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WTS LAST DANCE CAMP

MATHS PAPER ONE

GRADE 12

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MATHS & SCIENCE TUTORING**

REGISTRATION NUMBER: 149 – 892 NPO

2022 WTS LAST DANCE CAMP

SUBJECTS : MATHS / MATHS LIT & PHYSICS,
ACCOUNTING, LIFE SCIENCES, BUSINESS
STUDIES, EMS, EGD, TECH MATHS/
SCIENCES & NS

PROVINCE : KWAZULU NATAL

DURBAN : 03 TO 09 OCTOBER 2022

GRADE : 08 TO 12

PRICE : R2500

VENUE : MASIBUMBANE SCHOOL

TIME : 08:00 TO 23:00 DAILY

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**ONE ON ONE LESSONS: RICHARDS BAY, MTUBA, ESKHALENI,
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**FOR MORE INFORMATION CONTACT: PROF KWV SIBIYA: 082 6727
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Tutoring

KWV 01**QUESTION 1**1.1 Solve for x :

1.1.1 $x^2 - 2x - 24 = 0$ (3)

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

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

1.1.4 $\sqrt{x+28} = 2-x$ (4)

1.2 Solve simultaneously for x and y in:

$2y = 3 + x$ and $2xy + 7 = x^2 + 4y^2$ (6)

1.3 The roots of an equation are $x = \frac{-n \pm \sqrt{n^2 - 4mp}}{2m}$ where m , n and p are positive real numbers. The numbers m , n and p , in that order, form a geometric sequence. Prove that x is a non-real number. (4)
[24]

QUESTION 2Given the geometric series: $x + 90 + 81 + \dots$ 2.1 Calculate the value of x . (2)2.2 Show that the sum of the first n terms is $S_n = 1\,000(1 - (0,9)^n)$. (2)2.3 Hence, or otherwise, calculate the sum to infinity. (2)
[6]**QUESTION 3**Given: $\sum_{t=0}^{99} (3t - 1)$

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

3.2 Calculate the sum of the series. (4)
[5]1.2 Consider the equation: $x^2 + 5xy + 6y^2 = 0$ 1.2.1 Calculate the values of the ratio $\frac{x}{y}$. (3)1.2.2 Hence, calculate the values of x and y if $x + y = 8$. (5)

1.3 The solutions of a quadratic equation are given by $x = \frac{-2 \pm \sqrt{2p+5}}{7}$

For which value(s) of p will this equation have:

1.3.1 Two equal solutions (2)

1.3.2 No real solutions (1)

QUESTION 2

2.1 Consider the sequence: $\frac{1}{2}; 4; \frac{1}{4}; 7; \frac{1}{8}; 10; \dots$

2.1.1 If the pattern continues in the same way, write down the next TWO terms in the sequence. (2)

2.1.2 Calculate the sum of the first 50 terms of the sequence. (7)

2.2 Consider the sequence: $8; 18; 30; 44; \dots$

2.2.1 Write down the next TWO terms of the sequence, if the pattern continues in the same way. (2)

2.2.2 Calculate the n^{th} term of the sequence. (6)

2.2.3 Which term of the sequence is 330? (4)

[21]

QUESTION 3

Given the geometric series: $8x^2 + 4x^3 + 2x^4 + \dots$

3.1 Determine the n^{th} term of the series. (1)

3.2 For what value(s) of x will the series converge? (3)

3.3 Calculate the sum of the series to infinity if $x = \frac{3}{2}$. (3)

[7]

QUESTION 2

2.1 Given the sequence: $4; x; 32$

Determine the value(s) of x if the sequence is:

2.1.1 Arithmetic (2)

2.1.2 Geometric (3)

2.2 Determine the value of P if $P = \sum_{k=1}^{13} 3^{k-5}$ (4)

QUESTION 2

- 2.1 $3x + 1$; $2x$; $3x - 7$ are the first three terms of an arithmetic sequence. Calculate the value of x . (2)
- 2.2 The first and second terms of an arithmetic sequence are 10 and 6 respectively.
- 2.2.1 Calculate the 11th term of the sequence. (2)
- 2.2.2 The sum of the first n terms of this sequence is -560 . Calculate n . (6)
- [10]
- 3.3 The n^{th} term of a sequence is given by $T_n = -2(n - 5)^2 + 18$.
- 3.3.1 Write down the first THREE terms of the sequence. (3)
- 3.3.2 Which term of the sequence will have the greatest value? (1)
- 3.3.3 What is the second difference of this quadratic sequence? (2)
- 3.3.4 Determine ALL values of n for which the terms of the sequence will be less than -110 . (6)

QUESTION 3

Consider the quadratic number pattern: $-145 ; -122 ; -101 ; \dots$

- 3.1 Write down the value of T_4 . (1)
- 3.2 Show that the general term of this number pattern is $T_n = -n^2 + 26n - 170$. (3)
- 3.3 Between which TWO terms of the quadratic number pattern will there be a difference of -121 ? (4)
- 3.4 What value must be added to each term in the number pattern so that the value of the maximum term in the new number pattern formed will be 1? (3)
- [11]**

QUESTION 4

Consider the linear pattern: $5 ; 7 ; 9 ; \dots$

- 4.1 Determine T_{51} . (3)
- 4.2 Calculate the sum of the first 51 terms. (2)
- 4.3 Write down the expansion of $\sum_{n=1}^{5000} (2n+3)$. Show only the first 3 terms and the last term of the expansion. (1)
- 4.4 Hence, or otherwise, calculate $\sum_{n=1}^{5000} (2n+3) + \sum_{n=1}^{4999} (-2n-1)$. (4)
- ALL working details must be shown. **[10]**

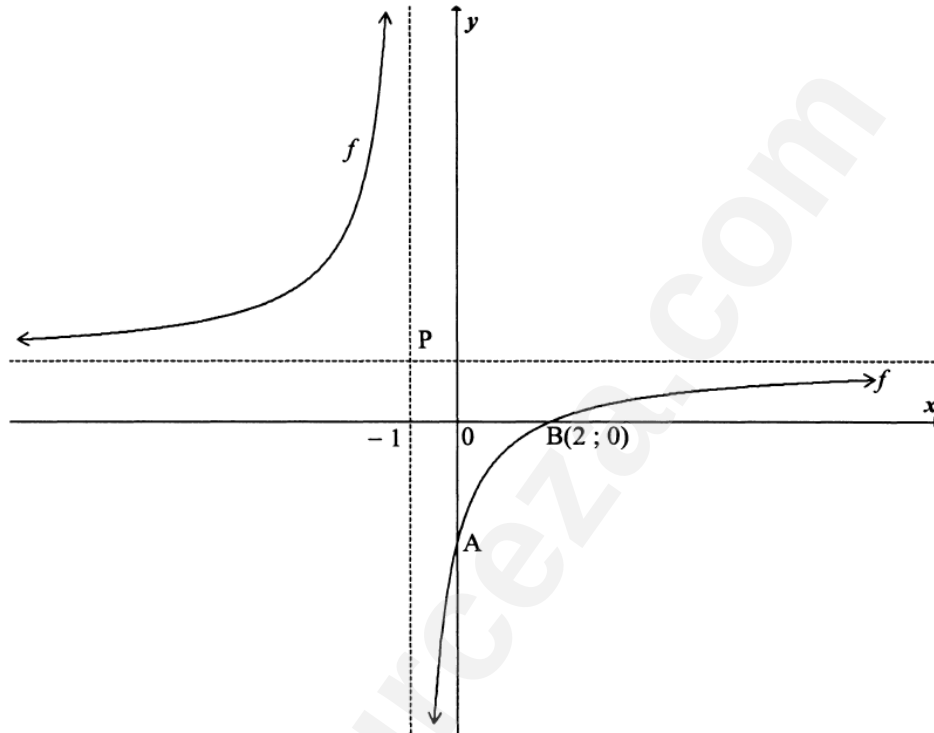
QUESTION 5

Given: $f(x) = \frac{-1}{x-3} + 2$

- 5.1 Write down the equations of the asymptotes of f . (2)
- 5.2 Write down the domain of f . (1)
- 5.3 Determine the coordinates of the x -intercept of f . (2)
- 5.4 Write down the coordinates of the y -intercept of f . (2)
- 5.5 Draw the graph of f . Clearly show ALL the asymptotes and intercepts with the axes. (3)
- [10]**

QUESTION 6

A sketch of the hyperbola $f(x) = \frac{x-d}{x-p}$, where d and p are constants, is given below. The dotted lines are the asymptotes. The asymptotes intersect at P and B(2 ; 0) is a point on f .

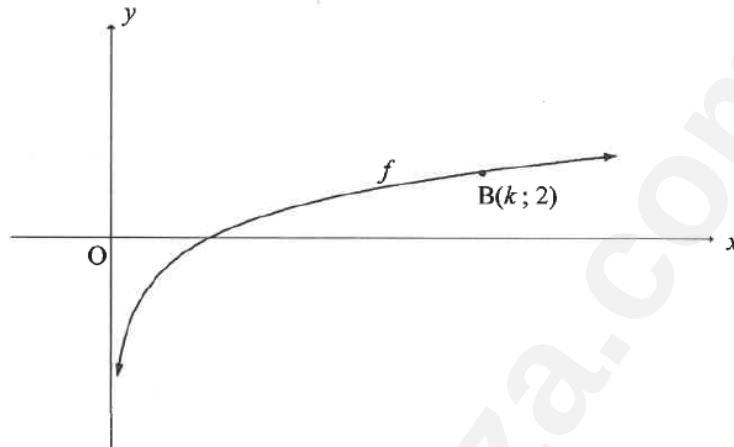


- 6.1.1 Determine the values of d and p . (2)
- 6.1.2 Show that the equation of f can be written as $y = \frac{-3}{x+1} + 1$. (2)
- 6.1.3 Write down the coordinates of P. (2)
- 6.1.4 Write down the coordinates of the image of B(2 ; 0) if B is reflected about the axis of symmetry $y = x + 2$. (2)
- 6.2 The exponential function, $g(x) = p \cdot 2^x + q$ has a horizontal asymptote at $y = 1$ and passes through (0 ; -2). Determine the values of p and q . (3)
- [11]

QUESTION 6

The graph of $f(x) = \log_4 x$ is drawn below.

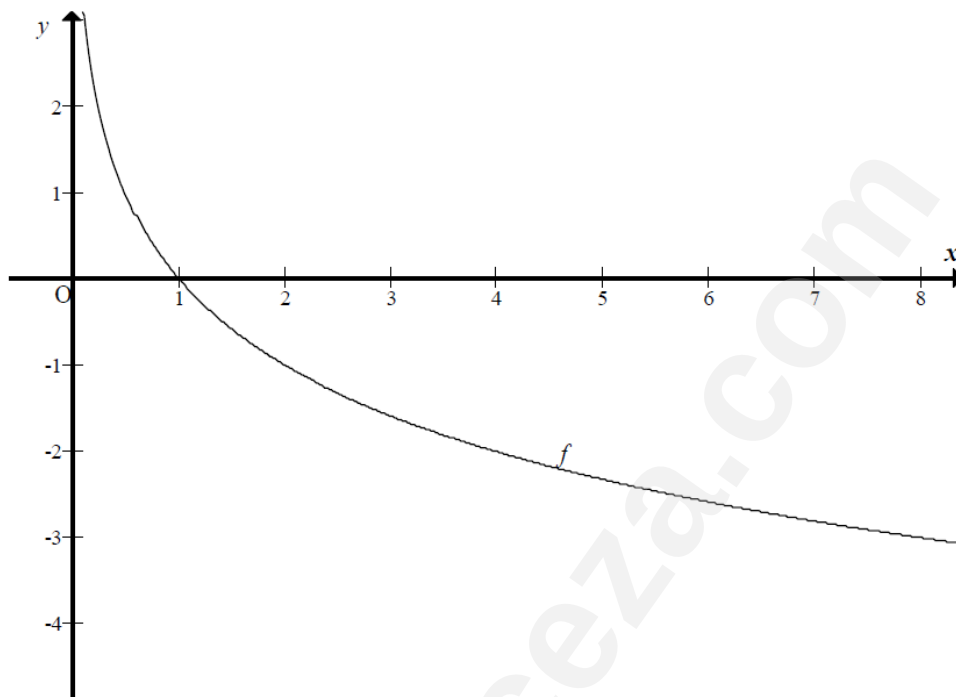
$B(k; 2)$ is a point on f .



- 6.1 Calculate the value of k . (2)
- 6.2 Determine the values of x for which $-1 \leq f(x) \leq 2$. (2)
- 6.3 Write down the equation of f^{-1} , the inverse of f , in the form $y = \dots$ (2)
- 6.4 For which values of x will $x \cdot f^{-1}(x) < 0$? (2)
- [8]**

QUESTION 8

Sketched below is the graph of $f(x) = -\log_2 x$.



- 8.1 Write down the domain of f . (1)
- 8.2 Write down the equation of f^{-1} in the form $y = \dots$ (1)
- 8.3 Write down the equation of the asymptote of f^{-1} . (1)
- 8.4 Explain how, using the graph of f , you would sketch the graphs of:
- 8.4.1 $g(x) = \log_2 x$ (1)
- 8.4.2 $h(x) = 2^{-x} - 5$ (3)
- 8.5 Use the graph of f to solve for x where $\log_2 x < 3$. (3)

[10]

QUESTION 7

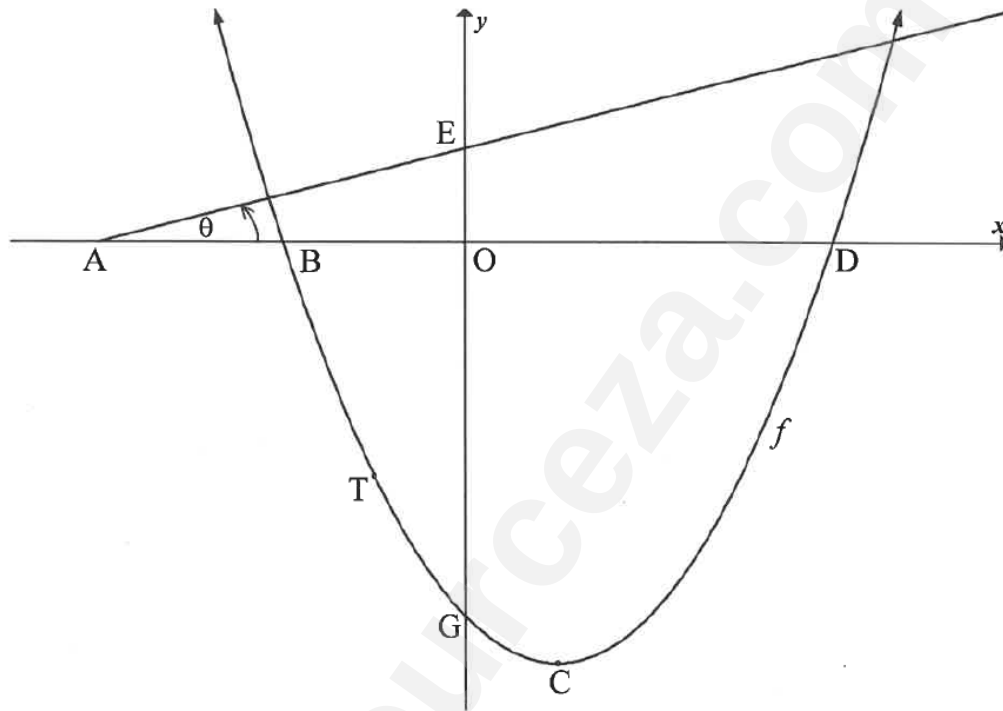
The graph of $f(x) = (x+4)(x-6)$ is drawn below.

The parabola cuts the x -axis at B and D and the y -axis at G.

C is the turning point of f .

Line AE has an angle of inclination of θ and cuts the x -axis and y -axis at A and E respectively.

T is a point on f between B and G.



7.1 Write down the coordinates of B and D. (2)

7.2 Calculate the coordinates of C. (2)

7.3 Write down the range of f . (1)

7.4 Given that $\theta = 14,04^\circ$ and the tangent to f at T is perpendicular to AE.

7.4.1 Calculate the gradient of AE, correct to TWO decimal places. (1)

7.4.2 Calculate the coordinates of T. (5)

7.5 A straight line, g , parallel to AE, cuts f at $K(-3; -9)$ and R. Calculate the x -coordinate of R. (6)

[17]

5.2 Draw a sketch graph of $y = ax^2 + bx + c$, where $a < 0$, $b < 0$, $c < 0$ and $ax^2 + bx + c = 0$ has only ONE solution. (4)

QUESTION 7

- 7.1 R1 570 is invested at 12% p.a. compound interest. After how many years will the investment be worth R23 000? (4)
- 7.2 A farmer has just bought a new tractor for R800 000. He has decided to replace the tractor in 5 years' time, when its trade-in value will be R200 000. The replacement cost of the tractor is expected to increase by 8% per annum.
- 7.2.1 The farmer wants to replace his present tractor with a new one in 5 years' time. The farmer wants to pay cash for the new tractor, after trading in his present tractor for R200 000. How much will he need to pay? (3)
- 7.2.2
- One month after purchasing his present tractor, the farmer deposited x rands into an account that pays interest at a rate of 12% p.a., compounded monthly.
 - He continued to deposit the same amount at the end of each month for a total of 60 months.
 - At the end of 60 months he has exactly the amount that is needed to purchase a new tractor, after he trades in his present tractor.
- Calculate the value of x . (6)
- 7.2.3 Suppose that 12 months after the purchase of the present tractor and every 12 months thereafter, he withdraws R5 000 from his account, to pay for maintenance of the tractor. If he makes 5 such withdrawals, what will the new monthly deposit be? (4)
- [17]

QUESTION 7

- 7.1 A business buys a machine that costs R120 000. The value of the machine depreciates at 9% per annum according to the diminishing-balance method.
- 7.1.1 Determine the scrap value of the machine at the end of 5 years. (3)
- 7.1.2 After five years the machine needs to be replaced. During this time, inflation remained constant at 7% per annum. Determine the cost of the new machine at the end of 5 years. (3)
- 7.1.3 The business estimates that it will need R90 000 by the end of five years. A sinking fund for R90 000, into which equal monthly instalments must be paid, is set up. Interest on this fund is 8,5% per annum, compounded monthly. The first payment will be made immediately and the last payment will be made at the end of the 5-year period.
- Calculate the value of the monthly payment into the sinking fund. (5)
- 7.2 Lorraine receives an amount of R900 000 upon her retirement. She invests this amount immediately at an interest rate of 10,5% per annum, compounded monthly.
- She needs an amount of R18 000 per month to maintain her current lifestyle. She plans to withdraw the first amount at the end of the first month.
- For how many months will she be able to live from her investment? (6)
- [17]

QUESTION 8

- 8.1 A farmer bought a tractor for R980 000. The value of the tractor depreciates annually at a rate of 9,2% p.a. on the reducing-balance method. Calculate the book value of the tractor after 7 years. (3)
- 8.2 How many years will it take for an amount of R75 000 to accrue to R116 253,50 in an account earning interest of 6,8% p.a., compounded quarterly? (4)
- 8.3 Thabo wanted to save R450 000 as a deposit to buy a house on 30 June 2018.
- 8.3.1 He deposited a fixed amount of money at the end of every month into an account earning interest of 8,35% p.a., compounded monthly. His first deposit was made on 31 July 2013 and his 60th deposit on 30 June 2018. Calculate the amount he deposited monthly. (3)
- 8.3.2 Thabo bought a house costing R1 500 000 and used his savings as the deposit. He obtained a home loan for the balance of the purchase price at an interest of 12% p.a., compounded monthly over 25 years. He made his first monthly instalment of R11 058,85 towards the loan on 31 July 2018.
- (a) What will the balance outstanding on the loan be on 30 June 2039, 21 years after the loan was granted? (3)
- (a) Calculate the interest Thabo will have paid over the first 21 years of the loan. (3)
- [16]

QUESTION 9

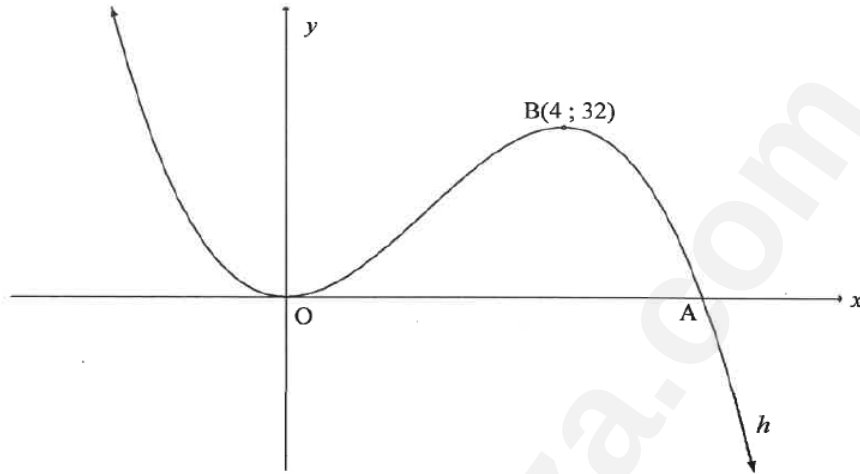
- 9.1 Determine $f'(x)$ from first principles if it is given that $f(x) = 2x^2 - 3x$. (5)
- 9.2 Determine:
- 9.2.1 $\frac{dy}{dx}$ if $y = 4x^5 - 6x^4 + 3x$ (3)
- 9.2.2 $D_x \left[-\frac{\sqrt[3]{x}}{2} + \left(\frac{1}{3x} \right)^2 \right]$ (4)
- [12]

QUESTION 10

The graph of $h(x) = ax^3 + bx^2$ is drawn.

The graph has turning points at the origin, $O(0; 0)$ and $B(4; 32)$.

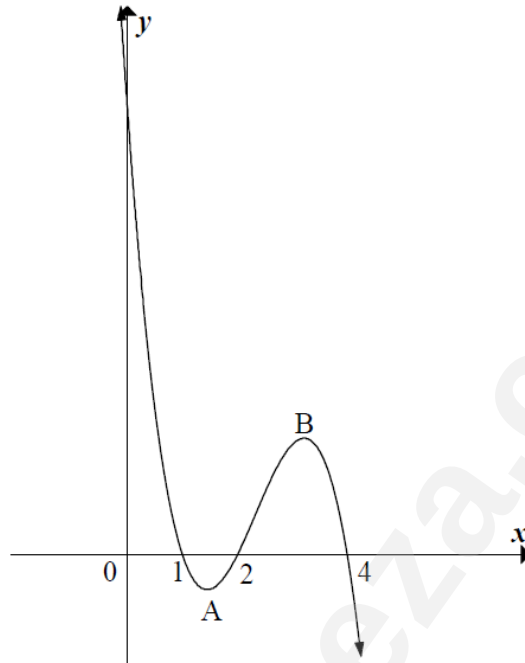
A is an x -intercept of h .



- 10.1 Show that $a = -1$ and $b = 6$. (5)
- 10.2 Calculate the coordinates of A. (3)
- 10.3 Write down the values of x for which h is:
- 10.3.1 Increasing (2)
- 10.3.2 Concave down (2)
- 10.4 For which values of k will $-(x-1)^3 + 6(x-1)^2 - k = 0$ have one negative and two distinct positive roots? (3)
- [15]

QUESTION 11

The graph of $f(x) = -x^3 + ax^2 + bx + c$ is sketched below. The x -intercepts are indicated.



- 11.1 Calculate the values of a , b and c . (4)
- 11.2 Calculate the x -coordinates of A and B, the turning points of f . (5)
- 11.3 For which values of x will $f'(x) < 0$? (3)
- [12]

QUESTION 11

Given: $f(x) = -x^3 + x^2 + 8x - 12$

- 11.1 Calculate the x -intercepts of the graph of f . (5)
- 11.2 Calculate the coordinates of the turning points of the graph of f . (5)
- 11.3 Sketch the graph of f , showing clearly all the intercepts with the axes and turning points. (3)
- 11.4 Write down the x -coordinate of the point of inflection of f . (2)
- 11.5 Write down the coordinates of the turning points of $h(x) = f(x) - 3$. (2)
- [17]

QUESTION 9

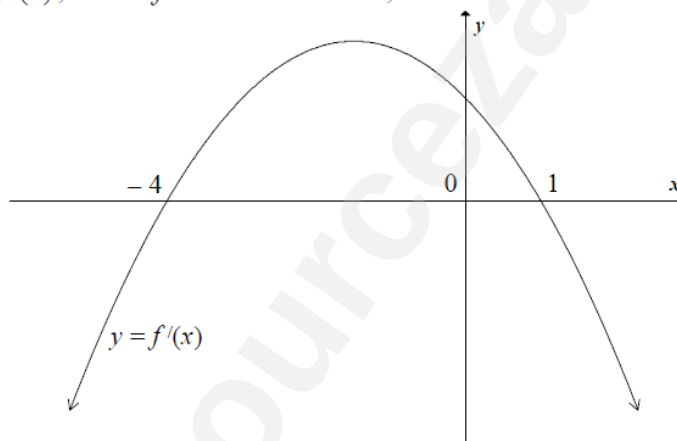
For a certain function f , the first derivative is given as $f'(x) = 3x^2 + 8x - 3$

- 9.1 Calculate the x -coordinates of the stationary points of f . (3)
- 9.2 For which values of x is f concave down? (3)
- 9.3 Determine the values of x for which f is strictly increasing. (2)
- 9.4 If it is further given that $f(x) = ax^3 + bx^2 + cx + d$ and $f(0) = -18$, determine the equation of f . (5)

[13]

QUESTION 10

The graph of $y = f'(x)$, where f is a cubic function, is sketched below.



Use the graph to answer the following questions:

- 10.1 For which values of x is the graph of $y = f'(x)$ decreasing? (1)
- 10.2 At which value of x does the graph of f have a local minimum? Give reasons for your answer. (3)

[4]

QUESTION 11

After travelling a distance of 20 km from home, a person suddenly remembers that he did not close a tap in his garden. He decides to turn around immediately and return home to close the tap.

The cost of the water, at the rate at which water is flowing out of the tap, is R1,60 per hour.

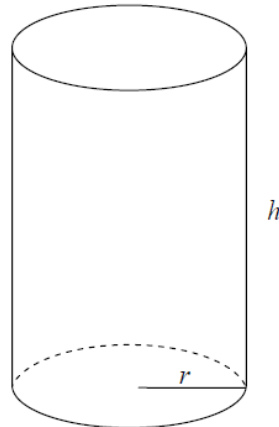
The cost of petrol is $\left(1,2 + \frac{x}{4000}\right)$ rands per km, where x is the average speed in km/h.

Calculate the average speed at which the person must travel home to keep his cost as low as possible.

[7]

QUESTION 10

A drinking glass, in the shape of a cylinder, must hold 200 ml of liquid when full.



- 10.1 Show that the height of the glass, h , can be expressed as $h = \frac{200}{\pi r^2}$. (2)
- 10.2 Show that the total surface area of the glass can be expressed as $S(r) = \pi r^2 + \frac{400}{r}$. (2)
- 10.3 Hence determine the value of r for which the total surface area of the glass is a minimum. (5)
- [9]

QUESTION 12

A tourist travels in a car over a mountainous pass during his trip. The height above sea level of the car, after t minutes, is given as $s(t) = 5t^3 - 65t^2 + 200t + 100$ metres. The journey lasts 8 minutes.

- 12.1 How high is the car above sea level when it starts its journey on the mountainous pass? (2)
- 12.2 Calculate the car's rate of change of height above sea level with respect to time, 4 minutes after starting the journey on the mountainous pass. (3)
- 12.3 Interpret your answer to QUESTION 12.2. (2)
- 12.4 How many minutes after the journey has started will the rate of change of height with respect to time be a minimum? (3)
- [10]

QUESTION 12

12.1 A and B are independent events. It is further given that:

$$P(A \text{ and } B) = 0,3 \text{ and } P(\text{only } B) = 0,2$$

12.1.1 Are A and B mutually exclusive? Motivate your answer. (1)

12.1.2 Determine:

(a) $P(\text{only } A)$ (4)

(b) $P(\text{not } A \text{ or not } B)$ (2)

12.2 A teacher has 5 different poetry books, 4 different dramas and 3 different novels. She must arrange these 12 books from left to right on a shelf.

12.2.1 Write down the probability that a novel will be the first book placed on the shelf. (1)

12.2.2 Calculate the number of different ways these 12 books can be placed on the shelf if any book can be placed in any position. (2)

12.2.3 Calculate the probability that a poetry book is placed in the first position, the three novels are placed next to each other and a drama is placed in the last position. (4)
[14]

KWV 02**QUESTION 1**1.1 Solve for x :

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

1.1.2 $x - 6 + \frac{2}{x} = 0$; $x \neq 0$. (Leave your answer correct to TWO decimal places.) (4)

1.1.3 $x^{\frac{2}{3}} = 4$ (2)

1.1.4 $3^x(x-5) < 0$ (2)

1.2 Solve for x and y simultaneously:

$y = x^2 - x - 6$ and $2x - y = 2$ (6)

1.3 Simplify, without the use of a calculator:

$\sqrt{3} \cdot \sqrt{48} - \frac{4^{x+1}}{2^{2x}}$ (3)

1.4 Given: $f(x) = 3(x-1)^2 + 5$ and $g(x) = 3$ 1.4.1 Is it possible for $f(x) = g(x)$? Give a reason for your answer. (2)1.4.2 Determine the value(s) of k for which $f(x) = g(x) + k$ has TWO unequal real roots. (2)
[23]**Solve for x**

1.1.4 $2^{2x} - 6 \cdot 2^x = 16$

1.3 The roots of a quadratic equation are given by $x = \frac{-5 \pm \sqrt{20+8k}}{6}$, where $k \in \{-3; -2; -1; 0; 1; 2; 3\}$.1.3.1 Write down TWO values of k for which the roots will be rational. (2)1.3.2 Write down ONE value of k for which the roots will be non-real. (1)

1.1.3 $2x^{\frac{-5}{3}} = 64$ (4)

1.1.4 $\sqrt{2-x} = x-2$ (4)

1.1.5 $x^2 + 7x < 0$ (3)

1.2 Given: $(3x-y)^2 + (x-5)^2 = 0$ Solve for x and y . (4)1.3 For which value of k will the equation $x^2 + x = k$ have no real roots? (4)

1.2 Simplify fully:

$$\frac{\sqrt{16x^7} - \sqrt{25x^7}}{\sqrt{x}} \quad (3)$$

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - x - 20 = 0$ (3)

1.1.2 $3x^2 - 2x - 6 = 0$ (correct to TWO decimal places) (4)

1.1.3 $(x-1)^2 > 9$ (4)

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

1.2 Solve simultaneously for x and y :

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

1.3 If it is given that $2^x \times 3^y = 24^6$, determine the numerical value of $x - y$. (4)
[24]

QUESTION 2

2.1 Consider the quadratic sequence: 72 ; 100 ; 120 ; 132 ; ...

2.1.1 Determine T_n , the n^{th} term of the quadratic sequence. (4)

2.1.2 A term in the quadratic sequence 72 ; 100 ; 120 ; 132 ; ... is equal to the twelfth term of the sequence of first-differences. Determine the position of this term in the quadratic sequence. (5)

2.1.3 Determine the maximum value of the quadratic sequence. (3)

2.1.4 Determine the maximum value of the sequence:
 $-23 ; 5 ; 25 ; 37 ; \dots$ (1)

2.2 Consider the sequence: $-11 ; 2 \sin 3x ; 15 ; \dots$
Determine the values of x in the interval $[0^\circ; 90^\circ]$ for which the sequence will be arithmetic. (4)
[17]

QUESTION 2

Given the arithmetic series: $-7 - 3 + 1 + \dots + 173$

2.1 How many terms are there in the series? (3)

2.2 Calculate the sum of the series. (3)

2.3 Write the series in sigma notation. (3)
[9]

QUESTION 3

3.1 If $r = \frac{1}{5}$ and $a = 2\,000$, determine:

3.1.1 T_n , the general term of the series (1)

3.1.2 T_7 (1)

3.1.3 Which term of the series will have a value of $\frac{16}{15\,625}$ (3)

3.2 Consider the geometric series where $\sum_{n=1}^{\infty} T_n = 27$ and $S_3 = 26$.

Calculate the value of the constant ratio (r) of the series. (4)
[9]

QUESTION 2

Given the finite arithmetic sequence: $5 ; 1 ; -3 ; \dots ; -83 ; -87$

2.1 Write down the fourth term (T_4) of the sequence. (1)

2.2 Calculate the number of terms in the sequence. (3)

2.3 Calculate the sum of all the negative numbers in the sequence. (3)

2.4 Consider the sequence: $5 ; 1 ; -3 ; \dots ; -83 ; -87 ; \dots ; -4\,187$
Determine the number of terms in this sequence that will be exactly divisible by 5. (4)
[11]

QUESTION 4

4.1 Consider the function $f(x) = 3 \cdot 2^x - 6$.

4.1.1 Calculate the coordinates of the y-intercept of the graph of f . (1)

4.1.2 Calculate the coordinates of the x-intercept of the graph of f . (2)

4.1.3 Sketch the graph of f in your ANSWER BOOK.

Clearly show ALL asymptotes and intercepts with the axes. (3)

4.1.4 Write down the range of f . (1)

QUESTION 4

The lines $y = x + 1$ and $y = -x - 7$ are the axes of symmetry of the function $f(x) = \frac{-2}{x+p} + q$.

- 4.1 Show that $p = 4$ and $q = -3$. (4)
- 4.2 Calculate the x -intercept of f . (2)
- 4.3 Sketch the graph of f . Clearly label ALL intercepts with the axes and the asymptotes. (4)
- [10]**

QUESTION 6

The graph of a hyperbola with equation $y = f(x)$ has the following properties:

- Domain: $x \in \mathbf{R}, x \neq 5$
- Range: $y \in \mathbf{R}, y \neq 1$
- Passes through the point $(2; 0)$

Determine $f(x)$. [4]

- 4.2 The graph of an increasing exponential function with equation $f(x) = a.b^x + q$ has the following properties:

- Range: $y > -3$
- The points $(0; -2)$ and $(1; -1)$ lie on the graph of f .

4.2.1 Determine the equation that defines f . (4)

4.2.2 Describe the transformation from $f(x)$ to $h(x) = 2.2^x + 1$. (2)

QUESTION 4

Given: $f(x) = -2x^2 - 5x + 3$

- 4.1 Write down the coordinates of the y -intercept of f . (1)
- 4.2 Determine the coordinates of the x -intercepts of f . (3)
- 4.3 Determine the coordinates of the turning point of f . (3)
- 4.4 Sketch the graph of $y = f(x)$, clearly showing the coordinates of the turning points and the three intercepts with the axes. (3)
- [10]**

QUESTION 6

Given: $f(x) = -x + 3$ and $g(x) = \log_2 x$

- 6.1 On the same set of axes, sketch the graphs of f and g , clearly showing ALL intercepts with the axes. (4)
- 6.2 Write down the equation of $g^{-1}(x)$, the inverse of g , in the form $y = \dots$ (2)
- 6.3 Explain how you will use QUESTION 6.1 and/or QUESTION 6.2 to solve the equation $\log_2(3-x) = x$. (3)
- 6.4 Write down the solution to $\log_2(3-x) = x$. (1)

[10]

QUESTION 4

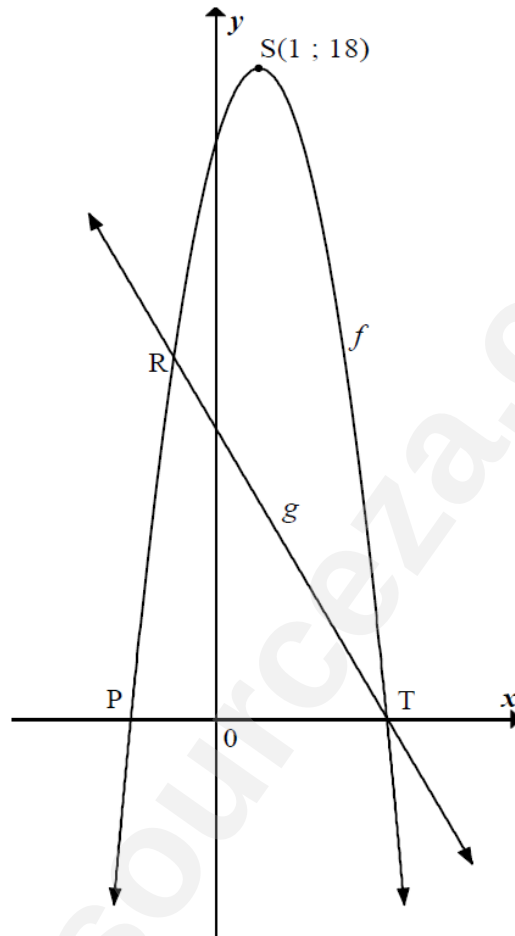
Given: $f(x) = -ax^2 + bx + 6$

- 4.1 The gradient of the tangent to the graph of f at the point $\left(-1; \frac{7}{2}\right)$ is 3.
Show that $a = \frac{1}{2}$ and $b = 2$. (5)
- 4.2 Calculate the x -intercepts of f . (3)
- 4.3 Calculate the coordinates of the turning point of f . (3)
- 4.4 Sketch the graph of f . Clearly indicate ALL intercepts with the axes and the turning point. (4)
- 4.5 Use the graph to determine the values of x for which $f(x) > 6$. (3)
- 4.6 Sketch the graph of $g(x) = -x - 1$ on the same set of axes as f . Clearly indicate ALL intercepts with the axes. (2)
- 4.7 Write down the values of x for which $f(x) \cdot g(x) \leq 0$. (3)

[23]

QUESTION 6

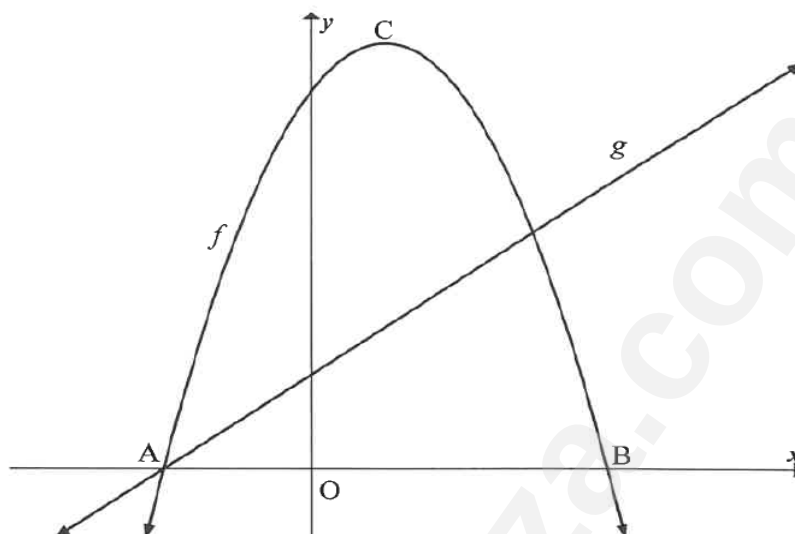
$S(1 ; 18)$ is the turning point of the graph of $f(x) = ax^2 + bx + c$. P and T are x -intercepts of f . The graph of $g(x) = -2x + 8$ has an x -intercept at T. R is a point of intersection of f and g .



- 6.1 Calculate the coordinates of T. (2)
- 6.2 Determine the equation for f in the form $f(x) = ax^2 + bx + c$. Show ALL your working. (4)
- 6.3 If $f(x) = -2x^2 + 4x + 16$, calculate the coordinates of R. (4)
- 6.4 Use your graphs to solve for x where:
- 6.4.1 $f(x) \geq g(x)$ (2)
- 6.4.2 $-2x^2 + 4x - 2 < 0$ (4)
- [16]

QUESTION 5

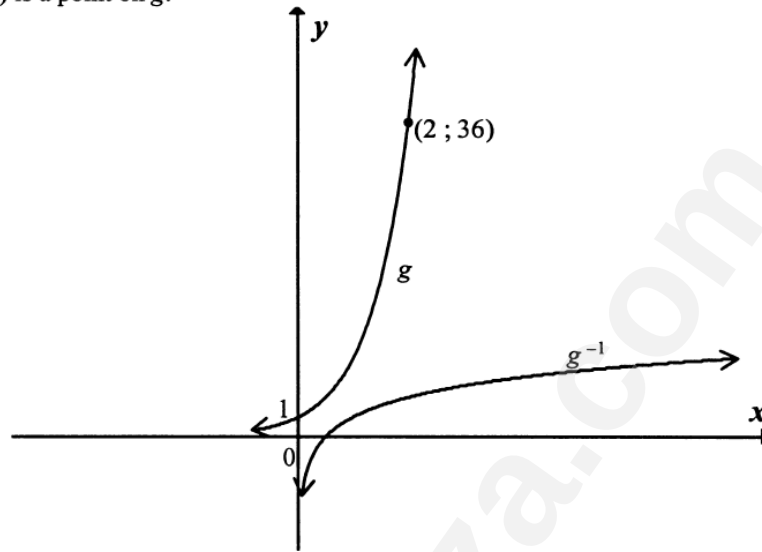
Sketched below are the graphs of $f(x) = -2x^2 + 4x + 16$ and $g(x) = 2x + 4$.
A and B are the x -intercepts of f . C is the turning point of f .



- 5.1 Calculate the coordinates of A and B. (3)
- 5.2 Determine the coordinates of C, the turning point of f . (2)
- 5.3 Write down the range of f . (1)
- 5.4 The graph of $h(x) = f(x + p) + q$ has a maximum value of 15 at $x = 2$. Determine the values of p and q . (3)
- 5.5 Determine the equation of g^{-1} , the inverse of g , in the form $y = \dots$ (2)
- 5.6 For which value(s) of x will $g^{-1}(x) \cdot g(x) = 0$? (2)
- 5.7 If $p(x) = f(x) + k$, determine the value(s) of k for which p and g will NOT intersect. (5)
- [18]

QUESTION 5

- 5.1 Sketched below are the graphs of $g(x) = k^x$, where $k > 0$ and $y = g^{-1}(x)$.
 (2 ; 36) is a point on g .



- 5.1.1 Determine the value of k . (2)
- 5.1.2 Give the equation of g^{-1} in the form $y = \dots$ (2)
- 5.1.3 For which value(s) of x is $g^{-1}(x) \leq 0$? (2)
- 5.1.4 Write down the domain of h if $h(x) = g^{-1}(x - 3)$. (1)
- 5.2 5.2.1 Sketch the graph of the inverse of $y = 1$. (2)
- 5.2.2 Is the inverse of $y = 1$ a function? Motivate your answer. (2)
- [11]

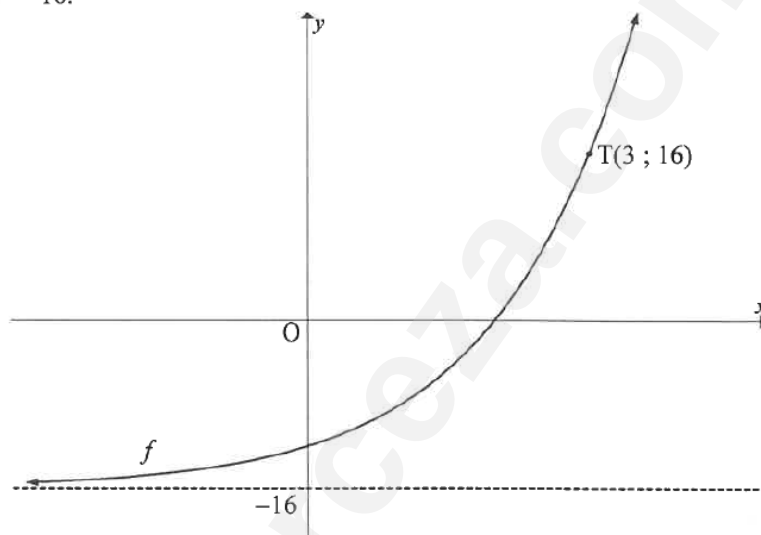
QUESTION 6

6.1 Given: $g(x) = 3^x$

6.1.1 Write down the equation of g^{-1} in the form $y = \dots$ (2)

6.1.2 Point $P(6 ; 11)$ lies on $h(x) = 3^{x-4} + 2$. The graph of h is translated to form g . Write down the coordinates of the image of P on g . (2)

6.2 Sketched is the graph of $f(x) = 2^{x+p} + q$. $T(3 ; 16)$ is a point on f and the asymptote of f is $y = -16$.



Determine the values of p and q . (4)
[8]

QUESTION 7

7.1 An amount of R10 000 was invested for 4 years, earning interest at $r\%$ p.a., compounded quarterly. At the end of the 4 years, the total amount in the account was R13 080. Determine the value of r . (4)

7.2 A businesswoman deposited R9 000 into an account at the end of January 2014. She continued to make monthly deposits of R9 000 at the end of each month up to the end of December 2018. The account earned interest at a rate of 7,5% p.a., compounded monthly.

7.2.1 Calculate how much money was in the account immediately after 60 deposits had been made. (3)

7.2.2 The businesswoman left the amount calculated in QUESTION 7.2.1 for a further n months in the account. The interest rate remained unchanged and no further payments were made. The total interest earned over the entire investment period was R190 214,14. Determine the value of n . (6)
[13]

QUESTION 7

- 7.1 Lerato wants to purchase a house that costs R850 000. She is required to pay a 12% deposit and she will borrow the balance from a bank. Calculate the amount that Lerato must borrow from the bank. (2)
- 7.2 The bank charges interest at 9% per annum, compounded monthly on the loan amount. Lerato works out that the loan will carry an effective interest rate of 9,6% per annum. Is her calculation correct or not? Justify your answer with appropriate calculations. (4)
- 7.3 Lerato takes out a loan from the bank for the balance of the purchase price and agrees to pay it back over 20 years. Her repayments start one month after her loan is granted. Determine her monthly instalment if interest is charged at 9% per annum compounded monthly. (4)
- 7.4 Lerato can afford to repay R7 000 per month. How long will it take her to repay the loan amount if she chooses to pay R7 000 as a repayment every month? (4)
- [14]

QUESTION 7

On 1 June 2016 a bank granted Thabiso a loan of R250 000 at an interest rate of 15% p.a. compounded monthly, to buy a car. Thabiso agreed to repay the loan in monthly instalments commencing on 1 July 2016 and ending 4 years later on 1 June 2020. However, Thabiso was unable to make the first two instalments and only commenced with the monthly instalments on 1 September 2016.

- 7.1 Calculate the amount Thabiso owed the bank on 1 August 2016, a month before he paid his first monthly instalment. (2)
- 7.2 Having paid the first monthly instalment on 1 September 2016, Thabiso will still pay his last monthly instalment on 1 June 2020. Calculate his monthly instalment. (4)
- 7.3 If Thabiso paid R9 000 as his monthly instalment starting on 1 September 2016, how many months sooner will he repay the loan? (5)
- 7.4 If Thabiso paid R9 000 as a monthly instalment starting on 1 September 2016, calculate the final instalment to repay the loan. (4)
- [15]

QUESTION 7

7.1 Determine $f'(x)$ from first principles if it is given that $f(x) = 4 - 7x$. (4)

7.2 Determine $\frac{dy}{dx}$ if $y = 4x^8 + \sqrt{x^3}$ (3)

7.3 Given: $y = ax^2 + a$

Determine:

7.3.1 $\frac{dy}{dx}$ (1)

7.3.2 $\frac{dy}{da}$ (2)

7.4 The curve with equation $y = x + \frac{12}{x}$ passes through the point $A(2; b)$. Determine the equation of the line perpendicular to the tangent to the curve at A . (4)
[14]

9.3 Calculate the values of a and b if $f(x) = ax^2 + bx + 5$ has a tangent at $x = -1$ which is defined by the equation $y = -7x + 3$ (6)

QUESTION 8

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

8.2 Determine:

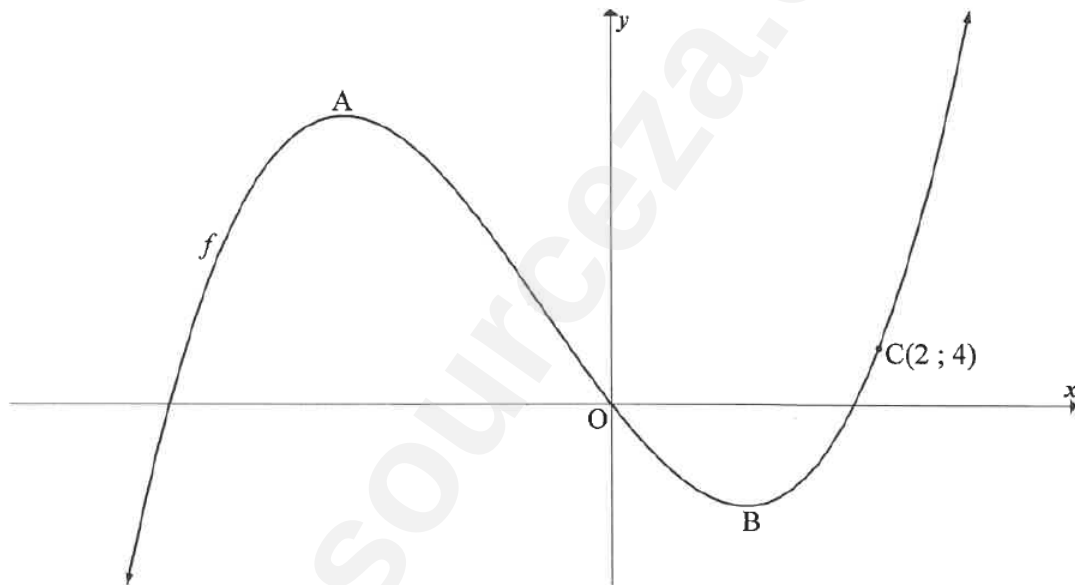
8.2.1 $f'(x)$ if $f(x) = x^2 - 3 + \frac{9}{x^2}$ (3)

8.2.2 $g'(x)$ if $g(x) = (\sqrt{x} + 3)(\sqrt{x} - 1)$ (4)
[12]

QUESTION 9

The graph of $f(x) = 2x^3 + 3x^2 - 12x$ is sketched below.

A and B are the turning points of f . C(2 ; 4) is a point on f .



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

9.2 For which values of x will f be concave up? (3)

9.3 Determine the equation of the tangent to f at C(2 ; 4). (3)
[11]

QUESTION 10

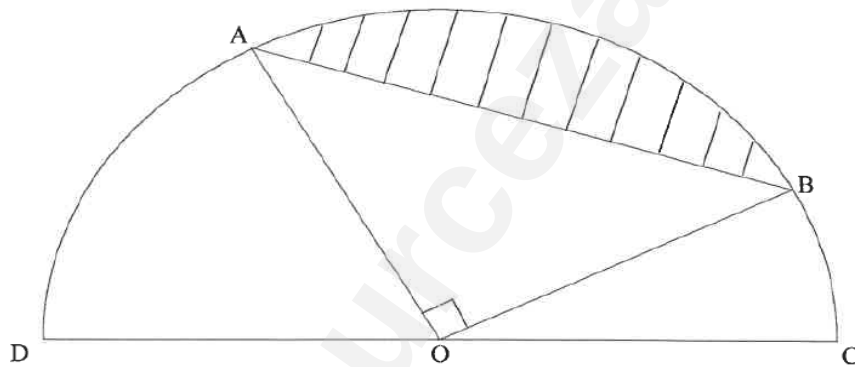
10.1 The graph of $f(x) = ax^3 + bx^2 + cx + d$ has two turning points.

The following information about f is also given:

- $f(2) = 0$
- The x -axis is a tangent to the graph of f at $x = -1$
- $f'(1) = 0$
- $f'\left(\frac{1}{2}\right) > 0$

Without calculating the equation of f , use this information to draw a sketch graph of f , only indicating the x -coordinates of the x -intercepts and turning points. (4)

10.2 O is the centre of a semicircle passing through A, B, C and D. The radius of the semicircle is $(x - x^2)$ units for $0 < x < 1$. $\triangle AOB$ is right-angled at O.



10.2.1 Show that the area of the shaded part is given by:

$$\text{Area} = \left(\frac{\pi - 2}{4}\right)(x^4 - 2x^3 + x^2) \quad (5)$$

10.2.2 Determine the value of x for which the shaded area will be a maximum. (4)
[13]

QUESTION 10

The tangent to the curve of $g(x) = 2x^3 + px^2 + qx - 7$ at $x = 1$ has the equation $y = 5x - 8$.

10.1 Show that $(1; -3)$ is the point of contact of the tangent to the graph. (1)

10.2 Hence or otherwise, calculate the values of p and q . (6)
[7]

QUESTION 11

A cubic function f has the following properties:

- $f\left(\frac{1}{2}\right) = f(3) = f(-1) = 0$
- $f'(2) = f'\left(-\frac{1}{3}\right) = 0$
- f decreases for $x \in \left[-\frac{1}{3}; 2\right]$ only

Draw a possible sketch graph of f , clearly indicating the x -coordinates of the turning points and ALL the x -intercepts. [4]

10.4 Given: $f(x) = ax^3 + bx^2 + cx + d$

Draw a possible sketch of $y = f'(x)$ if a , b and c are all NEGATIVE real numbers. (4)

QUESTION 8

After flying a short distance, an insect came to rest on a wall. Thereafter the insect started crawling on the wall. The path that the insect crawled can be described by $h(t) = (t - 6)(-2t^2 + 3t - 6)$, where h is the height (in cm) above the floor and t is the time (in minutes) since the insect started crawling.

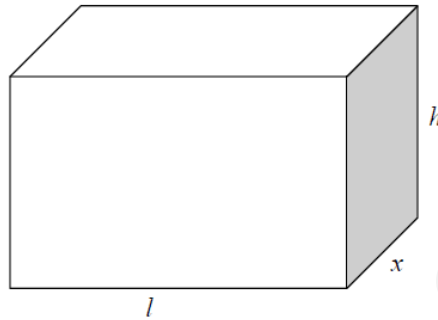
8.1 At what height above the floor did the insect start to crawl? (1)

8.2 How many times did the insect reach the floor? (3)

8.3 Determine the maximum height that the insect reached above the floor. (4)
[8]

QUESTION 11

A rectangular box is constructed in such a way that the length (l) of the base is three times as long as its width. The material used to construct the top and the bottom of the box costs R100 per square metre. The material used to construct the sides of the box costs R50 per square metre. The box must have a volume of 9 m^3 . Let the width of the box be x metres.

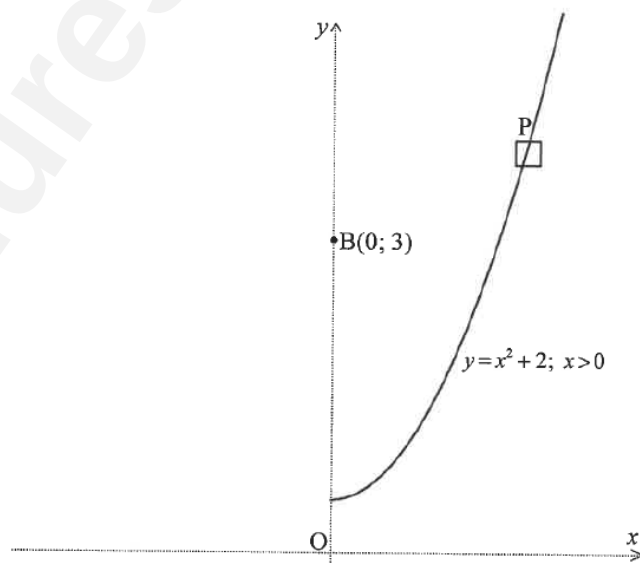


- 11.1 Determine an expression for the height (h) of the box in terms of x . (3)
- 11.2 Show that the cost to construct the box can be expressed as $C = \frac{1200}{x} + 600x^2$. (3)
- 11.3 Calculate the width of the box (that is the value of x) if the cost is to be a minimum. (4)
- [10]

QUESTION 9

An aerial view of a stretch of road is shown in the diagram below. The road can be described by the function $y = x^2 + 2$, $x \geq 0$ if the coordinate axes (dotted lines) are chosen as shown in the diagram.

Benny sits at a vantage point $B(0; 3)$ and observes a car, P, travelling along the road.



Calculate the distance between Benny and the car, when the car is closest to Benny.

[7]

QUESTION 11

11.1 Two events, A and B, are such that:

- Events A and B are independent
- $P(\text{not } A) = 0,4$
- $P(B) = 0,3$

Calculate $P(A \text{ and } B)$.

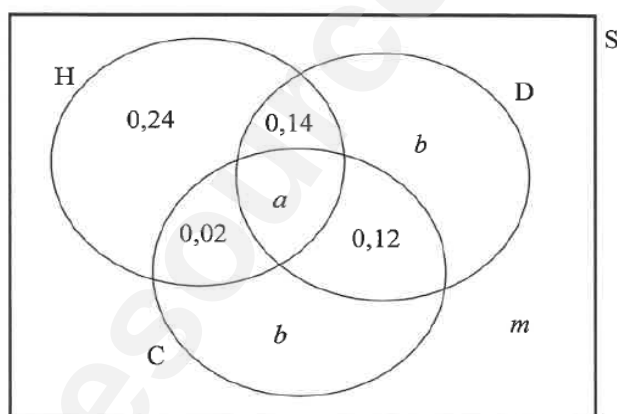
(3)

11.2 A survey was conducted among 150 learners at a school.

The following observations were made:

- The probability that a learner, selected at random, will take part in:
 - Only hockey (H) is 0,24
 - Hockey and debating (D), but not chess (C) is 0,14
 - Debating and chess, but not hockey is 0,12
 - Hockey and chess, but not debating is 0,02
- The probability that a learner, selected at random, participates in at least one activity is 0,7.
- 15 learners participated in all three activities.
- The number of learners that participate only in debating is the same as the number of learners who participate only in chess.

The Venn diagram below shows some of the above information.



11.2.1 Determine a , the probability that a learner, selected at random, participates in all three activities.

(1)

11.2.2 Determine m , the probability that a learner, selected at random, does NOT participate in any of the three activities.

(1)

11.2.3 How many learners play only chess?

(4)

11.3 A three-digit number is made up by using three randomly selected digits from 0 to 9. NO digit may be repeated.

11.3.1 Determine the total number of possible three-digit numbers, greater than 100, that can be formed.

(2)

11.3.2 Determine the total number of possible three-digit numbers, both even and greater than 600, that can be formed.

(4)

[15]

KWV 03**QUESTION 1**1.1 Solve for x :

$$1.1.1 \quad (x^2 - 9)(2x + 1) = 0 \quad (3)$$

$$1.1.2 \quad x^2 + x - 13 = 0 \quad (\text{Leave your answer correct to TWO decimal places.}) \quad (4)$$

$$1.1.3 \quad 2 \cdot 3^x = 81 - 3^x \quad (4)$$

$$1.1.4 \quad (x + 1)(4 - x) > 0 \quad (3)$$

1.2 Given: $2^x + 2^{x+2} = -5y + 20$ 1.2.1 Express 2^x in terms of y . (2)1.2.2 How many solutions for x will the equation have if $y = -4$? (2)

1.2.3 Solve for x if y is the largest possible integer value for which $2^x + 2^{x+2} = -5y + 20$ will have solutions. (3)

[21]

$$1.1.3 \quad 9 \cdot 2^{x-1} = 2 \cdot 3^x \quad (3)$$

1.2 Given: $f(x) = x^2 - 5x + c$

Determine the value of c if it is given that the solutions of $f(x) = 0$ are $\frac{5 \pm \sqrt{41}}{2}$. (3)

1.3 Solve for x and y if: $3^{x-10} = 3^{3x}$ and $y^2 + x = 20$. (5)

[18]**QUESTION 2**2.1 A geometric sequence has $T_3 = 20$ and $T_4 = 40$.

Determine:

2.1.1 The common ratio (1)

2.1.2 A formula for T_n (3)

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - 6x = 0$ (2)

1.1.2 $x^2 + 10x + 8 = 0$ (correct to TWO decimal places) (3)

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

1.1.4 $\sqrt{x+18} = x-2$ (5)

1.2 Solve simultaneously for x and y :

$x + y = 3$ and $2x^2 + 4xy - y = 15$ (6)

1.3 If n is the largest integer for which $n^{200} < 5^{300}$, determine the value of n . (3)
[22]

QUESTION 2

2.1 $7 ; x ; y ; -11 ; \dots$ is an arithmetic sequence. Determine the values of x and y . (4)2.2 Given the quadratic number pattern: $-3 ; 6 ; 27 ; 60 ; \dots$ 2.2.1 Determine the general term of the pattern in the form $T_n = an^2 + bn + c$. (4)2.2.2 Calculate the value of the 50th term of the pattern. (2)2.2.3 Show that the sum of the first n first-differences of this pattern can be given by $S_n = 6n^2 + 3n$. (3)2.2.4 How many consecutive first-differences were added to the first term of the quadratic number pattern to obtain a term in the quadratic number pattern that has a value of 21 060? (4)
[17]

QUESTION 2

- 2.1 Given the following quadratic sequence: $-2 ; 0 ; 3 ; 7 ; \dots$
- 2.1.1 Write down the value of the next term of this sequence. (1)
- 2.1.2 Determine an expression for the n^{th} term of this sequence. (5)
- 2.1.3 Which term of the sequence will be equal to 322? (4)
- 2.2 Consider an arithmetic sequence which has the second term equal to 8 and the fifth term equal to 10.
- 2.2.1 Determine the common difference of this sequence. (3)
- 2.2.2 Write down the sum of the first 50 terms of this sequence, using sigma notation. (2)
- 2.2.3 Determine the sum of the first 50 terms of this sequence. (3)
- [18]**

QUESTION 3

- 3.1 Prove that $\sum_{k=1}^{\infty} 4 \cdot 3^{2-k}$ is a convergent geometric series. Show ALL your calculations. (3)
- 3.2 If $\sum_{k=p}^{\infty} 4 \cdot 3^{2-k} = \frac{2}{9}$, determine the value of p . (5)
- [8]**

QUESTION 2

- 2.1 Given the geometric series: $256 + p + 64 - 32 + \dots$
- 2.1.1 Determine the value of p . (3)
- 2.1.2 Calculate the sum of the first 8 terms of the series. (3)
- 2.1.3 Why does the sum to infinity for this series exist? (1)
- 2.1.4 Calculate S_{∞} (3)

QUESTION 4

4.1 Given: $h(x) = \frac{-3}{x-1} + 2$

4.1.1 Write down the equations of the asymptotes of h . (2)

4.1.2 Determine the equation of the axis of symmetry of h that has a negative gradient. (2)

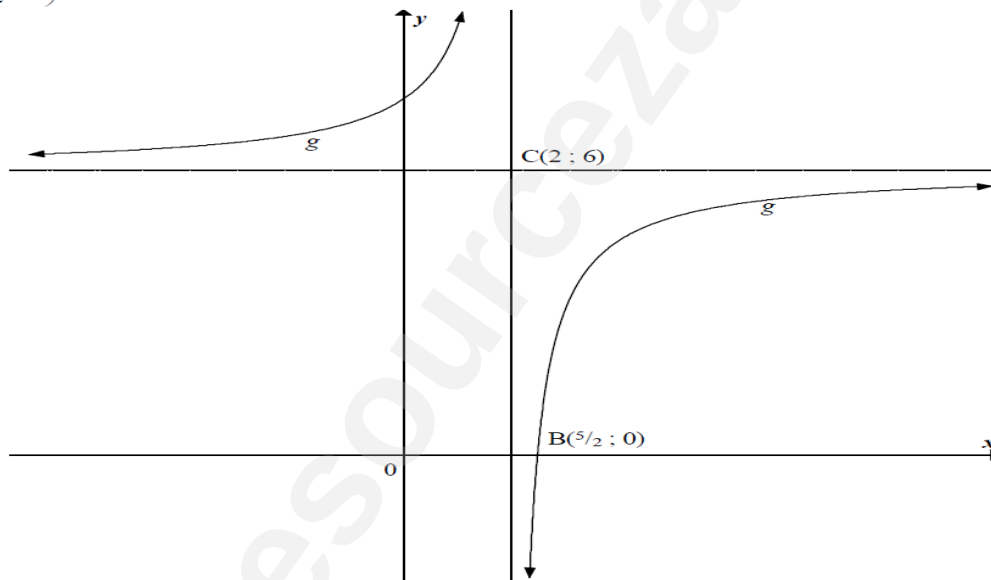
4.1.3 Sketch the graph of h , showing the asymptotes and the intercepts with the axes. (4)

QUESTION 5

Sketched below is the graph of $g(x) = \frac{a}{x-p} + q$.

$C(2; 6)$ is the point of intersection of the asymptotes of g .

$B\left(\frac{5}{2}; 0\right)$ is the x -intercept of g .



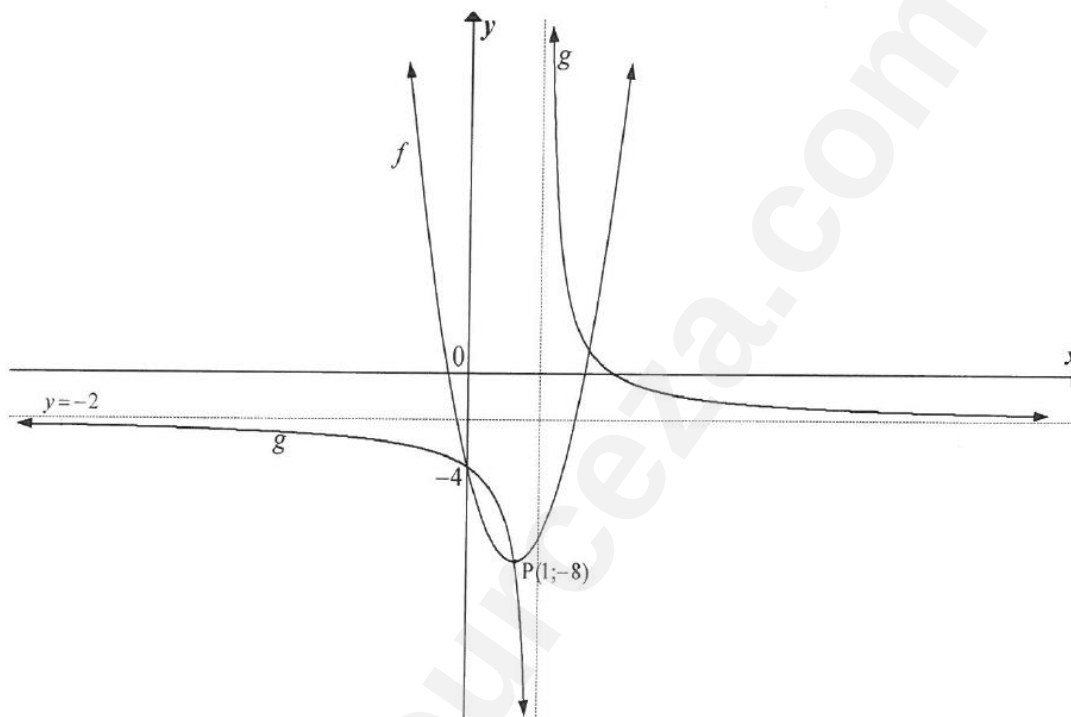
5.1 Determine the equation for g in the form $g(x) = \frac{a}{x-p} + q$. (4)

5.2 F is the reflection of B across C. Determine the coordinates of F. (2)
[6]

QUESTION 5

The graphs of the functions $f(x) = a(x + p)^2 + q$ and $g(x) = \frac{k}{x + r} + d$ are sketched below.

Both graphs cut the y -axis at -4 . One of the points of intersection of the graphs is $P(1; -8)$, which is also the turning point of f . The horizontal asymptote of g is $y = -2$.

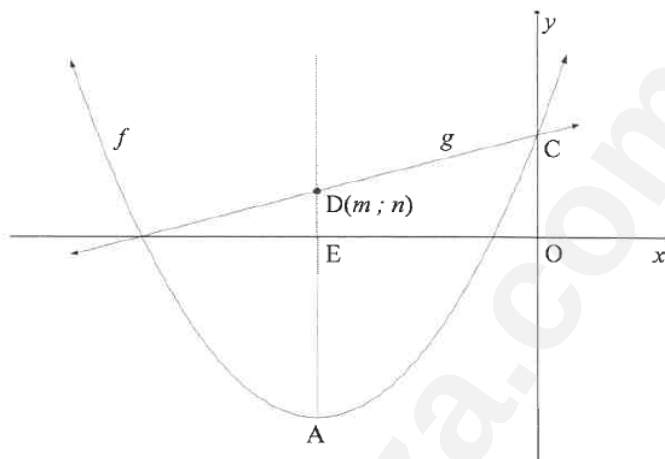


- 5.1 Calculate the values of a , p and q . (4)
- 5.2 Calculate the values of k , r and d . (6)
- 5.3 Determine the value(s) of x in the interval $x \leq 1$ for which $g(x) \geq f(x)$. (2)
- 5.4 Determine the value(s) of k for which $f(x) = k$ has two, unequal positive roots. (2)
- 5.5 Write down an equation for the axis of symmetry of g that has a negative gradient. (3)
- 5.6 The point P is reflected in the line determined in QUESTION 5.5 to give the point Q . Write down the coordinates of Q . (2)

[19]

4.2 The graphs of $f(x) = \frac{1}{2}(x+5)^2 - 8$ and $g(x) = \frac{1}{2}x + \frac{9}{2}$ are sketched below.

- A is the turning point of f .
- The axis of symmetry of f intersects the x -axis at E and the line g at $D(m; n)$.
- C is the y -intercept of f and g .



4.2.1 Write down the coordinates of A. (2)

4.2.2 Write down the range of f . (1)

4.2.3 Calculate the values of m and n . (3)

4.2.4 Calculate the area of OCDE. (3)

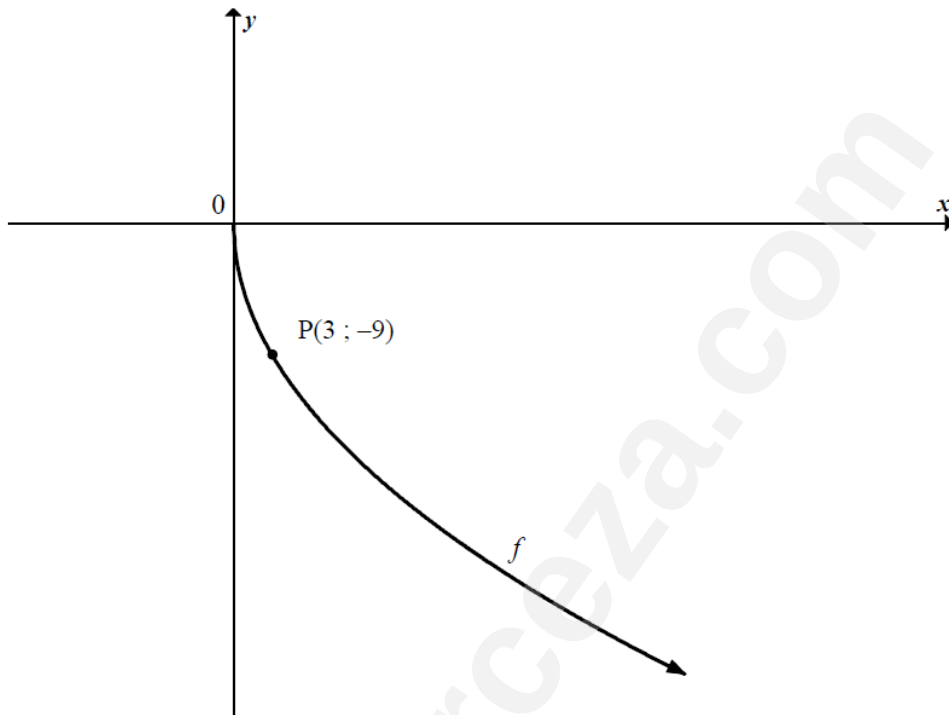
4.2.5 Determine the equation of g^{-1} , the inverse of g , in the form $y = \dots$ (2)

4.2.6 If $h(x) = g^{-1}(x) + k$ is a tangent to f , determine the coordinates of the point of contact between h and f . (4)

[23]

QUESTION 5

The graph of $f(x) = -\sqrt{27x}$ for $x \geq 0$ is sketched below.
The point $P(3; -9)$ lies on the graph of f .



- 5.1 Use your graph to determine the values of x for which $f(x) \geq -9$. (2)
- 5.2 Write down the equation of f^{-1} in the form $y = \dots$. Include ALL restrictions. (3)
- 5.3 Sketch f^{-1} , the inverse of f , in your ANSWER BOOK.
Indicate the intercept(s) with the axes and the coordinates of ONE other point. (3)
- 5.4 Describe the transformation from f to g if $g(x) = \sqrt{27x}$, where $x \geq 0$. (1)
- [9]

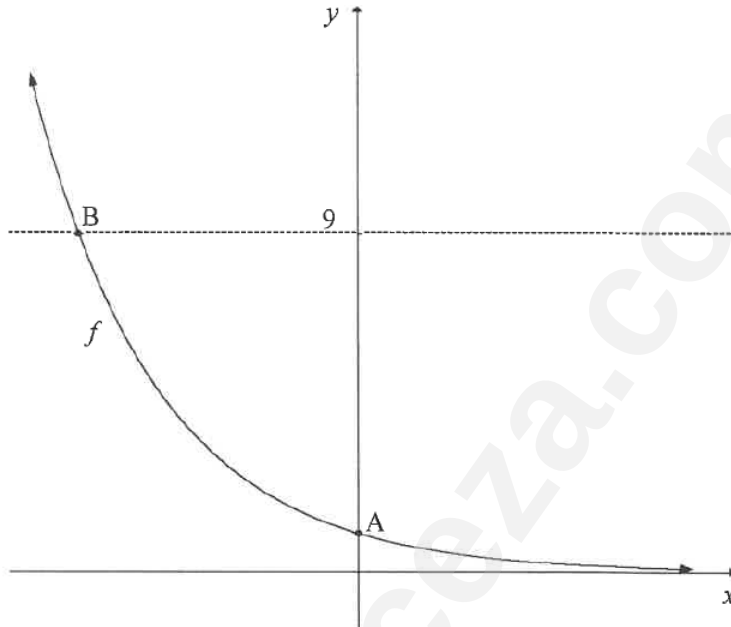
QUESTION 6

The graph of g is defined by the equation $g(x) = \sqrt{ax}$. The point $(8 ; 4)$ lies on g .

- 6.1 Calculate the value of a . (2)
- 6.2 If $g(x) > 0$, for what values of x will g be defined? (1)
- 6.3 Determine the range of g . (1)
- 6.4 Write down the equation of g^{-1} , the inverse of g , in the form $y = \dots$ (2)
- 6.5 If $h(x) = x - 4$ is drawn, determine ALGEBRAICALLY the point(s) of intersection of h and g . (4)
- 6.6 Hence, or otherwise, determine the values of x for which $g(x) > h(x)$. (2)
- [12]**

QUESTION 5

The graph of $f(x) = 3^{-x}$ is sketched below. A is the y -intercept of f .
B is the point of intersection of f and the line $y = 9$.



- 5.1 Write down the coordinates of A. (1)
- 5.2 Determine the coordinates of B. (3)
- 5.3 Write down the domain of f^{-1} . (2)
- 5.4 Describe the translation from f to $h(x) = \frac{27}{3^x}$. (3)
- 5.5 Determine the values of x for which $h(x) < 1$. (3)
- [12]**

QUESTION 6

- 6.1 On 31 January 2020, Tshepo made the first of his monthly deposits of R1 000 into a savings account. He continues to make monthly deposits of R1 000 at the end of each month up until 31 January 2032. The interest rate was fixed at 7,5% p.a., compounded monthly.
- 6.1.1 What will the investment be worth immediately after the last deposit? (4)
- 6.1.2 If he makes no further payments but leaves the money in the account, how much money will be in the account on 31 January 2033? (2)
- 6.2 Jim bought a new car for R250 000. The value of the car depreciated at a rate of 22% p.a. annually according to the reducing-balance method. After how many years will its book value be R92 537,64? (3)
- 6.3 Mpho is granted a loan under the following conditions:
- The interest rate is 11,3% p.a., compounded monthly.
 - The period of the loan is 6 years.
 - The monthly repayment on the loan is R1 500.
 - Her first repayment is made one month after the loan is granted.
- 6.3.1 Calculate the value of the loan. (3)
- 6.3.2 How much interest will Mpho pay in total over the first 5 years? (4)
- [16]**

QUESTION 9

Susan buys a car for R350 000. She secures a loan at an interest rate of 7% p.a., compounded monthly. The monthly instalment is R6 300. She pays the first instalment one month after the loan was secured.

- 9.1 Calculate the effective annual interest rate on the loan. Leave your answer correct to TWO decimal places. (3)
- 9.2 How many months will it take to repay the loan? (5)
- 9.3 Calculate the value of the final instalment. (5)
- 9.4 The value of the car depreciates at i % p.a. After 3 years its value is R252 000. Calculate i . (3)
- [16]**

QUESTION 7

Siphokazi bought a house. She paid a deposit of R102 000, which is equivalent to 12% of the selling price of the house. She obtained a loan from the bank to pay the balance of the selling price. The bank charges her interest of 9% per annum, compounded monthly.

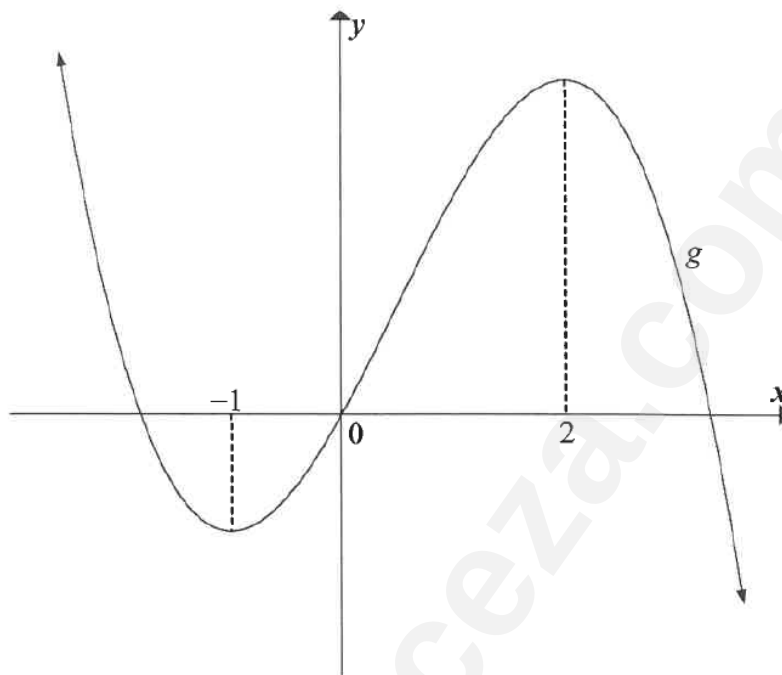
- 7.1 Determine the selling price of the house. (1)
- 7.2 The period of the loan is 20 years and she starts repaying the loan one month after it was granted. Calculate her monthly instalment. (4)
- 7.3 How much interest will she pay over the period of 20 years? Round your answer correct to the nearest rand. (2)
- 7.4 Calculate the balance of her loan immediately after her 85th instalment. (3)
- 7.5 She experienced financial difficulties after the 85th instalment and did not pay any instalments for 4 months (that is months 86 to 89). Calculate how much Siphokazi owes on her bond at the end of the 89th month. (2)
- 7.6 She decides to increase her payments to R8 500 per month from the end of the 90th month. How many months will it take to repay her bond after the new payment of R8 500 per month? (4)
- [16]**

QUESTION 7

- 7.1 Determine $f'(x)$ from first principles if $f(x) = 2x^2 - 1$. (5)
- 7.2 Determine:
- 7.2.1 $\frac{d}{dx}(\sqrt[5]{x^2 + x^3})$ (3)
- 7.2.2 $f'(x)$ if $f(x) = \frac{4x^2 - 9}{4x + 6}$; $x \neq -\frac{3}{2}$ (4)
- [12]**

QUESTION 8

The graph of $g(x) = ax^3 + bx^2 + cx$, a cubic function having a y -intercept of 0, is drawn below. The x -coordinates of the turning points of g are -1 and 2 .



- 8.1 For which values of x will g increase? (2)
- 8.2 Write down the x -coordinate of the point of inflection of g . (2)
- 8.3 For which values of x will g be concave down? (2)
- 8.4 If $g'(x) = -6x^2 + 6x + 12$, determine the equation of g . (4)
- 8.5 Determine the equation of the tangent to g that has the maximum gradient. Write your answer in the form $y = mx + c$. (5)
- [15]

QUESTION 9

A closed rectangular box has to be constructed as follows:

- Dimensions: length (l), width (w) and height (h).
- The length (l) of the base has to be 3 times its width (w).
- The volume has to be 5 m^3 .

The material for the top and the bottom parts costs R15 per square metre and the material for the sides costs R6 per square metre.

- 9.1 Show that the cost to construct the box can be calculated by: $\text{Cost} = 90w^2 + 48wh$ (4)
- 9.2 Determine the width of the box such that the cost to build the box is a minimum. (6)
- [10]

QUESTION 10

In a certain country, 10-digit telephone numbers with the following format were introduced:

Format	Area Code	Exchange Code	Number
Number of digits	3 digits	3 digits	4 digits
Example	901	544	1230

Digits may be repeated.

10.1 How many possible 10-digit telephone numbers could be formed? (2)

10.2 Certain restrictions were placed on the groups of digits:

- Area code: must be 3 digits and the first digit can NOT be 0 or 1
- Exchange code: must be 3 digits and the first and second digits can NOT be 0 or 1
- Number: must be 4 digits and the first digit MUST be a 0 or 1

10.2.1 How many valid 10-digit telephone numbers could be formed by applying the given restrictions? (3)

10.2.2 Determine the probability that any randomly chosen 10-digit telephone number would be a valid phone number. (2)
[7]

QUESTION 11

Harry shoots arrows at a target board. He has a 50% chance of hitting the bull's eye on each shot.

11.1 Calculate the probability that Harry will hit the bull's eye in his first shot and his second shot. (2)

11.2 Calculate the probability that Harry will hit the bull's eye at least twice in his first three shots. (3)

11.3 Glenda also has a 50% chance of hitting the bull's eye on each shot. Harry and Glenda will take turns to shoot an arrow and the first person to hit the bull's eye will be the winner. Calculate the probability that the person who shoots first will be the winner of the challenge. (3)
[8]

QUESTION 3

The probability that it will rain on a given day is 63%. A child has a 12% chance of falling in dry weather and is three times as likely to fall in wet weather.

- 3.1 Draw a tree diagram to represent all outcomes of the above information. (6)
- 3.2 What is the probability that a child will not fall on any given day? (3)
- 3.3 What is the probability that a child will fall in dry weather? (2)
- [11]**

QUESTION 5

In a survey 1 530 skydivers were asked if they had broken a limb. The results of the survey were as follows:

	Broken a limb	Not broken a limb	TOTAL
Male	463	b	782
Female	a	c	d
TOTAL	913	617	1 530

- 5.1 Calculate the values of a , b , c and d . (4)
- 5.2 Calculate the probability of choosing at random in the survey, a female skydiver who has not broken a limb. (2)
- 5.3 Is being a female skydiver and having broken a limb independent? Use calculations, correct to TWO decimal places, to motivate your answer. (4)
- [10]**

QUESTION 7

Consider the digits 1, 2, 3, 4, 5, 6, 7 and 8 and answer the following questions:

- 7.1 How many 2-digit numbers can be formed if repetition is allowed? (2)
- 7.2 How many 4-digit numbers can be formed if repetition is NOT allowed? (3)
- 7.3 How many numbers between 4 000 and 5 000 can be formed? (3)
- [8]**

QUESTION 5

The digits 0, 1, 2, 3, 4, 5 and 6 are used to make 3 digit codes.

- 5.1 How many unique codes are possible if digits can be repeated? (2)
- 5.2 How many unique codes are possible if the digits cannot be repeated? (2)
- 5.3 In the case where digits may be repeated, how many codes are numbers that are greater than 300 and exactly divisible by 5? (3)
[7]

QUESTION 6

Complaints about a restaurant fell into three main categories: the menu (M), the food (F) and the service (S). In total 173 complaints were received in a certain month. The complaints were as follows:

- 110 complained about the menu.
- 55 complained about the food.
- 67 complained about the service.
- 20 complained about the menu and the food, but not the service.
- 11 complained about the menu and the service, but not the food.
- 16 complained about the food and the service, but not the menu.
- The number who complained about all three is unknown.

- 6.1 Draw a Venn diagram to illustrate the above information. (6)
- 6.2 Determine the number of people who complained about ALL THREE categories. (3)
- 6.3 Determine the probability that a complaint selected at random from those received, complained about AT LEAST TWO of the categories (that is. menu, food and service). (3)
[12]

QUESTION 6

A survey is conducted among 174 students. The results are shown below.

- 37 study Life Sciences
- 60 study Physical Sciences
- 111 study Mathematics
- 29 study Life Sciences and Mathematics
- 50 study Mathematics and Physical Sciences
- 13 study Physical Sciences and Life Sciences
- 45 do not study any of Life Sciences, Mathematics or Physical Sciences
- x students study Life Sciences, Mathematics and Physical Sciences

6.1 Draw a Venn diagram to represent the information above. (6)

6.2 Show that $x = 13$. (3)

6.3 If a student were selected at random, calculate the probability that he studies the following:

6.3.1 Mathematics and Physical Sciences but not Life Sciences (2)

6.3.2 Only one of Mathematics or Physical Sciences or Life Sciences (2)

[13]

QUESTION 4

The events A, B and C are such: A and B are independent, B and C are independent and A and C are mutually exclusive. Their probabilities are $P(A) = 0,3$, $P(B) = 0,4$ and $P(C) = 0,2$.

Calculate the probability of the following events occurring:

4.1 Both A and C occur. (2)

4.2 Both B and C occur. (2)

4.3 At least one of A or B occur. (4)

[8]

QUESTION 5

Consider the word: PRODUCT.

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

5.2 How many different arrangements can be made if the first letter is T and the fifth letter is C? (2)

5.3 How many different arrangements can be made if the letters R, O and D must follow each other, in any order? (3)

[7]

QUESTION 11

11.1 Events A and B are mutually exclusive. It is given that:

- $P(B) = 2P(A)$
- $P(A \text{ or } B) = 0,57$

Calculate $P(B)$. (3)

11.2 Two identical bags are filled with balls. Bag A contains 3 pink and 2 yellow balls. Bag B contains 5 pink and 4 yellow balls. It is equally likely that Bag A or Bag B is chosen. Each ball has an equal chance of being chosen from the bag. A bag is chosen at random and a ball is then chosen at random from the bag.

11.2.1 Represent the information by means of a tree diagram. Clearly indicate the probability associated with each branch of the tree diagram and write down all the outcomes. (4)

11.2.2 What is the probability that a yellow ball will be chosen from Bag A? (1)

11.2.3 What is the probability that a pink ball will be chosen? (3)
[11]

QUESTION 12

Consider the word M A T H S.

12.1 How many different 5-letter arrangements can be made using all the above letters? (2)

12.2 Determine the probability that the letters S and T will always be the first two letters of the arrangements in QUESTION 12.1. (3)
[5]

10.2 A Banana Airways aeroplane has 6 seats in each row.

10.2.1 How many possible arrangements are there for 6 people to sit in a row of 6 seats? (2)

10.2.2 Xoliswa, Anees and 4 other passengers sit in a certain row on a Banana Airways flight. In how many different ways can these 6 passengers be seated if Xoliswa and Anees must sit next to each other? (2)

10.2.3 Mary and 5 other passengers are to be seated in a certain row. If seats are allocated at random, what is the probability that Mary will sit at the end of the row? (4)