axes and asymptotes. (6)

6.2 Write down the range of $g$. (1)

6.3 Write down the domain of:

6.3.1 $f^{-1}$, the inverse of $f$ (1)

6.3.2 $k$ if $k(x)=g(x-2)$ (1)

6.4 For $x>0$, determine the value(s) of $x$ for which $g(x) \geq f(x)$. (2)

6.5 Determine the equation of the line of symmetry of $g$ in the form $y=mx+c$, if $m<0$. (3)

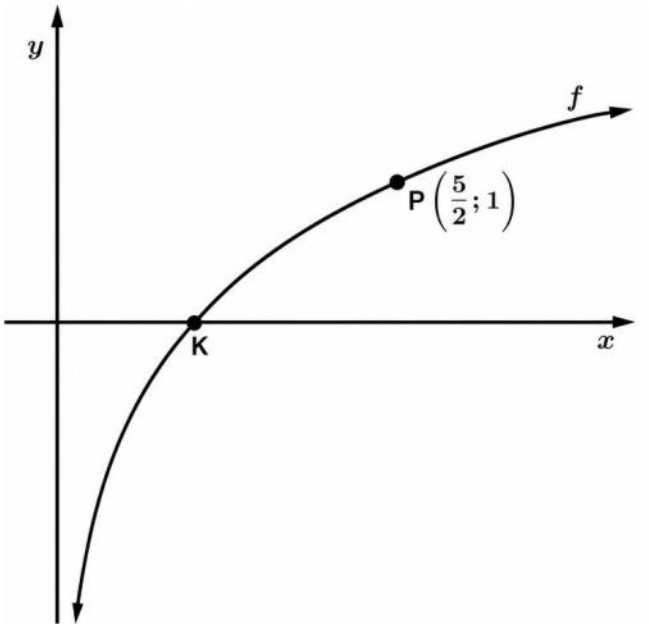
**[14]**

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**Western Cape**

**QUESTION 4**

In the diagram below, the function $f(x) = \log_a x$ is drawn with the point $P\left(\frac{5}{2}\ ;\ 1\right)$ on the graph. K is the $x$-intercept of $f$.




4.1 Determine the value of $a$. (2)

4.2 Write down the coordinates of K. (2)

4.3 Determine the equation of $f^{-1}$, the inverse of $f$. (2)

4.4 Sketch the graph of $f^{-1}$. Clearly indicate the asymptote and the intercepts with the axes. (3)

4.5 For which values of $x$ will $f(x+3) \leq 1$. (2)

**[11]**

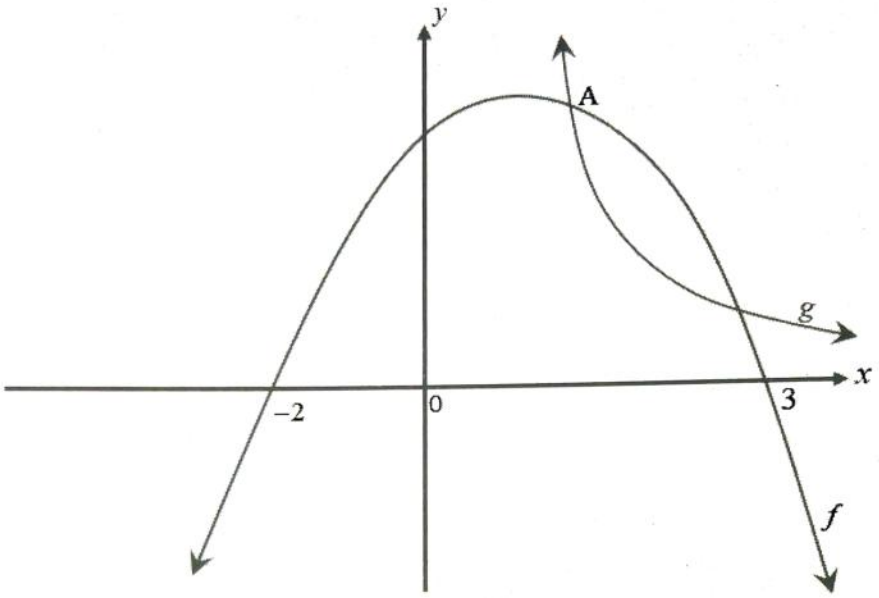
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## Eastern Cape

### QUESTION 5

5.1 The graphs of $f(x)=ax^2+bx+c$ and $g(x)=\frac{6}{x}$; $x>0$ are drawn below.

$-2$ and $3$ are the $x$-intercepts of $f$. A is a point of intersection between $f$ and $g$.




5.1.1 Write down the equation of the axis of symmetry of $f$. (1)

5.1.2 Given that $h(x)=-6x+12$ is the tangent to $g$ at A, determine the equation of $f$ in the form $f(x)=ax^2+bx+c$ (6)

5.1.3 If $f(x)=-x^2+x+6$, calculate the maximum value of $f$. (2)

5.1.4 A transformation is applied to $f$ as follows, $f(x)=a(x+p+m)^2+q+n$ to obtain a new function defined as $t(x)=-\left(x-\frac{1}{4}\right)^2+\frac{29}{4}$

Determine the values of $m$ and $n$. (2)

5.1.5 For which values of $k$ will:

(a) $y=-6x+k$ cut $g$ at two points. (2)

(b) $y=f(x)+k$ have no real roots. (2)

5.2 If $p(x)$ is a quadratic function of $x$ such that $p(-2)=-6$, $p(0)=-4$ and $p(1)=0$, what is the value of $p(10)$? (5)

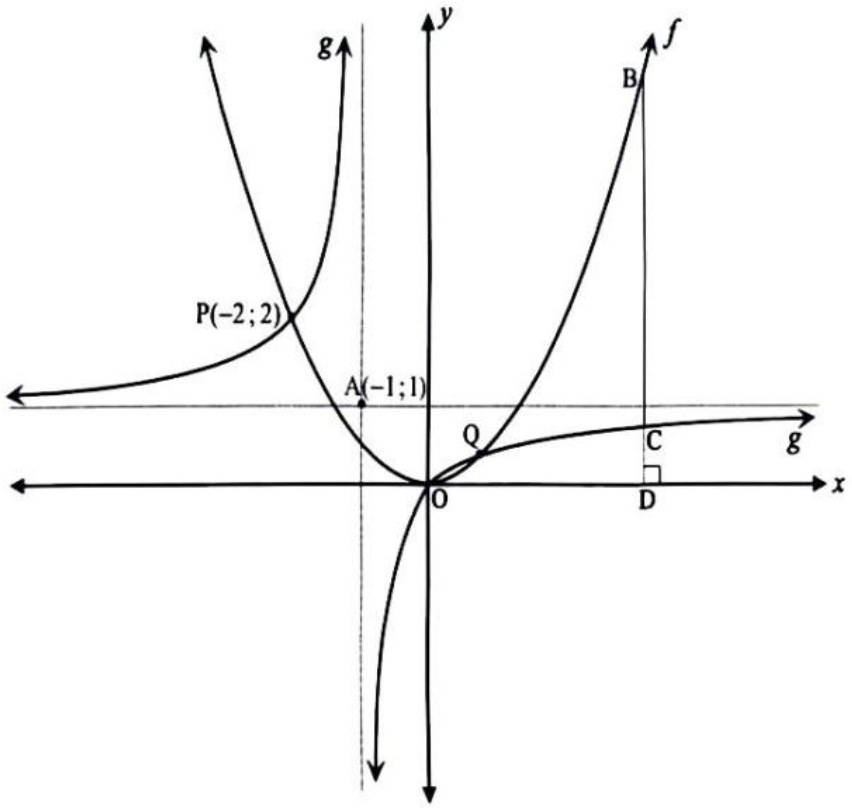
**[20]**

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**Free State**

**QUESTION 5**

In the diagram below, the graphs of $f(x) = dx^2$ and $g(x) = \frac{a}{x+p} + q$ intersect at $P(-2\,;\,2)$ and Q. The asymptotes of $g$ intersect at A (-1; 1). BD is perpendicular to the $x$-axis, such that D has the coordinates (4; 0). BD intersect $g$ at C.




5.1 Determine the values of $a$, $p$, $q$ and $d$. (4)

5.2 Determine the coordinates of Q. (5)

5.3 Determine the numerical distance BC from the given diagram. (3)

[12]

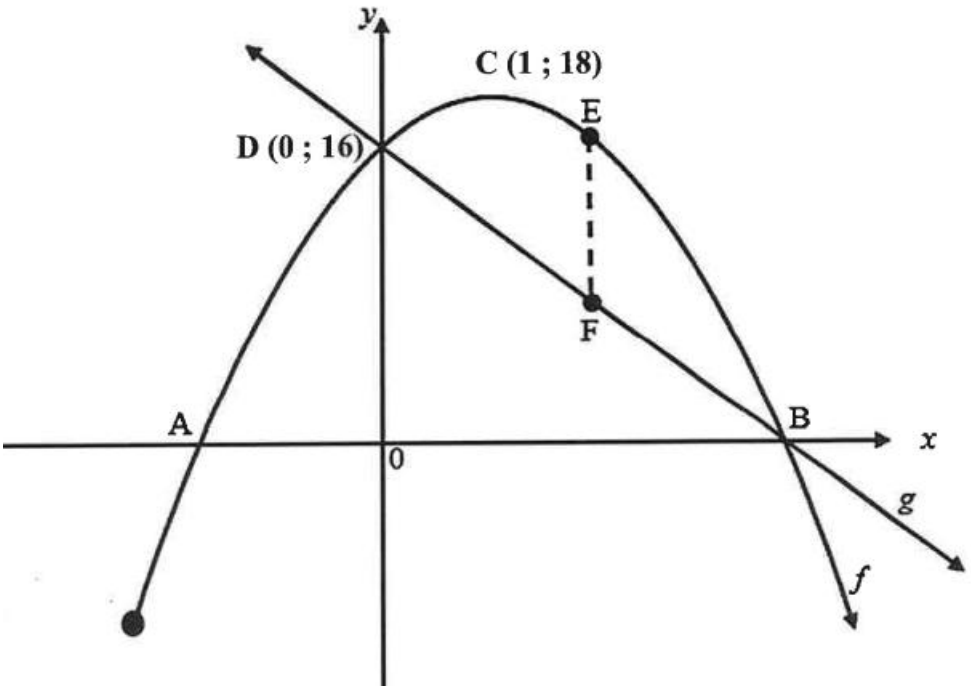
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**Gauteng**

**QUESTION 5**

The graphs of $f(x)=a(x+p)^2+q$ for $x\geq -4$ and $g(x)=mx+c$ are sketched below.

- Points A and B are the $x$-intercepts of $f$.
- C(1 ; 18) is the turning point of $f$.
- D(0 ; 16) is a point of intersection of $f$ and $g$.




5.1 Show that the equation of $f$ can be written as $f(x)=-2x^2+4x+16$. (4)

5.2 Calculate the length of AB. (2)

5.3 Determine the equation of $g$ in the form $g(x)=...$ (2)

5.4 For which value(s) of $x$ is:

5.4.1 $f$ increasing? (2)

5.4.2 $f(x).f'(x)<0$? (2)

5.5 E is a point on $f$ and F is a point on $g$ such that EF is a line drawn parallel to the $y$-axis. Determine the maximum length of EF. (5)

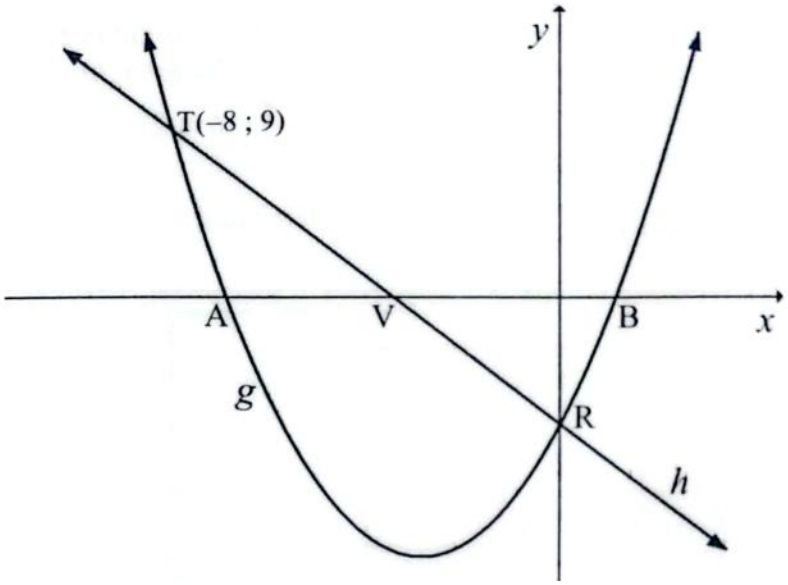
**[17]**

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**KZN**

**QUESTION 5**

The diagram below shows the graphs of $g(x) = x^2 + 5x - 6$ and $h(x) = mx + c$. A and B are the $x$-intercepts of $g$, and V is the $x$-intercept of $h$. $g$ and $h$ intersect on the $y$-axis at R and also at $T(-8\,;\,9)$.




5.1 Write down the coordinates of R. **(1)**

5.2 Determine the equation of $h$. **(3)**

5.3 Write the equation of $g$ in the form $y = a(x + p)^2 + q$. **(2)**

5.4 Determine the coordinates of point W on $g$, such that the average gradient between T and W will be $-1$. **(5)**

5.5 It is given that the coordinates of A and B are $(-6\,;\,0)$ and $(1\,;\,0)$ respectively.

Determine the values of $x$ for which $\frac{g(x)}{h(x)} \leq 0$. **(4)**

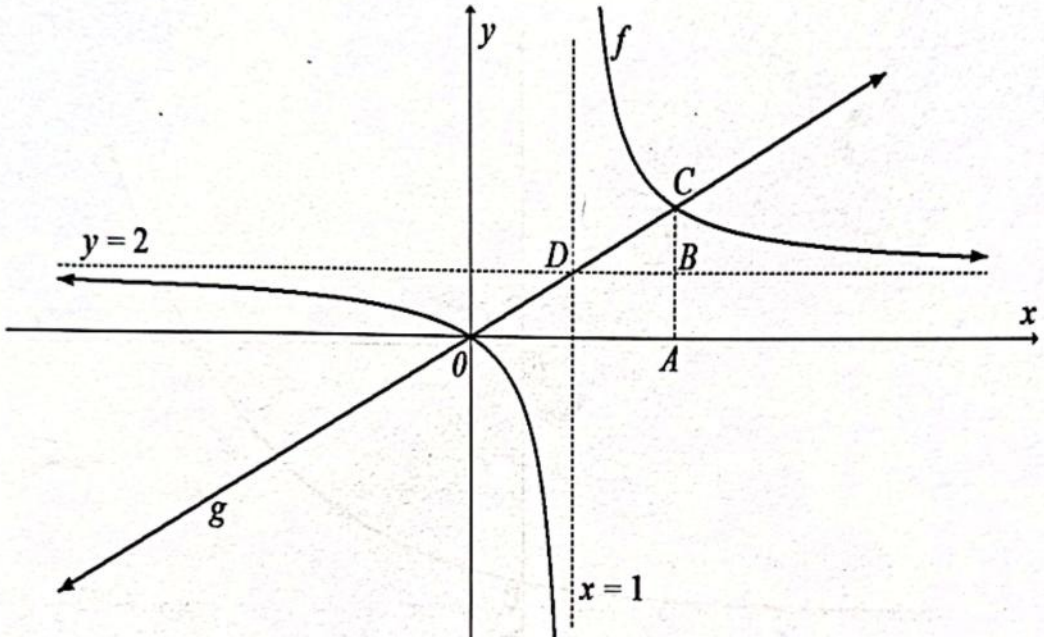
**[15]**

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**Limpopo**

**QUESTION 5**

The sketch graphs of $f(x)=\frac{a}{x+p}+q$ and $g(x)=mx+c$ are drawn below:




5.1 Determine the equation of $f$. (3)

5.2 Determine the equation of $g$. (3)

5.3 Determine the coordinates of C. (4)

5.4 For which value(s) of $x$ will $f(x)>g(x)$? (2)

5.5 For which value(s) of $x$ will $g(x).f(x)<0$? (2)

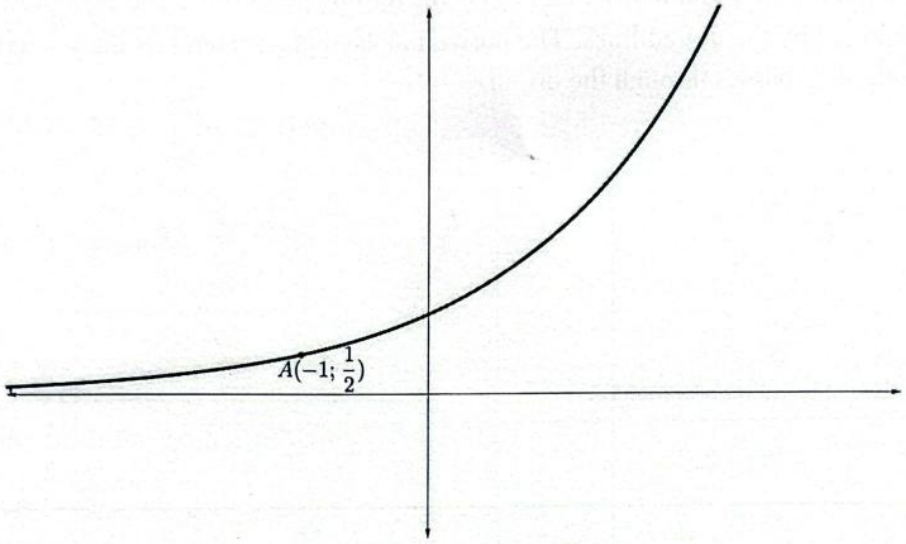
**[14]**

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## Mpumalanga

**QUESTION 5**

Consider the graph of the function $f(x)=2^x$ below




5.1 Write down the equation of the inverse of $f$ in the form $y=...$ (2)

5.2 The point $A\left(-1;\frac{1}{2}\right)$ is a point on the graph. If this function is reflected along the line $y=x$, write the coordinates of $A'$, the image A. (1)

5.3 Draw the graph of the inverse of $f$ on the same system of axes. Include the coordinates of one point on the graph, other than an intercept with the axes, as well as the symmetry-axis. (4)

5.4 Determine the point of intersection of the graph of $f$ and $g(x)=\left(\frac{1}{2}\right)^{x-1}$ (4)

**[11]**

## Northern Cape

**QUESTION 5**

Given $p(x)=3^{-x}$

5.1 State whether $p(x)$ is an increasing or decreasing function. (1)

5.2 Determine $p^{-1}$, the inverse of $p$, in the form $y=\ldots$ (2)

5.3 If point $m\left(2;\frac{1}{9}\right)$ lies on $p$, then write down the coordinates of its image $m'$ which is the reflection across the line $y=x$. (1)

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5.4 Draw the graphs of $p$ and $p^{-1}$ on the set of axes provided in the ANSWER BOOK. Clearly indicate ALL the intercepts with the axes. (4)

5.5 Write down the domain of $p^{-1}$. (1)

5.6 Write down the equation for the asymptote of $p(x) - 2$. (1)

5.7 Describe the transformation from $p$ to $k$ if $k(x) = \log_3 x$. (2)

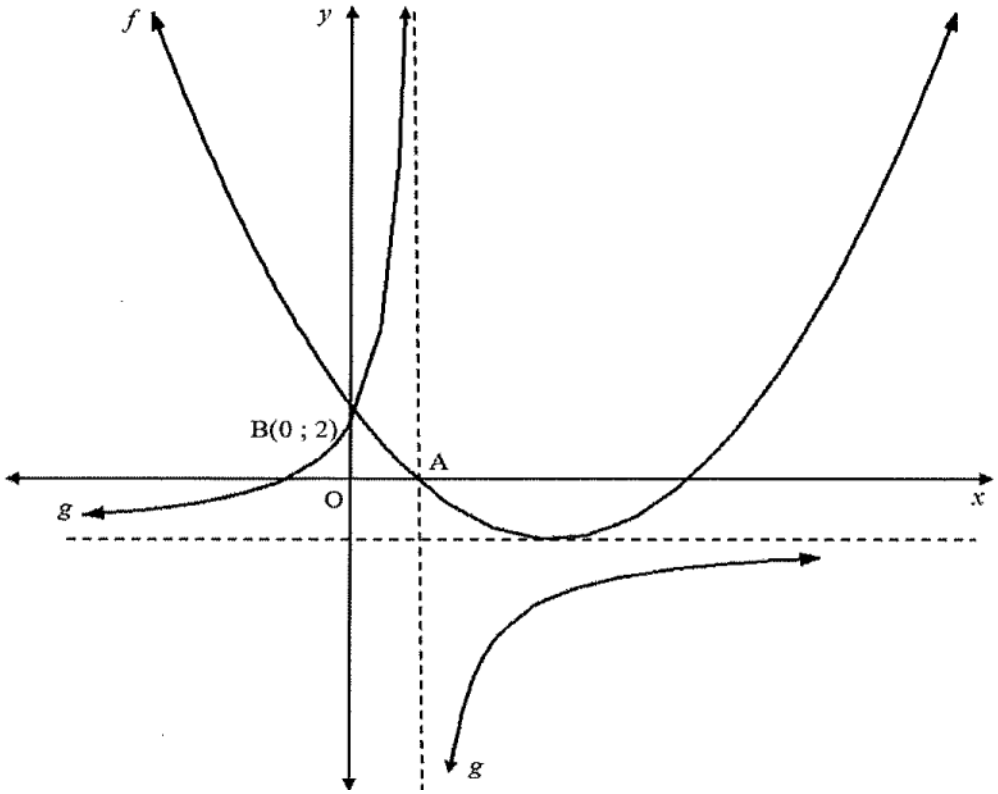
**[12]**

**North-West**

**QUESTION 5**

In the diagram below, the graphs of $f(x) = \frac{1}{2}(x-3)^2 - 2$ and $g(x) = \frac{a}{x+p} + q$ are drawn.

- The horizontal asymptote of $g$ is a tangent to $f$.
- A is a $x$-intercept of $f$ and lies on the vertical asymptote of $g$.
- B(0 ; 2) is the $y$-intercept of $g$.




5.1 Write down the coordinates of the turning point of $f$. (1)

5.2 Calculate the coordinates of A. (3)

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5.3 Write down the range of $g$. (1)

5.4 Determine the equation of $g$. (3)

5.5 Determine the equation of $k$, the decreasing axis of symmetry of $g$. (3)

5.6 Determine the values of $x$ for which: $g(x) \cdot f'(x) \geq 0$. (3)

5.7 For which values of $t$ will: $f(x) = k(x) + t$ have two distinct roots greater than 1? (7)

**[21]**

**SACAI**

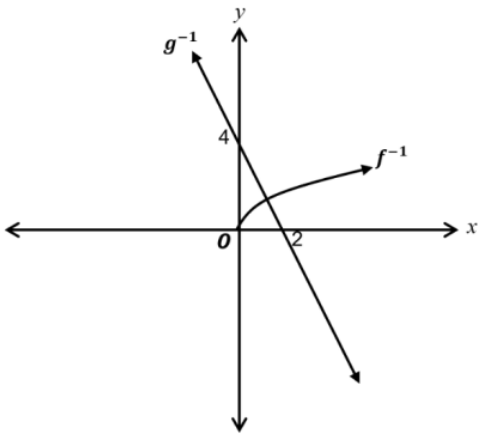
## QUESTION 7

7.1 The function $g$ with equation $g(x) = \log_4 x$ is given. B$(k; 3)$ is a point on $g$.

7.1.1 Calculate the value of $k$. (2)

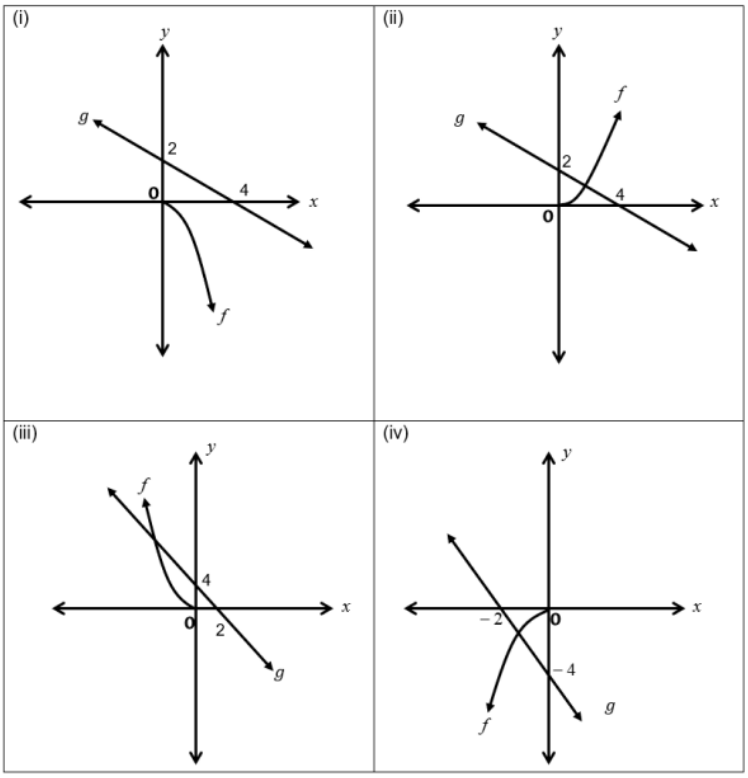
7.1.2 Write down the equation of $g^{-1}$, the inverse of $g$. (2)

7.2 Given the graphs of $f^{-1}$ and $g^{-1}$ as follows:



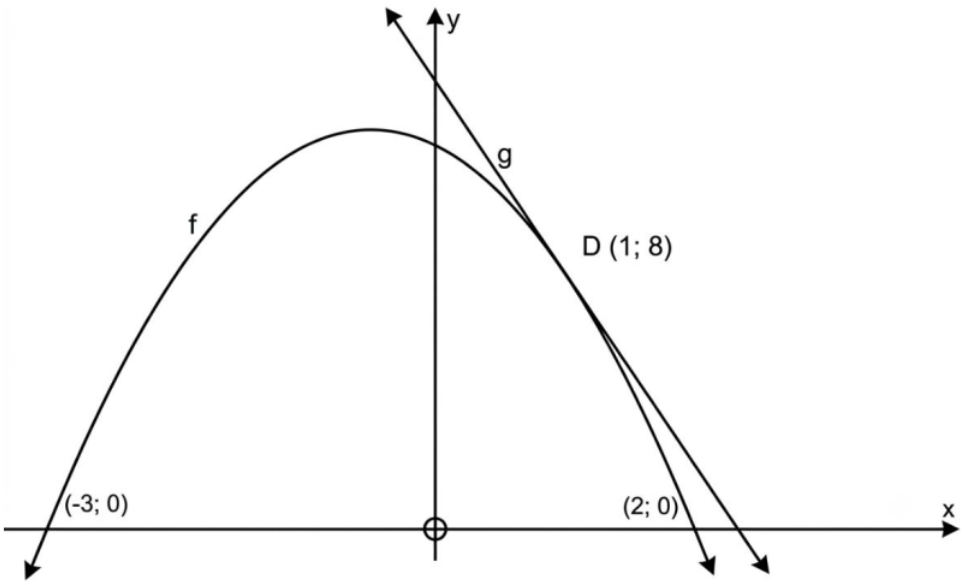

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Indicate which of the following is the correct representation of the graphs of $f$ and $g$.




(1)

7.3 The graphs of $f(x) = ax^2 + bx + c$; $a \neq 0$ and $g(x) = mx + k$ are drawn below. D$(1; 8)$ is a common point on $f$ and $g$. The $x$ –intercept of $f$ is $(-3; 0)$ and $(2; 0)$. $g$ is a tangent to $f$ at D.




7.3.1 Show that $a = -2$; $b = -2$ and $c = 12$. (4)

7.3.2 Determine the value(s) of $x$ for which $f$ is decreasing. (3)

7.3.3 Determine the equation of $g$. (4)

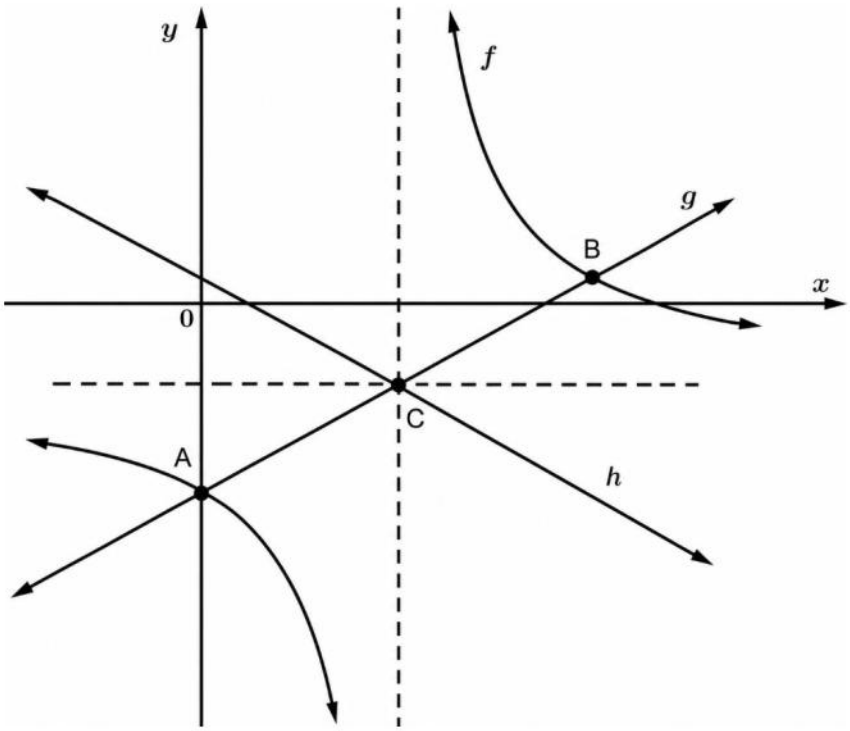
7.3.4 Determine the value(s) of $p$ for which $f(x-p)=0$ has two negative solutions. (2)

**[18]**

**Western Cape**

**QUESTION 5**

In the diagram below $f(x)=\frac{a}{x+p}+q$ with axes of symmetry $g(x)=x-7$ and $h(x)=-x+1$ are drawn. A is the $y$-intercept of both $f$ and $g$.




5.1 Write down the coordinates of A. (2)

5.2 Determine the equation of $f$. (5)

5.3 For which values of $x$ will $f(x)\geq h(x)$? (1)

5.4 Calculate the distance AB. (4)

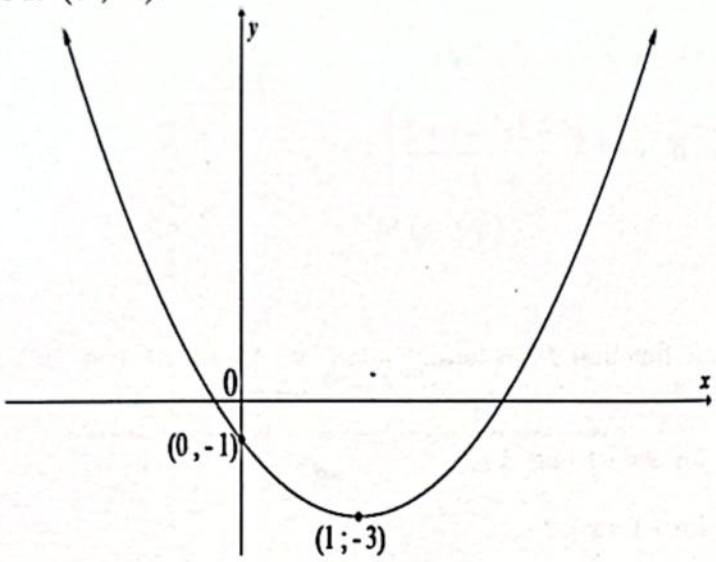
**[12]**

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**Limpopo**

**QUESTION 6**

The figure below shows the graph of $y = ax^2 + bx + c$. The turning point is at $(1\ ;-3)$ and the $y-$intercept is at $(0\ ;-1)$.




6.1 Determine the values of $a$ and $b$. (4)

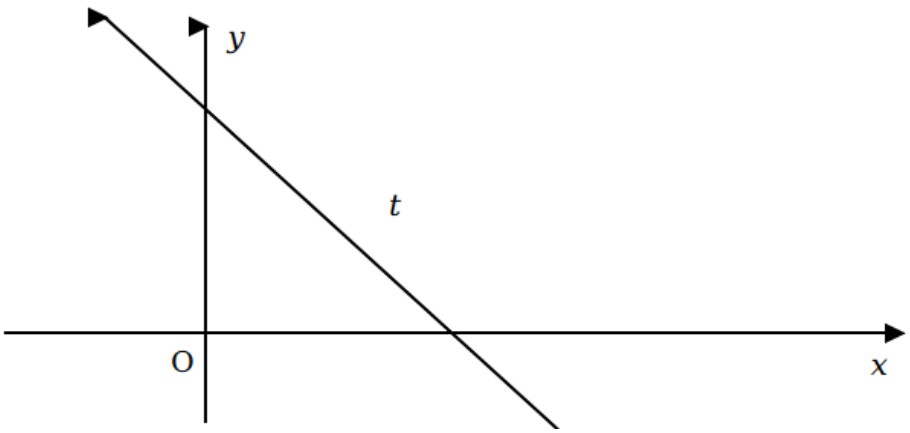
6.2 Determine, with the aid of the graph, the values of $k$ for which the product of the roots of $ax^2 + bx + c = k$ is negative. (2)

**[6]**

**KZN**

**QUESTION 6**

The graph of $t(x) = -x + 4$ is drawn below.



6.1 Draw on the same set of axes the graph of $s(x) = \log_3 x$, showing any intersections with the axes. **(2)**

6.2 Write down the equation of $s^{-1}(x)$, in the form $y =$ ..... **(2)**

6.3 Explain how you will use question 6.1 and/or question 6.2 to solve $\log_3 (4 - x) = x$. **(3)**

6.4 Write down the solution to $\log_3 (4 - x) = x$. **(1)**

**[8]**

# Financial Mathematics

**Eastern Cape**

**QUESTION 6**

6.1 A father invests money for his daughter on her fifth birthday. On her twenty-first birthday the daughter receives a sum of R85 000. If the money has been invested at an interest rate of 12% per annum, compounded half-yearly, what amount did her father invest initially? (3)

6.2 Mr Ntoa owns a business. He plans to expand his business after a period of four years. He decides to make equal quarterly payments of R55 000 into a savings account, starting in 3 months' time. He will make the last payment at the end of the four years. The interest paid on the savings is 6,75% p.a. compounded quarterly.

Calculate if he will have sufficient funds in four years' time, if the project will cost R1 million. (4)

6.3 Kim takes out a loan of R750 000 to buy a house. She plans to repay the loan over 20 years after the loan is granted by means of equal monthly instalments. The interest rate is 11,5% p.a. compounded monthly.

6.3.1 Calculate her monthly repayments, if the first payment starts six months after the loan was drawn. (4)

6.3.2 If the first payment (of monthly repayments) started one month after the loan is granted is R7 998,22. How much additional money did she pay, over the loan period, by deferring the repayment? (2)

**[13]**

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## Free State

### QUESTION 6

6.1 Edgar's motor car, costing R230 000, depreciates at a rate of 7% per annum using the reducing balance method. Calculate how long it took for the car's value to depreciate to a value of R100 000 under these conditions. (3)

6.2 A person wants to buy a car for cash in eight years. The amount required is R350 000. He opens an investment account that earns interest at 14% per annum, compounded monthly. Payments commence immediately and are made monthly.

6.2.1 Determine the monthly payments. (4)

6.2.2 At the end of the first year, he deposited an additional R15 000 into the account. One year later, he withdrew R20 000. Determine the future value of the investment at the end of eight years. Hence, calculate the shortfall. (4)

6.3 From 2010 to 2012, the population of town X decreased by 8% per year, while the population of town Y increased by 12% per year. At the end of 2012, the populations of these two towns were equal. Determine the ratio of the population of town X (call it $P_X$) to the population of town Y (call it $P_Y$) at the beginning of 2010. (4)

**[15]**

## Gauteng

**6.1** The International Union for Conservation of Nature (ICUN) estimates that approximately 39 000 African lions remain in the wild in 2026. If the rate of population growth is estimated to average 18% p.a, in which year can the ICUN expect the African lion population to double? (4)

**6.2** Mrs Molefe, a Mathematics teacher, decides to invest in a retirement fund. She plans to retire in 20 years. She makes equal, monthly contributions of R3 200 into the fund which earns interest at 9,75% p.a. compounded monthly.

**6.2.1** Determine how much Mrs Molefe will have in her retirement fund when she retires. (3)

**6.2.2** If Mrs Molefe has R2 352 649,68 in her retirement fund when she retires, what percentage of the total investment is interest? (3)

**6.3** After settling all her debt, Mrs Molefe plans to purchase a property valued at R1 200 000. She obtains a 20-year home loan (mortgage bond) from a bank at an interest rate of 11,37% p.a., compounded monthly. The loan is to be repaid in equal monthly instalments commencing one month after the loan is granted.

Mrs Molefe can afford monthly repayments of R13 000 from the income generated by her investments. Determine whether she will be able to afford the new property. (4)

**[14]**

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## KZN

**QUESTION 7**

7.1 Rajesh inherited a sum of money from his father. He invested the money at 7,3% p.a., compounded quarterly. After how many years will his inheritance have doubled? Give your answer correct to 1 decimal place. (4)

7.2 On 30 June 2013, and at the end of each month thereafter, Jacob deposited R2 500 into a bank account that paid 8% p.a., compounded monthly. He continued making these deposits until 31 May 2018. How much money was in his account immediately after making the last deposit on 31 May 2018? (4)

7.3 On 31 January 2026, Thandokuhle took out a loan of R82 000 from the bank to pay for her studies. The bank charges interest of 12% per year, compounded monthly. Her monthly instalment to pay back the loan is R3 200. She paid her first instalment on 28 February 2026.

7.3.1 How many instalments will she have to pay in order to settle the loan? (4)

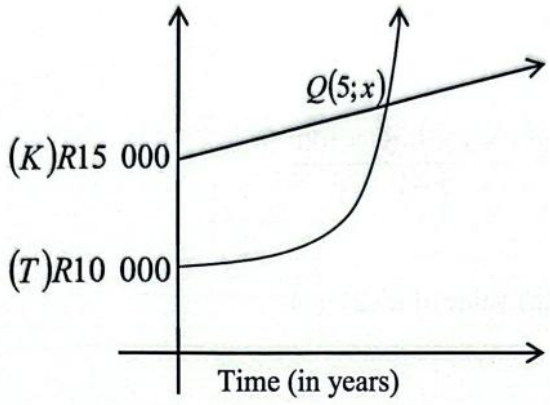
7.3.2 Calculate her final instalment. (3)

**[15]**

## Mpumalanga

**QUESTION 6**

6.1 A company buys two different assets, T and K which are both increasing in value in exponential and linear form respectively, as shown in the diagram below. Point Q is a point of intersection of the two functions. The linear increase is at a rate of 7,5% p.a.




6.1.1 Calculate the value of $x$. (2)

6.1.2 Hence, calculate the annual interest rate for asset T. (4)

6.2 After 5 years, both assets in 6.1 (K and T) are traded in for new machinery of a value of R70 000. A sinking fund is set-up at the time the two assets are bought for the balance of a new machine.

6.2.1 How much is the total trade-in value? (1)

6.2.2 Calculate the value of the sinking fund , after the 2 assets were traded in. (1)

6.2.3 If the sinking fund is set-up at 11% p.a. compounded monthly for 5 years, calculate the value of the regular payments. (4)

6.3 A loan of R15 000 is taken out at 13% p.a., compounded monthly. If monthly repayments of R588,32 are made for 2,5 years to repay the loan, calculate the outstanding balance after 1 year. (3)
**[15]**

## Northern Cape

**QUESTION 6**

6.1 A company bought a photocopier for R185 000 on 1 July 2026. They will use the old photocopier as a trade-in when they replace it with a similar new photocopier in 5 years' time, on 30 June 2031.

6.1.1 The average rate of inflation over the next 5 years will be 6,2% p.a. Determine the price of a similar new photocopier in 5 years' time. (2)

6.1.2 Calculate the trade-in value of the old photocopier after 5 years if it depreciates at a rate of 8,5% p.a. on a straight-line method. (2)

6.1.3 The company sets up a sinking fund to cover the replacement cost of the new photocopier. The fund earns interest at a rate of 8,1% p.a., compounded monthly. The company makes its first deposit on 31 July 2026 and continues to do so until 31 May 2031, one month prior to the new photocopier being bought. How much should be deposited at the end of each month so that the company will be able to buy the new photocopier? (4)

6.2 A bank granted Lerato a loan of R180 000 at an interest rate of 12% p.a., compounded monthly, to renovate her home. Lerato agreed to repay the loan over five years in equal monthly instalments.

6.2.1 Calculate the monthly instalment Lerato must pay the bank. (2)

6.2.2 However, Lerato was unable to make three consecutive monthly instalments immediately after the 12th payment. If Lerato still needs to finish her payments in 5 years' time from the time the loan was granted, calculate her new monthly instalment after the three months she was unable to pay. (6)

**[16]**

**North-West**

**QUESTION 6**

Sam plans to buy a house with the value of R1 200 000. He borrows R1 200 000 from a financial institution that charges interest at a rate of 9,8% per annum compounded monthly. Sam agrees to pay monthly instalments of R15 000, starting 4 months after the loan was granted.

6.1 Calculate the amount Sam owes to the financial institution at the beginning of the 4th month. (3)

6.2 Determine how many monthly instalments will Sam pay to settle the loan. (4)

6.3 Eighty months after Sam bought the house, he received an offer of R2 000 000 for the house. He decided to sell the house. Calculate the profit Sam made on the sale of the house. (6)

**[13]**

**SACAI**

**QUESTION 5**

5.1 Tumi invests a lump sum of R3 000 at an interest of 12% per annum, compounded quarterly.

5.1.1 Calculate the number of years required for the investment to reach a value of R4 277,28. (3)

5.1.2 Tumi re-invests the amount of R4 277,28 for another 2 years. She adds R1 000 to the investment at the end of every quarter. The last payment of R1 000 is made at the end of the 2-year period. Calculate the total value of the investment if the interest rate changed to 13% per annum, compounded quarterly. (5)

5.2 Alan bought a house. He paid a deposit of R200 000, which is equivalent to 16% of the selling price of the house. He obtained a loan from the bank to pay the balance of the selling price. The bank charges him interest of 11% per annum, compounded monthly.

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5.2.1 Calculate the selling price of the house. (2)

5.2.2 The total period of the loan is 20 years. Alan starts his first repayment at the end of the third month after the loan has been granted and makes his last payment at the end of the 20-year period. Calculate his monthly instalments. (5)

**[15]**

**Western Cape**

**QUESTION 7**

7.1 Susan invests a lump sum of R50 000 in a savings account for 6 years. The investment earns 9,35% p.a., compounded quarterly.

7.1.1 Determine the effective interest rate. (3)

7.1.2 Calculate the value of Susan's investment after 6 years. (2)

7.2 John invests R800 000 in a fund that earns interest at a rate of 14% p.a., compounded monthly. At the end of each month, he withdraws R10 000 from the fund. His first withdrawal is made one month after the initial investment.

7.2.1 How many withdrawals of R10 000 will John be able to make from this fund? (5)

7.2.2 Exactly four years after the initial investment, John decides to withdraw all the remaining money from his account and use it as a deposit towards a house.

(a) Calculate the value of the deposit, rounded to the nearest rand. (3)

(b) Calculate the price of the house to the nearest rand, if the deposit is exactly 30% of the purchase price of the house. (1)

**[14]**

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# CALCULUS

## Eastern Cape

**QUESTION 7**

7.1 Given the function: $f(x)=3x^2-1$

7.1.1 Determine $f'(x)$ from first principles. (4)

7.1.2 Determine the equation of the tangent to $f$ at point (1 ; 2). (3)

7.2 Determine:

7.2.1 $\frac{d}{dx}\left(x^2+5x\right)$ (2)

7.2.2 $\frac{dy}{dx}$ if $\frac{y}{\left(1-\sqrt{x}\right)}=\frac{2}{x}$ (4)

**[13]**

## Free State

**QUESTION 7**

**7.1** Determine $f'(x)$ from first principles if it is given that $f(x)=-x^2-3$ **(4)**

**7.2** Determine:

**7.2.1** $D_x\left[\frac{8x^2-14x-15}{4x+3}\right]$ **(3)**

**7.2.2** $\frac{dy}{dx}$ if $y=\frac{\sqrt[4]{x^{-5}}}{x^{-3}}-\frac{\sqrt[3]{x^2}}{2x^2}+3x^3$ **(6)**

**7.3** Determine the equation of the tangent to the graph of $f(x)=-3x^3-4x+5$ at $x=-1$. **(4)**

**[17]**

## Gauteng

7.1 Determine $f'(x)$ from first principles if $f(x)=-x+2x^2$. (5)

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7.2 Determine: $\frac{dy}{dx}$ if $y=2x^3-6x^2+1$ (2)

7.3 Given: $f(x)=\frac{\sqrt{x}}{x}-9x$ and $g(x)=-16x$

Determine: $D_x\left[f(x)+\frac{1}{2}g(x)\right]$ (5)

**[12]**

**KZN**

**QUESTION 8**

8.1 Determine $f'(x)$ from first principles if $f(x)=x-3x^2$. **(5)**

8.2 Determine the following:

$$D_x\left(\frac{4x^2+x+2\sqrt{x}}{2x^2}\right)$$ **(4)**

8.3 Given: $p(x)=5x^3+x$.

Explain, using relevant calculations, why it is not possible for a tangent drawn to the graph of $p$ to have a negative gradient. **(3)**

**[12]**

**Limpopo**

**QUESTION 8**

8.1 Determine $f'(x)$ from first principles if it is given that $f(x)=-x^2+3x$. (5)

8.2 Determine:

8.2.1 $g'(x)$ if $g(x)=x^2-2\sqrt{x}$ (3)

8.2.2 $\frac{dy}{dx}$ if $y=\left[\frac{x^3-2x^2-x+2}{x-1}\right]$ (3)

**[11]**

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## Mpumalanga

**QUESTION 7**

7.1 If $f(x) = -\pi x^2$, determine $f'(x)$ from the first principles. (5)

7.2 Determine $\frac{dy}{dx}$ if $y = \left(1 - \sqrt{x}\right)^2$ (3)

7.3 Determine $g'(x)$ if $g(x) = \frac{x(x^2 - 100) - x^2 + 100}{x - 1}$ (4)

7.4 If $h(x) = 7 - \frac{2}{x^3}$, calculate the value of $h'(2) + 4$. (3)

**[15]**

## Northern Cape

**QUESTION 7**

7.1 Determine $f'(x)$ from first principles if it is given that $f(x) = x^2 - 3x + 2$. (6)

7.2 Determine:

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

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

7.3 Determine the $x$-coordinate of the point on the curve $y = 3(2 - x)^2$ where the tangent at this point is perpendicular to the line $y = \frac{1}{2}x - 5$. (4)

**[17]**

## North-West

**QUESTION 7**

7.1 Given: $f(x) = 3x^2 - x$

Determine $f'(x)$ from first principles. (5)

7.2 Determine:

7.2.1 $D_x\left[(x - 3)(x - 1)\right]$ (3)

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7.2.2 $f'(x)$ if $f(x) = 2\sqrt[3]{x^4} + \frac{3}{x^5}$ (4)

7.3 Use the following information below to draw a neat sketch graph of $f(x) = ax^3 + bx^2 + cx + d$ (without calculating the values of $a, b, c$ or $d$).

- $f'(-1) = 0$
- $f''(-1) < 0$
- $y = 2$ is a tangent to $f(x)$ at $x = 3$

(4)
**[16]**

**SACAI**

## QUESTION 8

8.1 If $f(x) = -2x^2$, determine $f'(x)$ from first principles. (5)

8.2 Given $f(x) = \frac{3x^4 - 2x + 6x^2}{3x^2}$

8.2.1 Determine $f'(x)$. (4)

8.2.2 Hence, determine the gradient of the tangent to $f$ at the point where $x = 1$. (2)

8.3 Given: $y = 5 + \sqrt[3]{t^6}$ and $t = \frac{1}{x}$

8.3.1 Determine $\frac{dy}{dt}$ (2)

8.3.2 Express $y$ in terms of $x$ and hence determine $\frac{dy}{dx}$ (3)

**[16]**

**Western Cape**

## QUESTION 8

8.1 Determine $f'(x)$ from first principles, if it is given that $f(x) = x^2 + x$. (5)

8.2 Determine:

8.2.1 $D_x[-x^5 + 2x^{-3} - 5m^3]$ (3)

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8.2.2 $\frac{dy}{dx}$ if $y = \sqrt[4]{16x^3} + \frac{3}{x^2}$ (4)

**[12]**

## Eastern Cape

**QUESTION 8**

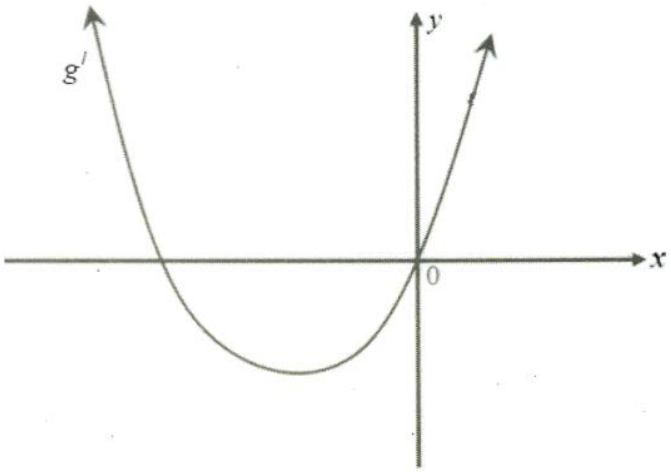
8.1 Given the function: $f(x) = -x^3 + 3x^2 + 9x + 5$

8.1.1 Determine the $x$-intercepts of the graph of $f$. (3)

8.1.2 Determine the coordinates of the turning points of $f$. (4)

8.1.3 Sketch the graph of $f$. Show clearly ALL the turning points as well as the intercepts on the axes. (3)

8.2 In the diagram, the graph of $g'(x) = 3x^2 + 6x$ is given, where $g(x) = ax^3 + bx^2$ represents a cubic function. The graph $g'$ passes through the origin.




8.2.1 For which values of $x$ is the graph of $g(x)$ decreasing? (2)

8.2.2 Determine the $x$-coordinate of the point of inflection of graph $g$. (2)

8.2.3 Solve for $x$, if $g'(x).g''(x) \geq 0$ (3)

**[17]**

## Free State

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**QUESTION 8**

Given that a cubic function $f(x) = ax^3 + bx^2 + cx + d$ has roots at $x = -2$, $x = 1$, $x = 4$, the turning points at $(x_1, y_1)$ and $(x_2, y_2)$, and passes through the point $(2,10)$:

8.1 Determine the value of $a$ and hence write down the equation of the cubic function in the form $f(x) = ax^3 + bx^2 + cx + d$ (4)

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

8.3 Use the above information to draw the graph of $f(x)$, showing the intercepts with the axes and the turning points clearly. (4)

**[12]**

**Gauteng**

**QUESTION 8**

Consider the function $f(x) = x^3 - ax^2 + bx - 6$ where:

- The graph of $f$ has a point of inflection at $x = 2$ and;
- The gradient of $f$ at $x = -1$ is 26.

8.1 Show that $a = 6$ and $b = 11$. (4)

8.2 The graph of $f$ passes through the $x$-axis at $x = 1$. Determine, showing ALL relevant calculations, the other $x$-intercepts of $f$. (3)

8.3 Determine the $x$-coordinate of the local maximum of $f$. (3)

8.4 Describe the concavity of the function at $x = 4$. Support your answer with a valid calculation. (3)

8.5 Sketch the graph of $f$, clearly indicating ALL intercepts and turning points. (It is NOT necessary to determine the $y$-coordinates of the turning points). (3)

8.6 A tangent to $f$ is drawn at the $y$-intercept of the function. Determine the equation of the tangent. (2)

**KZN**

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## QUESTION 9

9.1 Given: $f(x)=-x(x-3)^2$ with $f'(1)=f'(3)=0$ and $f(1)=-4$

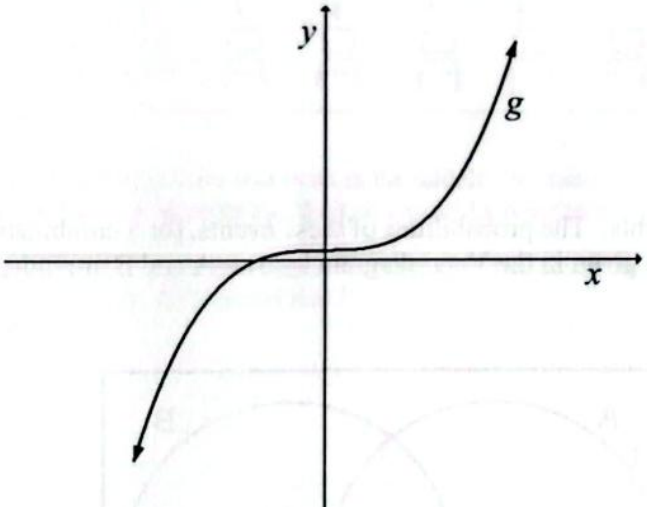
9.1.1 Draw a sketch graph of $f$, clearly indicating the intercepts with the axes and the turning points. **(4)**

9.1.2 Determine the coordinates for the local maximum of $h$ if $h(x)=-f(x-2)$. **(2)**

9.1.3 Calculate $f''(x)$. **(3)**

9.1.4 Hence, determine whether the graph of $f$ is concave up or concave down at $(0\,;0)$. Show all your calculations. **(3)**

9.2 Sketched below is the graph of $g(x)=x^3+1$.




For which values of $k$ will $y=12x+k$ intersect $g$ at 3 distinct points? **(5)**

**[17]**

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## Limpopo

**QUESTION 9**

The graph of a cubic function $f$ has turning points at $A(-1\ ;\ p)$ and $B(2\ ;\ q)$.
The function $f$ has the following properties:

$f'(x) > 0$ for $x < -1$ or $x > 2$

$f'(x) < 0$ for $-1 < x < 2$

$f(2) > 0$

9.1 Draw a neat graph of $f$. Clearly label A and B on the sketch.
(It is not necessary to show the $x$ and $y-$intercepts). (3)

9.2 Determine the number of roots for $f$. (1)

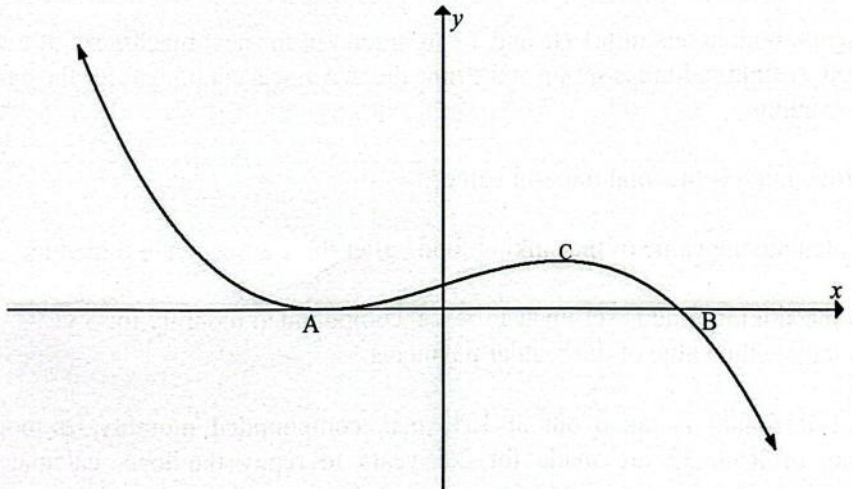
9.3 If $f(x) = x^3 + bx^2 + cx + d$, calculate the values of $b$ and $c$. (6)

**[10]**

## Mpumalanga

**QUESTION 8**

The graph below represent the function $f(x) = -x^3 + dx + q$ with $A(-1;0)$ and $B(2;0)$.




8.1 Show that $d = 3$ and $q = 2$. (3)

8.2 Determine the coordinates of turning point C. (4)

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8.3 If $f'(x) = -9, x > 0$, determine the coordinates of the point of tangency. (3)

8.4 If $g(x) = f(x-3)$, determine the coordinates of $C'$, the maximum turning point of g. (1)

8.5 Use the graph to solve for $x$ if $f'(x).f(x) < 0$ (2)

8.6 For which values of $k$ will $-x^3 + 3x + 2 = k$ have one root only? (2)

**[15]**

## Northern Cape

**QUESTION 8**

The equation of the cubic function $f$ is given as
$f(x) = (x+1)(x-2)(x+k) = x^3 - 5x^2 + 2x + 8$

8.1 Calculate:

8.1.1 The value of $k$ (2)

8.1.2 The coordinates of the turning points of $f$ (3)

8.2 Draw the graph of $f$ on the set of axes provided in the ANSWER BOOK. Clearly indicate the intercepts with the axes and the turning points. (3)

8.3 Determine the intervals in which the function is concave down. (2)

8.4 Determine the value(s) of $x$ for which $x.f'(x) > 0$. (2)

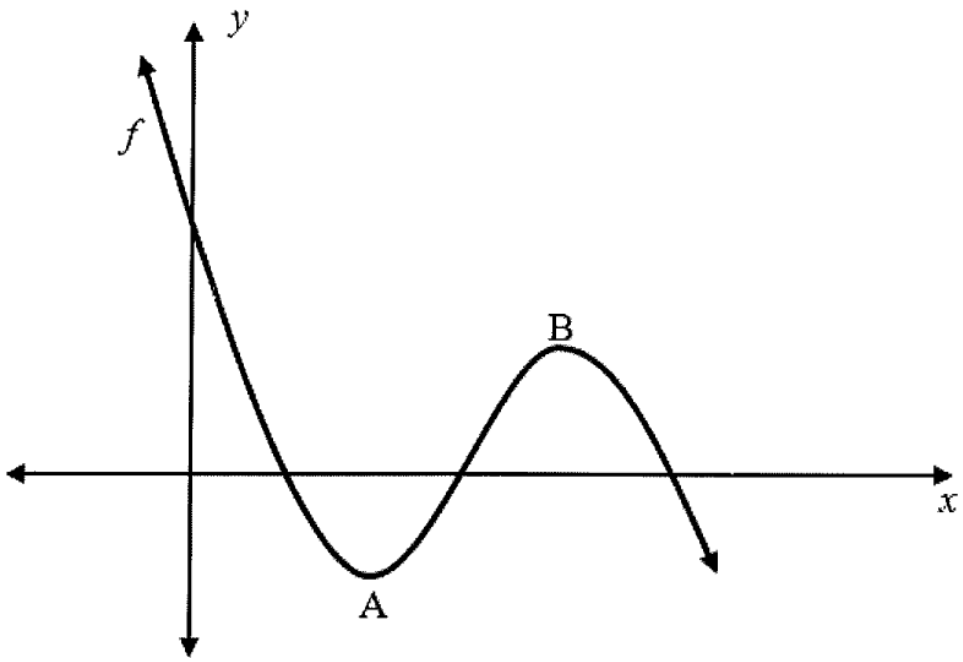
**[12]**

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**North-West**

**QUESTION 8**

The graph of $f(x) = -2x^3 + 21x^2 - 60x + 43$ is sketched below. A and B are the turning points of $f$.




8.1 Determine the $x$-values of A and B. (3)

8.2 Determine the equation of the tangent to $f$ with a maximum gradient. Give your answer in the form $y = mx + c$. (5)

8.3 Determine how many different positive real roots will $f(x + 2) - 20$ have, WITHOUT solving for $x$. (3)

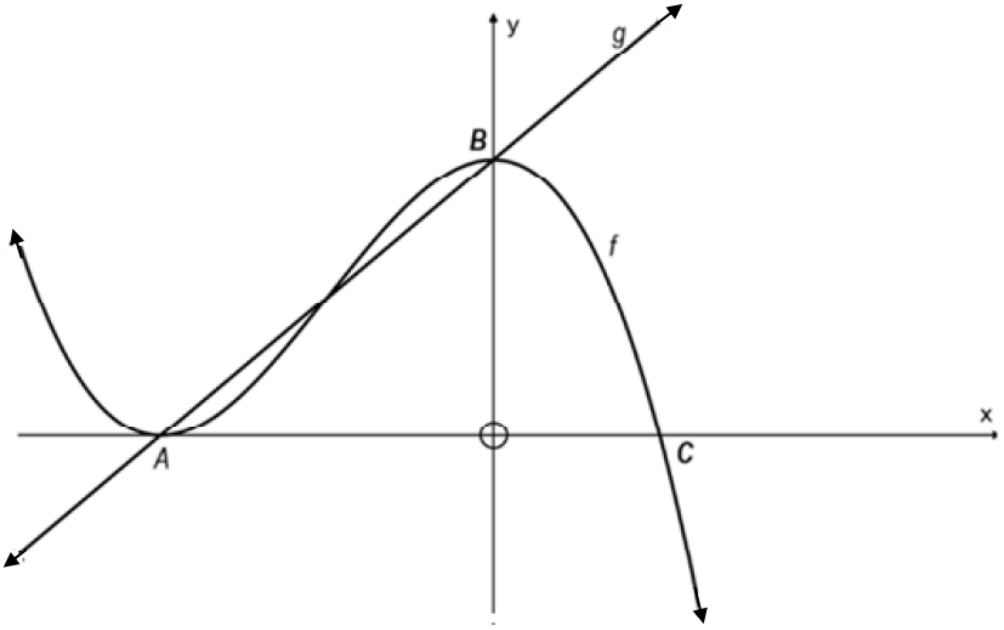
**[11]**

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**SACAI**

## QUESTION 9

9.1 The diagram below shows the graphs of $f(x) = -(x+k)(x+2)^2$ and $g(x) = mx + 4$. The maximum turning point of $f$ and the $y$ –intercept of $g$ is at B. The minimum turning point of $f$ and $x$ –intercept of $g$ is at A.




9.1.1 Write down the coordinates of B. (1)

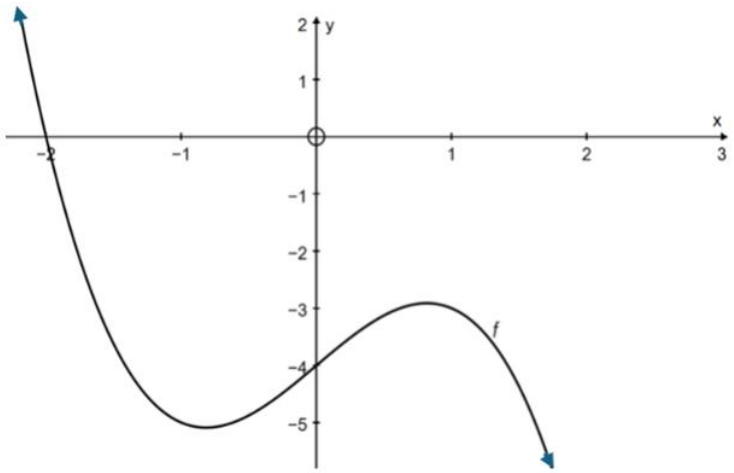
9.1.2 Show that the value of $k$ is -1. (2)

9.1.3 Calculate the gradient of $g$. (3)

9.1.4 Determine the value(s) of $x$ for which the graph is concave up. (4)

9.2 The graph below represents the cubic graph $f$ with the following properties:

- $-2$ is the $x$ –intercept.
- $(-1;-5)$ and $(1;-3)$ are the turning points.
- The point of inflection is at $(0;-4)$



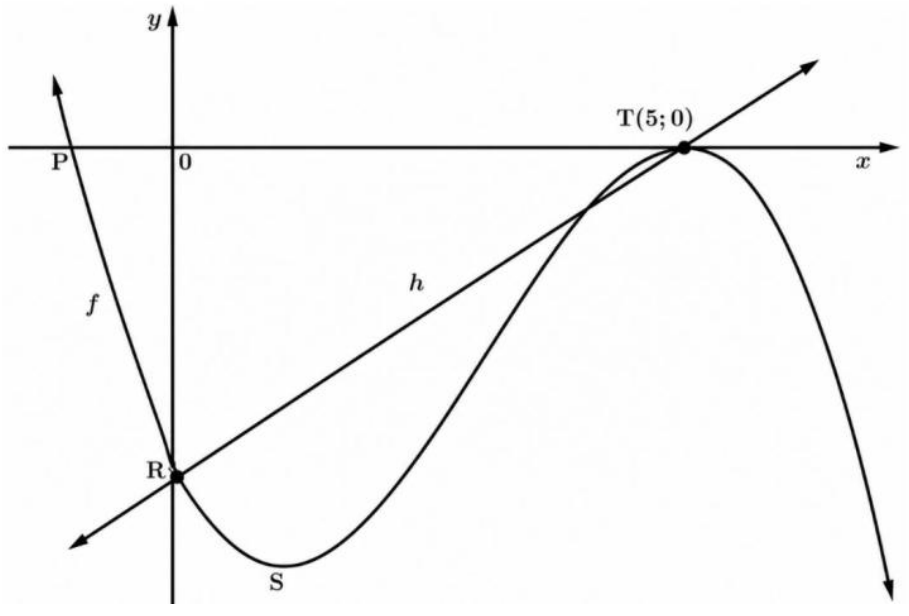

Draw the graph of $f'(x)$, the derivates of $f$. Show all intercepts with the axes and turning point(s). (4)

**[14]**

**Western Cape**

**QUESTION 9**

In the diagram below the function $f(x) = -x^3 + bx^2 + cx + d$ and $h(x) = 5x - 25$ is given. P and T(5 ; 0) are the $x$-intercepts of $f$. R is the common $y$-intercept of $f$ and $h$. S and T are the turning points of $f$.




9.1 Write down the coordinates of R, the $y$-intercept of $h$. (1)

9.2 Show that $b = 9, c = -15$ and $d = -25$. (4)

9.3 Determine the coordinates of S. (4)

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9.4 A tangent to $f$ is drawn at a point Q on the curve. This tangent passes through R. Determine the coordinates of Q, if Q is not the point R itself. (4)

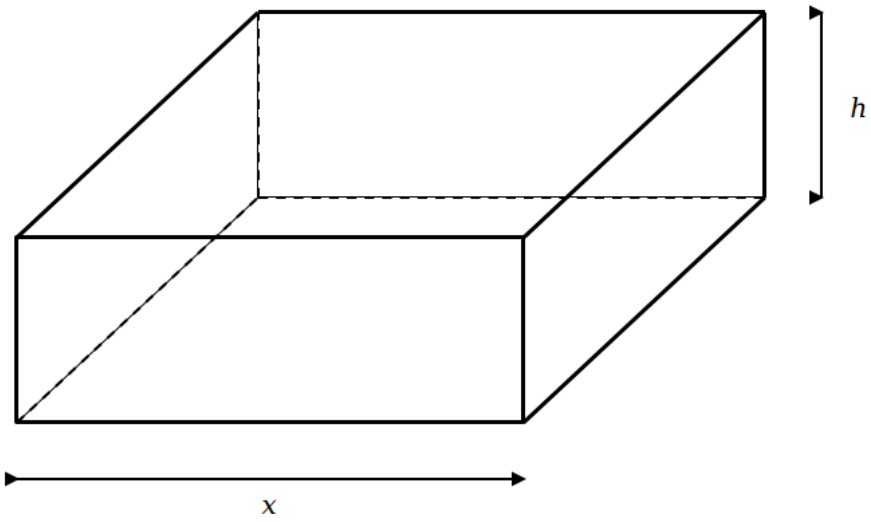
**[13]**

# Optimisation

## Eastern Cape

### QUESTION 9

A piece of wire, three metres (3 m) long, is bent into the framework of a rectangular prism with a square base, as shown in the diagram. The sides of the square base are $x$ units and the height of the prism is $h$ units.




Calculate the values of $x$ and $h$ of the frame which will ensure the maximum volume of a solid block with the same dimensions. **[7]**

## Free State

### QUESTION 9

A company manufactures and sells **portable power banks**. The profit (in Rands) it makes from selling units is given by the function: $p(x) = -2x^2 + 160x - 2000$

9.1 Define the term *maximum turning point* in the context of a profit function. (1)

9.2 Determine the number of units that must be sold to maximise the profit. (2)

9.3 Calculate the maximum profit the company can earn. (2)

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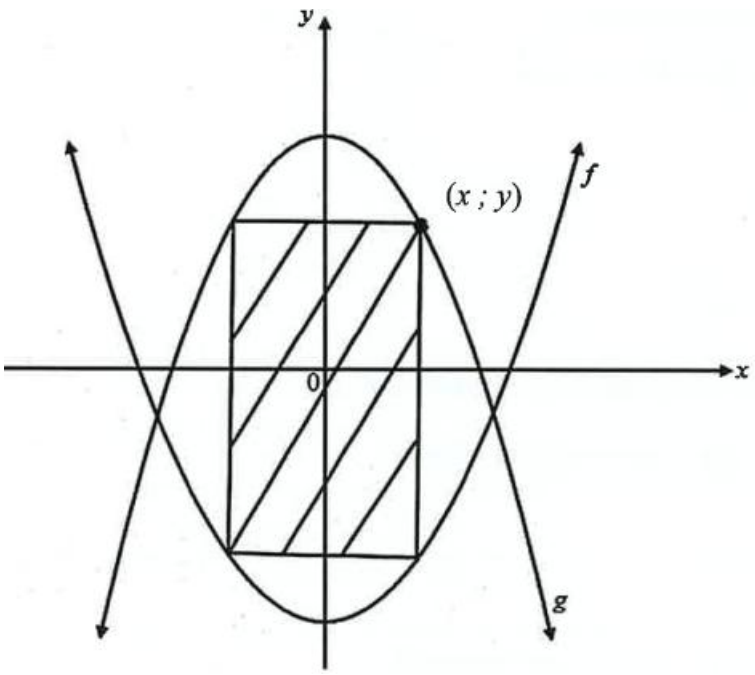
9.4 Due to equipment limitations, the company can produce a maximum of 60 units per day, at most. Should the business run at full speed? Justify your answer by showing all calculations. (3)

**[8]**

**Gauteng**

**QUESTION 9**

$f(x)=\frac{1}{2}x^2-6$ and $g(x)=-x^2+12$ enclose a rectangle, as shown in the diagram below. The vertical sides of the rectangle lie perpendicular to the $x$-axis. A point $(x\,;y)$ is given on $g$.




9.1 Determine the dimensions of the rectangle in terms of $x$. (3)

9.2 Hence or otherwise, determine the maximum area of the rectangle. (5)

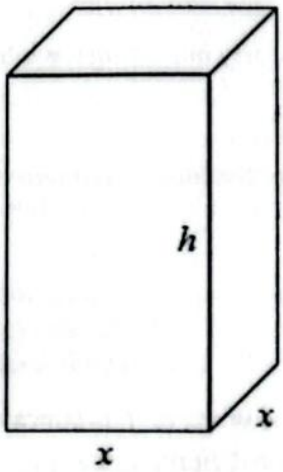
**[8]**

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## KZN

**QUESTION 10**

A piece of cardboard with area 1 350 $cm^2$ is folded to form a closed rectangular box with a square base. The side length of the square base is $x$ cm and the height of the box is $h$ cm.




10.1 Show that the volume of the box is given by: $V(x)=\frac{675x}{2}-\frac{x^3}{2}$ (4)

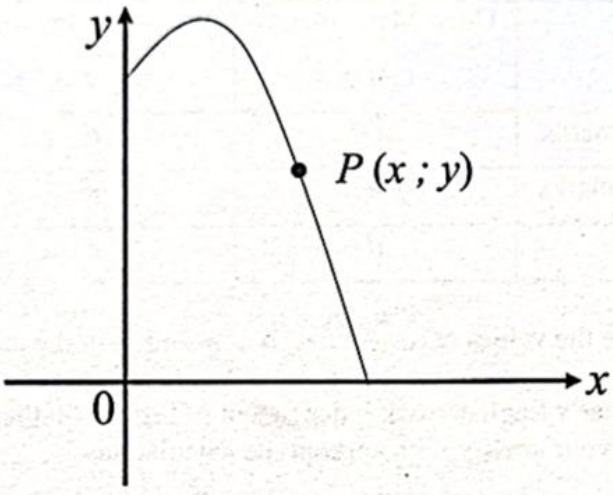
10.2 Determine the value of $x$ for which the volume of the box will be a maximum. (3)

[7]

## Limpopo

**QUESTION 10**

10.1 The graph of $x^3+y^2=8$, not drawn to scale, is represented alongside for the interval $0\le x\le 2$, $P(x\ ;\ y)$ is any point on the graph.



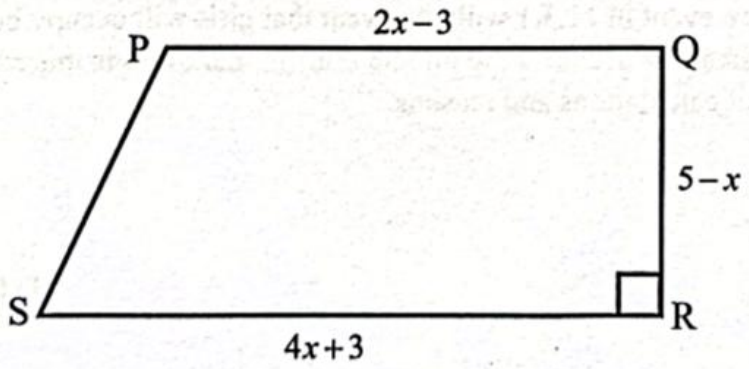

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10.1.1 Determine the length of $OP$ in terms of $x$. (2)

10.1.2 Determine the maximum value of $OP^2$. (5)

10.1.3 Calculate the shortest distance from the origin to the graph. (2)

10.2 PQRS is a trapezium with PQ parallel to RS and measurements $PQ = 2x-3$, $QR = 5-x$ and $RS = 4x+3$ in meters, as indicated on the diagram.




10.2.1 Show that the area of the trapezium is $A = 15x-3x^2$. (2)

10.2.2 Calculate the value of $x$ if PQRS has a maximum area. (2)

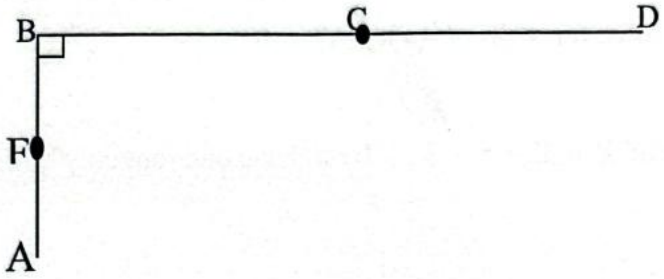
10.2.3 Calculate the maximum area of PQRS. (2)

**[15]**

**Mpumalanga**

**QUESTION 9**

Two Bikers start to cycle at the same time. One starts at point B and is heading due south to point A, whilst the other starts at point D and is heading due west to point B. The biker starting from B cycles at 20 km/h while the biker starting from D cycles at 35 km/h. The distance between B and D is 80 km. After time t (measured in hours), they reach points F and C respectively.




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9.1 Prove that the distance between F and C is given by $FC = \sqrt{1625t^2 - 5600t + 6400}$ (4)

9.2 After how long will the two bikers be closest to each other? (4)

9.3 What will the distance between the bikers be at the time determined in QUESTION 9.2? (2)

**[10]**

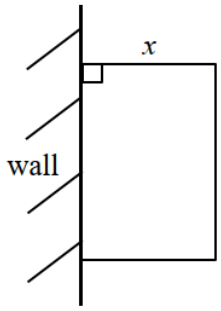
## Northern Cape

**QUESTION 9**

The diagram below shows a rectangular enclosure designed so that one side is fixed against a wall and therefore does not require fencing.

Let the two equal sides perpendicular to the wall each be $x$ metres long.

The total length of fencing available for the remaining three sides is 60 metres.




9.1 Show that the expression for the area is $A = -2x^2 + 60x$. (1)

9.2 Calculate the maximum possible area of the enclosure. (3)

9.3 The farmer is not restricted to 60 m of fencing but instead has a budget of R480 for the fencing.

- The two sides perpendicular to the wall cost R5 per metre each
- The side parallel to the wall costs R8 per metre

Let the length of each perpendicular side be $x$ metres and the length of the side parallel to the wall be $y$ metres.

Using differentiation, determine the value of $x$ that will maximise the area of the enclosure. (5)

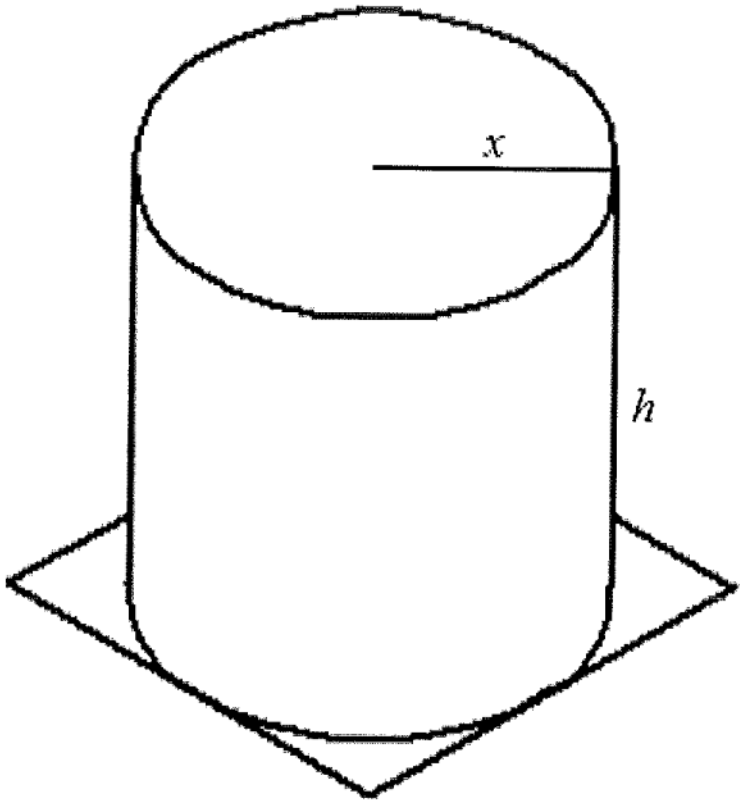
**[9]**

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**North-West**

**QUESTION 9**

A farmer wants to make a metal container by attaching a pipe to a square base. The radius of the pipe is $x$ and the height $h$. The length of the square is $2x$.




9.1 Show that the area of the container is given by $A = 4x^2 + 2\pi xh$. (1)

9.2 If the farmer only has 20 $m^2$ metal sheet, determine the height of the container in terms of $x$ and $\pi$. (3)

9.3 Show that the volume of the container is given by: $V(x) = 10x - 2x^3$. (1)

9.4 Calculate the maximum volume of the container. (4)

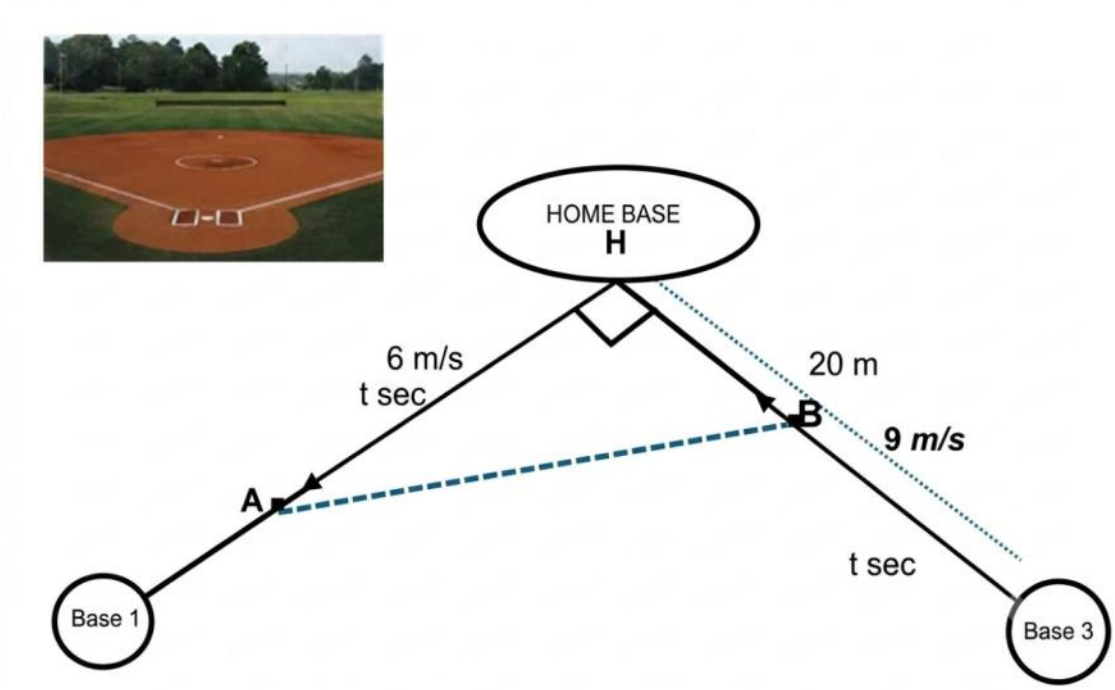
**[9]**

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**SACAI**

## QUESTION 10

- During a softball match, Kelvin is running from home base towards first base at a constant speed of 6 m/s.
- Nic is heading from third base towards home base at a constant speed of 9 m/s.
- Both runners start running at exactly the same moment.
- The distance between third base and home base is 20 m.
- $A\hat{H}B = 90°$
- After $t$ seconds Kelvin reaches point A and Nic reaches point B.




10.1 Express the distance from home base to point A in terms of $t$. (1)

10.2 Show that $AB^2 = 117t^2 - 360t + 400$. (2)

10.3 Hence, or otherwise, calculate how long after Kelvin and Nic started running, they were nearest to each other. Round your answer off to the nearest THREE decimal places. Assume that AB is a minimum if $AB^2$ is a minimum. (3)

10.4 Rounding off to the nearest meter, calculate the distance AB when they were the nearest to each other. (1)

**[7]**

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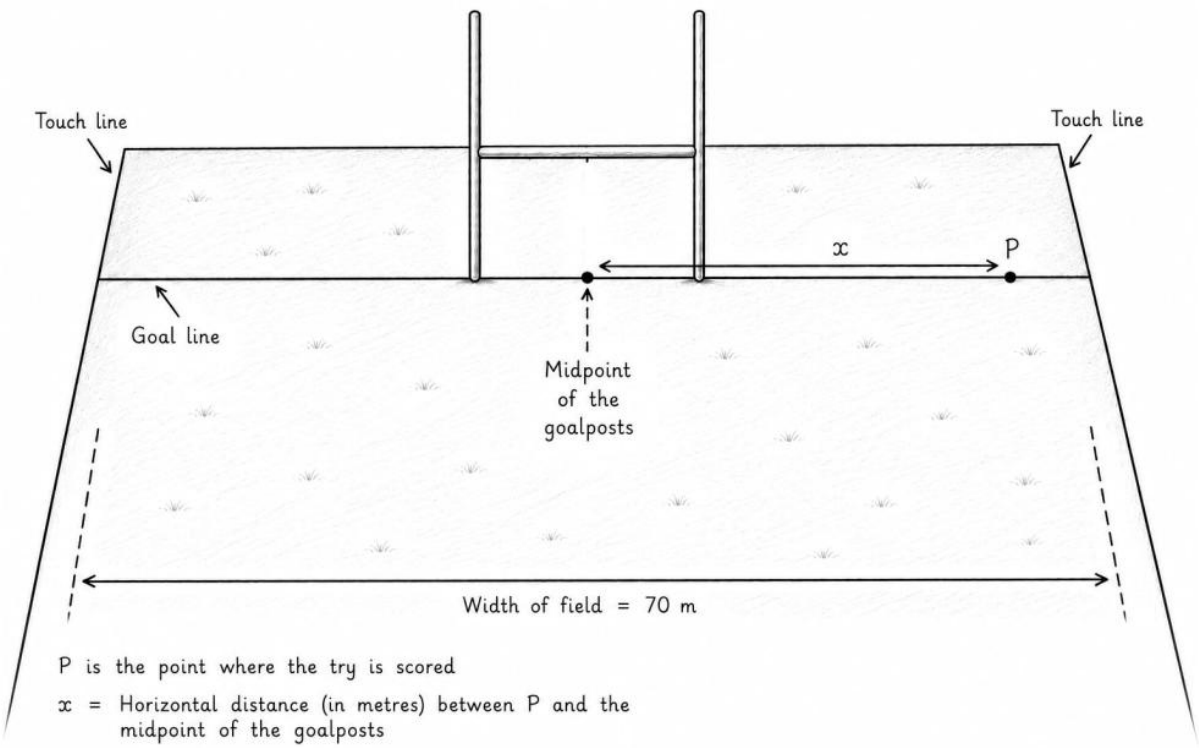
**Western Cape**

## QUESTION 10

An ***attack-rating*** is used in rugby to show the probability that an offensive move will end in a successful try.
The ***attack-rating*** (A) is given by:

$$A(x) = \frac{600 + 40x - x^2}{1200};\ 0 \leq x \leq 35$$

Where $x$ is the distance between the midpoint of the goalposts and P, the point where the try was scored.




10.1 A rugby field is 70m wide. Calculate the ***attack-rating*** (A) of a try scored on the touch line. (2)

10.2 Determine the value of $x$, where the ***attack-rating*** (A) will be a maximum. (4)

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10.3 For the team's current kicker the probability of a successful conversion is given by: $C(x) = 0,9 - \frac{x}{100}$

If it is given that $C(x)$ and $A(x)$ are independent, determine the probability that a try will be scored and a successful conversion at the point calculated in QUESTION 10.2. (2)

**[8]**

# PROBABILITY

**Eastern Cape**

**QUESTION 10**

10.1 Given that:

- The probability that event A will occur is 0,3
- The probability that event B will occur is 0,5
- The probability that at least one of the events will occur is 0,65

10.1.1 Determine the probability that both events A and B will occur. (2)

10.1.2 Are the events A and B independent? Show your working to justify your conclusion. (3)

10.2 The two-way contingency table below shows the favourite sport activity of 80 students at a certain university in South Africa.

| | Soccer | Cycling | Tennis | Total |
|---|---|---|---|---|
| Male | 17 | 12 | 6 | $a$ |
| Female | 19 | 11 | $b$ | 45 |
| Total | 36 | 23 | 21 | 80 |

10.2.1 Write down that values of $a$ and $b$. (2)

10.2.2 What is the probability of cycling being the favourite sport activity of a female student? (2)

**[9]**

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## Free State

**QUESTION 10**

10.1 A and B are mutually exclusive events. If it is given that P(A) = 0,35 and P(B) = 0,52, determine:

10.1.1 P (not A) (2)

10.1.2 P (A and B) (1)

10.1.3 P (A or B) (2)

10.2 In a city where the ratio of males to females is 1 : 2, one person is randomly selected to flip a coin for the kick-off of a soccer tournament.

10.2.1 Draw a tree diagram to show all possible outcomes of the coin toss. (3)

10.2.2 Determine the probability that it will be a female who flips the coin. (1)

10.2.3 Determine the probability that it will be a male's coin that lands on heads. (2)

10.3 A coding system used to identify members of an organisation is made up of two letters and a sequence of digits, for example, DE2 or BC34 or AB136 or CC2697 or CD054986 and so forth. The letters that can be used are A, B, C, D and E. The digits that can be used are 0 to 9. Letters may be repeated, but not the digits. Determine the least number of digits required for the organisation to uniquely identify 120 000 members. (4)
**[15]**

## Gauteng

**QUESTION 10**

Three events A, B and C are given such that:

- B and C are independent.
- A and C are mutually exclusive.
- P(A) = 0,3
- P(B) = 0,4
- P(C) = 0,2
- P(A and B) = 0,12

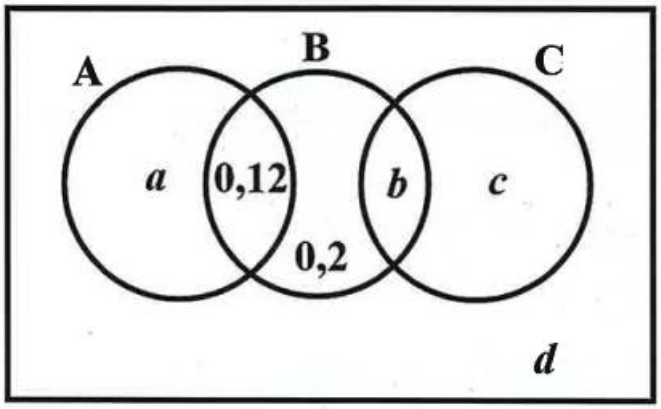
10.1 Calculate the probability of the following:

10.1.1 Both A and C occur simultaneously. (1)

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10.1.2 Both B and C occur simultaneously. (2)

10.2 Using the Venn Diagram given below, determine values for $a$, $b$, $c$ and $d$.




(4)

[7]

**QUESTION 11**

9 members of a school's Representative Council of Learners (RCL) are seated in the front row for the school's photographs.

11.1 Determine the number of ways in which the 9 RCL members can be arranged? (2)

11.2 The following office bearers/portfolio managers are present at the school's photo session:

- President (P)
- Deputy President (DP)
- Secretary (S) and
- Public Relations Officer (PRO)

11.2.1 Calculate the probability that the President, Deputy President and Secretary will be seated next to each other. (3)

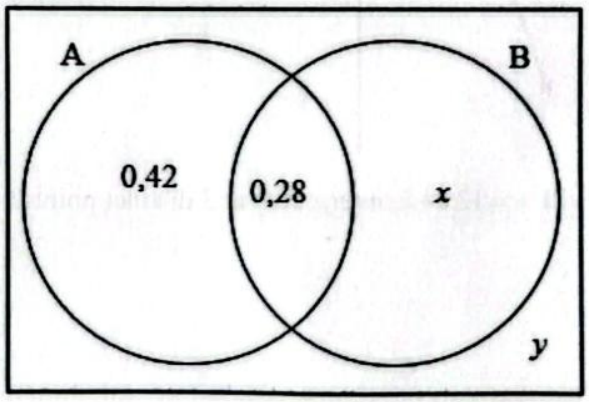
11.2.2 If the Secretary and Public Relations Officer may NOT sit together, in how many different ways can the RCL members be seated? (3)

**[8]**

**KZN**

**QUESTION 11**

11.1 A and B are two events. The probabilities of these events, (or a combination of them) occurring, are given in the Venn-diagram below. A and B are independent events.




Calculate:

11.1.1 the value of $x$. (3)

11.1.2 the value of $y$. (1)

11.1.3 P (A or B) (1)

11.2 The probability that it will rain tomorrow is 70%.
If it rains, the probability that Nomsa will arrive late at the office is 25%.
If it does not rain, the probability that Nomsa will arrive late at the office is 10%.
Calculate the probability that Nomsa will be on time for work tomorrow. (4)

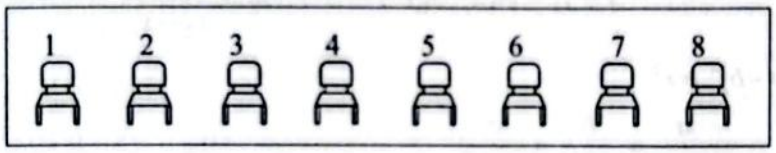
11.3 A modelling agency invited eight grade 12 learners for a photo shoot. There were 4 girls and 4 boys. The names of the girls were Zanele, Sandra, Anashya and Nonhlanhla. The names of the boys were Thulani, Ruan, Reggie and Peter.

11.3.1 For the first photo, the learners had to stand in a line in any order they preferred. In how many ways could they arrange themselves for this photo? (1)

11.3.2 For the second photo, four chairs were placed in a row, and the learners were told that any four of them could pose for this photo. How many arrangements were possible for this photo? (1)

11.3.3 For the third photo, eight chairs were placed in a row, as shown in the sketch below:

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Peter and Nonhlanhla were told to sit in the middle, on chairs no. 4 and 5, in any order. The other six learners could sit on any of the remaining chairs.

What is the probability that all three the other girls will sit on the one side, and all three the other boys on the other side? (4)

**[15]**

## Limpopo

**QUESTION 11**

11.1 The marks of 720 learners who took both Mathematics and English were analysed and are summarised in the table below.

| | Good Mathematics marks | Weak Mathematics marks | Total |
|---|---|---|---|
| Good English marks | 360 | $b$ | 480 |
| Weak English marks | $e$ | 60 | $f$ |
| Total | $d$ | $c$ | $a$ |

11.1.1 Calculate the values of $a$ , $b$ , $c$, $d$ , $e$ and $f$ in the table above. (3)

11.1.2 Is a learner's English mark independent of his/her Mathematics ability? Support your answer with appropriate calculations. (4)

11.2 Rugby players want to go to the beach after a game if the sun is shining. The chance that the sun will shine is $\frac{1}{3}$. If it is a sunny day, the chance that they will go to the beach is $\frac{5}{8}$ . If it is not a sunny day, their chances are reduced to $\frac{2}{8}$. Determine the probability that the rugby players will go to the beach. (3)

11.3 Four boys and three girls are seated in a row.

11.3.1 Calculate the probability that the middle seat and both end seats are occupied by boys. (3)

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11.3.2 Compare event in 11.3.1 with the event that girls will occupy both end seats and a boy occupies the middle seat. Which event is more likely? Show all calculations and reasons. (3)

[16]

## Mpumalanga

**QUESTION 10**

10.1 Let A and B be two events in a sample space. Suppose that the $P(A) = 0,4$; $P(A \text{ or } B) = 0,7$ and $P(B) = k$.
For what value of $k$ are the two events independent? (4)

10.2 Consider the word WIZARDS.

10.2.1 How many different arrangements are possible if all the letters are used? (2)

10.2.2 How many different arrangements are possible if the letters RDS must follow each other in any order? (3)

10.3 Consider the sample space of integers from 1 to 9.

10.3.1 How many 4-digit codes can be created if:

- The code must be greater than 7000
- The code must be divisible by 2
- Numbers can be repeated. (3)

10.3.2 If numbers can be repeated, what is the probability of forming a 4-digit code which is a multiple of 5? (4)

[16]

## Northern Cape

**QUESTION 10**

10.1 A community youth centre surveyed 50 of its learners on the after-school activities they regularly participate in namely sports (S), music (M) and drama (D). The results of the survey are given in percentages:

- 8% of the learners participate in all three activities.
- 18% participate in sports and music.
- 10% only participate in music and drama.
- $x$% only participate in sports and drama.
- 64% participate in sports.
- 40% participate in music.
- 52% participate in drama.
- 10% participate in none of the three activities.

10.1.1 Draw a Venn diagram to represent ALL the learners who participated in the survey. (4)

10.1.2 Calculate the value of $x$. (1)

10.1.3 Determine whether participation in sports (S) and music (M) are independent events. (2)

10.2 Consider the letters of the word STATISTICS. The letters that are the same are treated as being identical. If the letters are arranged in any order without repetition, what is the probability that the word arrangement formed will end with the letter S? (4)

10.3 A school has 7 boys and 5 girls. A committee of 6 learners is selected and then seated in a row for a photograph. In how many ways can the 6-member committee be chosen if at least 3 girls must be included? (2)

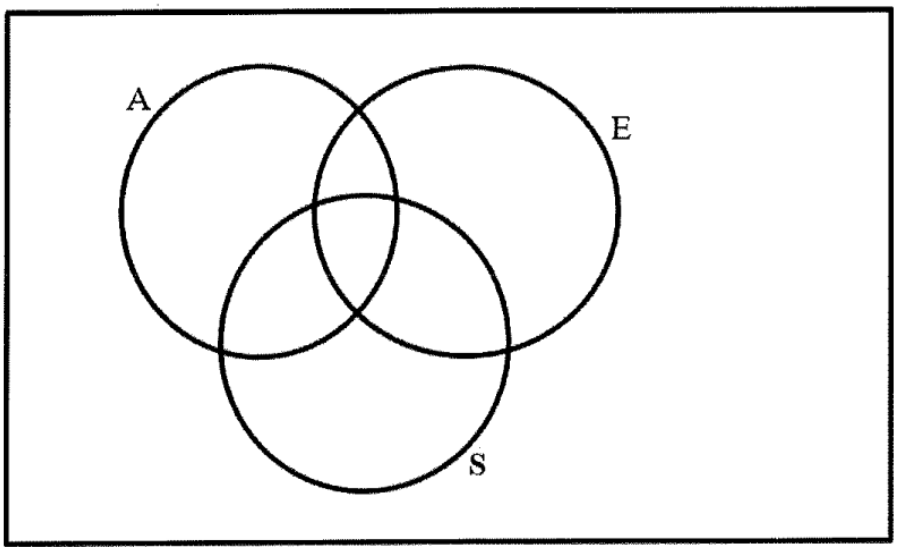
**[13]**

## North-West

### QUESTION 10

A survey was conducted among 200 grade 12 learners of a high school to determine which languages the learners use at their homes. The results are shown below:

- 70 speak Afrikaans
- 73 speak Setswana
- 63 speak only English
- 8 speak all three languages
- 11 speak Afrikaans and Setswana
- 18 speak English and Setswana
- 18 speak Afrikaans and English but not Setswana
- 5 speak none of the three languages at home




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10.1 Complete the Venn-diagram to represent the given data, in your answer book. (3)

10.2 Calculate the probability that a learner, chosen at random, will speak only ONE of these three languages at home. (2)

10.3 Determine whether the events to speak Afrikaans at home and to speak Setswana at home, are independent. (4)
**[9]**

**SACAI**

## QUESTION 11

11.1 The pass rate in Mathematics in Grade 12 depends on a number of factors. Preparation for the examination is one of the factors that influence the outcome in the examination.

- The probability that a learner in the Grade 12 group prepared adequately, is 65%.
- If a learner has prepared adequately, the probability of NOT attaining a distinction, is 30%.
- If the learner has NOT prepared adequately, the probability of attaining a distinction, is $\frac{2}{25}$.

There are 120 learners in the Grade 12 group.

11.1.1 Draw a tree diagram to represent the information and show all possible outcomes. (3)

11.1.2 If a learner refuses to prepare adequately for the examination, determine the probability that he will not attain a distinction. (1)

11.1.3 Showing all working, predict the number of learners that will get a distinction in the examination. (4)

11.2 A car dealership has 30 cars for sale. 8 cars are BMW's, 7 cars are Volvo's and 15 cars are Toyota's. Two cars are bought on a specific day, one in the morning and one in the afternoon. Assume that it is equally likely to sell any of the cars.

Determine the probability that both cars sold are Toyota's. (3)

11.3 At the Awards ceremony, 6 learners need to stand on three steps in a pyramid shape with 1 learner on the top step, 2 learners on the middle step and 3 learners on the bottom step.

11.3.1 In how many ways can the 6 learners be arranged on the steps? (1)

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11.3.2 John is the top performer and must stand on the top step. The 3 learners that need to stand on the bottom step are two boys and 1 girl. How many ways can the learners be arranged if the 2 boys on the bottom step are not allowed to stand next to each other? (3)

**[15]**

**Western Cape**

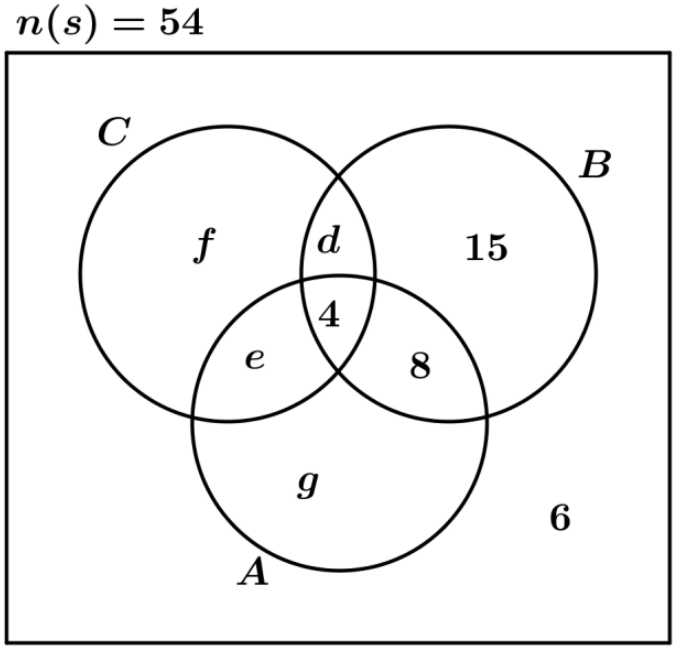
**QUESTION 11**

11.1 Research into driving under the influence of alcohol was carried out. Alcohol levels are determined by three methods: **alcohol content of breath (A), blood-alcohol concentration (B)** and **certificates issued b doctors (C)**. The list below summarises information from traffic authorities in 54 countries on how alcohol levels are measured.

- 4 countries use all three methods (A, B and C).
- 12 countries use the alcohol content of breath (A) and blood-alcohol concentration (B).
- 9 countries use blood-alcohol concentration (B) and certificates issued by doctors (C).
- 8 countries use the alcohol content of breath (A) and certificates issued by doctors (C).
- 21 countries use the alcohol content of breath (A).
- 32 countries use blood-alcohol concentration (B).
- 20 countries use certificates issued by doctors (C).
- 6 countries use none of these methods.

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Below is a partially completed Venn diagram representing the above information.




11.1.1 Use the given information and the Venn diagram to determine the values of $d$, $e$, $f$ and $g$. (4)

11.1.2 For a randomly selected country, determine P(B or C) (2)

11.2 Ten runners, A to J, complete a race.

11.2.1 In how many different orders can the 10 runners finish the race? (1)

11.2.2 In how many of the possible arrangements do A, B and C finish in the first three positions, regardless of the order? (2)

11.2.3 In how many different ways can the gold, silver and bronze medals be awarded to the 10 runners? (2)

11.2.4 Determine the probability that H and G do not finish consecutively. (4)

**[15]**