Province of the
EASTERN CAPE
EDUCATION

EC CURRICULUM: FET MATHEMATICS, MATHEMATICAL LITERACY AND TECHNICAL MATHEMATICS

TECHNICAL MATHEMATICS

GRADE 12 REVISION BOOKLET 1 OF 2020
(PAPER 1 QUESTIONS MEMORANDA)

A COLLECTION OF 2017 – 2019 NSC EXAM QUESTIONS AND MEMORANDA GROUPED ACCORDING TO TOPICS

- # MATER THE BASICS FIRST!
- HARDWORK NEVER KILLS!
- PRACTICE MAKES PERFECT!

YES

YOU

CAN!

building blocks for growth

PROVINCIAL GROWTH AND DEVELOPMENT PLAN
PGDP
EASTERN CAPE
2004 - 2014
Ikamva eliqaqambileyo!

PLEASE READ:

Dear Grade 12 Technical Mathematics learner

INTRODUCTION

Your final school exam result in Technical Mathematics is extremely important. Good results in Technical Mathematics will surely open doors for you that will influence the quality of your future life. So, practice Technical Mathematics regularly, not only before tests and exams. Always tell yourself that "I Can Do TMAT!".

REQUIRED RESOURCES

- A Technical Mathematics textbook
- Workbooks/ Revision Material
- Past Examination Question Papers
- A scientific calculator, etc.

CONTENT CHECKLIST

Below is a checklist you should use to ensure that you have covered the content for Grade 12 Technical Mathematics in full:

Paper 1

Equations and inequalities

- Quadratic equations and inequalities
- Simultaneous equations
- Exponents and Surds
- Nature of Roots
- Logarithms
- Binary numbers
- Complex Numbers

Functions and graphs

- Linear, parabola; hyperbola;
- exponential and circle/ semi-circle
- finding equation when critical points are given
- horizontal and vertical translation and reflection about the *x* and *y* axis.
- interpret functions and graphs

Finance, Growth and Decay

- Simple and compound interest
- Different periods of compounding
- Analysis of different Loan options
- Nominal and effective interest rates
- Depreciation (reducing balance and straight line)

Differential Calculus and Integration

- Limits and average gradient
- First principles and differentiation rules
- Gradient at a point and tangents to curves
- Polynomials (Remainder and Factor theorems)
- Cubic functions
- Applications (maxima and minima; rate of change including Calculus of motion)
- Definite and indefinite integrals

Paper 2

Analytical Geometry

- Distance, midpoint, gradient, parallel and perpendicular lines
- Equation of a line, Co-linear points
- Angle of inclination
- Equation of a circle (centre at the origin **only!**)
- Equation of a tangent to a circle
- properties of geometric figures (triangles,
- quadrilaterals, etc.)
- Ellipse

Trigonometry

- Trigonometric definitions, Special angles
- Reduction formulae
- Identities and equations (simple Trig. equations)
- Solution of triangles and problems in 2D and 3D (sine-, cosine-, area rules)
- Trigonometric Functions and transformations

Euclidean geometry

Solving riders using properties of parallel lines, triangles and quadrilaterals

Circle geometry – apply theorems with converses in solving problems.

Ratio and proportion - apply the concept of:

- Midpoint theorem
- Proportionality
- Similarity

Mensuration

- Convert units, square and cubic units
- Volumes and Surface Areas of solids
- Area of irregular figures using the
- Mid-ordinate rule

Circles, Angles and Angular Movement

- Define Radian
- Convert between degrees and radians
- Central angles and arcs
- Area of Sector
- Height of segment
- Angular velocity
- Circumferential velocity

TIPS FOR SUCCESS:

Ensure that you are fully acquainted with your calculator. It will save you time in the examination. For instance, in converting radians to degrees, finance, trigonometry, etc.

Attend school every day and any extra tuition offered* to *you

Do Class and Homework every day.

Practice, Practice, Practice!

'YES YOU CAN!'

ENJOY TECHNICAL MATHEMATICS… BECAUSE YOU CAN!

ALGEBRA

2018 EXEMPLAR
QUESTION 1

1.1 Given: $f(x) = x(x+2)$

Solve for x if:

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

1.1.2 $f(x) \geq 0$ and then represent the solution on a number line. (4)

1.2 Solve for x if $5x^2 = 2 + x$ (rounded off to TWO decimal places) (4)

1.3 Solve algebraically for m and t simultaneously if:
$m - t - 1 = 0$ and $m^2 + t^2 = 5$ (6)

1.4 The two diagrams below represent a metal rod with an initial length L_1 which is then stretched (elongated) to a length L_2.

The strain measure (ε) is defined as the ratio of elongation with respect to the original length and is given by the formula:

$$\varepsilon = \frac{L_2 - L_1}{L_1}$$

1.4.1 Express L_1 as the subject of the formula. (3)

1.4.2 Hence, or otherwise, calculate the value of L_1 if $\varepsilon = 0,8$ and $L_2 = 18$ cm (2)

1.4.3 Convert the value obtained in QUESTION 1.4.2 to a binary number. (2)

1.5 Write the simplified value of $12 \times 0,00361$ in scientific notation without any rounding. (2)
[25]

QUESTION 2

2.1 Given: $A=\dfrac{\sqrt{9-3p}}{p+1}$

Determine the value(s) of p for which A will be:

2.1.1 Undefined (1)

2.1.2 Non-real (2)

2.1.3 Rational (give only ONE integer) (1)

2.2 Determine the value of k for which the equation $x^2-4x+(k-1)=0$ will have equal roots. (4)
[8]

QUESTION 3

3.1 Simplify the following without the use of a calculator (show ALL steps):

3.1.1 $\dfrac{5\times 2^{n-1}-2^n}{2^n}$ (3)

3.1.2 $\sqrt{64+16}-\sqrt{20}$ (4)

3.1.3 $\log_6 216\times\log 0{,}001$ (4)

3.2 Solve for x: $\log(x-18)-\log x=1$ (4)

3.3 Express the complex number $z=3+\sqrt{3}i$ in trigonometric (polar) form. (5)

3.4 Solve for x and y if $x+yi=(3+5i)(2-7i)$ (5)
[24]

NOV 2018

QUESTION 1

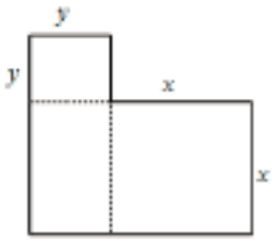
1.1 Solve for x:

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

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

1.1.3 $5x(x-3)\leq 0$ and then represent the solution on a number line (3)

1.2 The total area represented by the L-shaped diagram below is 21 units^2. The equation $y-2x=-7$ represents the relationship of the sides of the two squares.



Solve for x and y (dimensions of the two squares) if:

$y-2x=-7$ and $x^2+xy+y^2=21$ (7)

1.3 The formula below represents the moment of inertia (E), with mass (M) and length (L):

$$E=\frac{1}{12}ML^2$$

1.3.1 Make L the subject of the formula. (2)

1.3.2 Calculate the value of L, if $E=8{,}3\times 10^{-2}\,\text{kg.m}^2$ and $M=1{,}6\times 10^{3}\,\text{kg}$. (2)

1.4 Express 36 as a binary number. (2)

[23]

QUESTION 2

2.1 Given the roots: $x = \frac{-8 \pm \sqrt{q-3}}{2}$

Describe the nature of the roots if:

2.1.1 $q = 5$ (1)

2.1.2 $q = 3$ (1)

2.1.3 $q < 0$ (1)

2.2 Determine for which value(s) of p will the equation $3x^2 + 7x = 2x + p$ have non-real roots. (4)

[7]

QUESTION 3

3.1 Simplify (showing ALL calculations) the following without the use of a calculator:

3.1.1 $\left(2a^{\frac{7}{3}}\right)^3$ (2)

3.1.2 $\log_p p + \log_m 1$ (2)

3.1.3 $\frac{\sqrt{48} - \sqrt{12}}{2\sqrt{75}}$ (3)

3.2 Solve for x: $\log_2(x+62) - \log_2 x = 5$ (4)

3.3 Express the complex number $z = -\sqrt{2} + \sqrt{2}\,i$ in the polar form $z = a\,cis\,\theta$ (6)

3.4 Solve for p and q if $p + qi = (2-3i)^2$. (4)

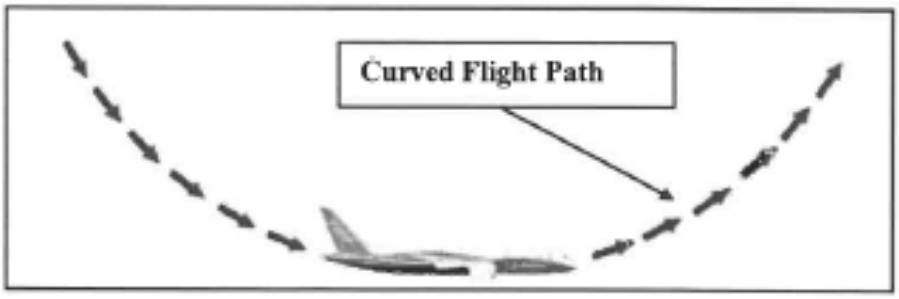
[21]

NOV 2019

QUESTION 1

1.1 The picture below shows the curved flight path of an aircraft. The flight path, as indicated by the arrows, is parabolic in shape and is defined by the equation:

$$p(x) = 2x^2 - \frac{8}{81}$$



1.1.1 Factorise $p(x)$ completely. (2)

1.1.2 Hence, solve for x if $p(x) = 0$ (1)

1.2 Solve for x in EACH of the following:

1.2.1 $(3x-5)(x+2) = -13$ where $x \in$ {Complex numbers} (5)

1.2.2 $(4-x)(x+3) < 0$ (3)

1.3 Solve for x and y if:

$$y = 3x - 8 \text{ and } x^2 - xy + y^2 = 39$$ (6)

1.4 The following formula represents the relationship between the voltage, the current and the impedance in an alternating current circuit: $V = I \times Z$

Where:

V = Voltage (in volts)
I = Current (in amperes)
Z = Impedance (in ohms)

1.4.1 Express I as the subject of the formula. (1)

1.4.2 Hence, determine in simplified form the value of I (in amperes) if:

$$V = 7i \text{ and } Z = 3 - i$$ (5)

1.5 Simplify: $101_2 \times 11_2$ (2)

[25]

QUESTION 2

2.1 Given: $G = \sqrt{\frac{p+1}{2p-1}}$

Determine the value(s) of p such that G will be as follows:

2.1.1 Undefined (1)

2.1.2 Equal to zero (1)

2.2 Determine for which value(s) of k the equation $x^2 - k + 4 = 5x$ will have real roots. (5)

[7]

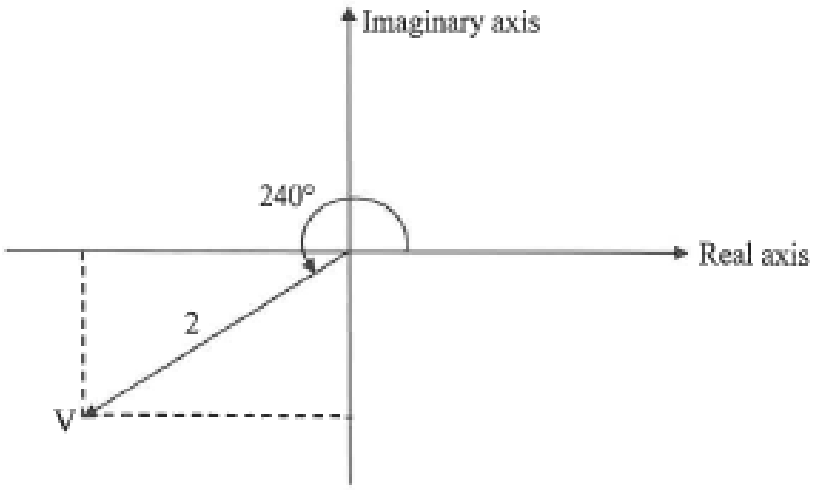
QUESTION 3

3.1 Simplify: $\left(-2\sqrt[4]{a^3}\right)^8$ (2)

3.2 Solve for x: $\log_2(3x-2) + \log_2 0{,}5 = 3$ (4)

3.3 If $\log 2 = a$ and $\log 3 = b$, determine the value of $\log\sqrt{0{,}6}$ in terms of a and b. (5)

3.4 The voltage (V) in an alternating current circuit is represented by the Argand diagram below.



3.4.1 Use the Argand diagram above to write down the voltage in the form $V = r(\cos\theta + i\sin\theta)$ (1)

3.4.2 Hence, or otherwise, express V in rectangular form. Leave your answer in simplified surd form. (3)

3.5 Determine the numerical values of m and n if $m + ni = 2(6 - 4i) - (-7i)$ (2)

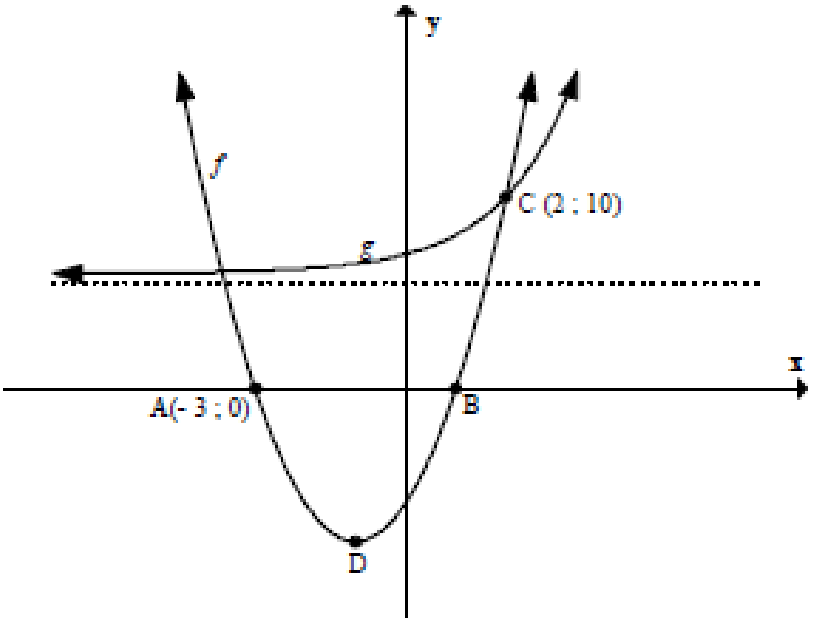
[17]

FUNCTIONS AND GRAPHS

EXEMPLAR 2018

QUESTION 4

4.1 The graphs of the functions defined by $f(x)=2x^2+4x-6$ and $g(x)=k^x+6$ are shown in the figure below. $C(2;10)$ is a point of intersection of f and g. Points $A(-3;0)$ and B are the x-intercepts and D is the turning point of f.



Determine:

4.1.1 The coordinates of B (2)

4.1.2 The coordinates of turning point D (3)

4.1.3 The numerical value of k (3)

4.1.4 The equation of the asymptote of g (1)

4.1.5 The values of x for which $f(x)\times g(x)<0$ (2)

4.2 Given: $g(x)=\sqrt{4-x^2}$ and $h(x)=\frac{3}{x}+1$

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

4.2.2 Determine the x-intercept of h. (2)

4.2.3 Write down the length of the radius of g. (1)

4.2.4 On the ANSWER SHEET provided, draw neat sketch graphs of g and h on the same set of axes. Clearly show ALL the asymptotes and the intercepts with the axes. (7)

4.2.5 Determine the range of g. (2)

[25]

NOV 2018

QUESTION 4

4.1 Given: $g(x) = 2^{-x} - 1$ and $h(x) = -\frac{6}{x} - 1$

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

4.1.2 Determine the coordinates of the x-intercept of h. (2)

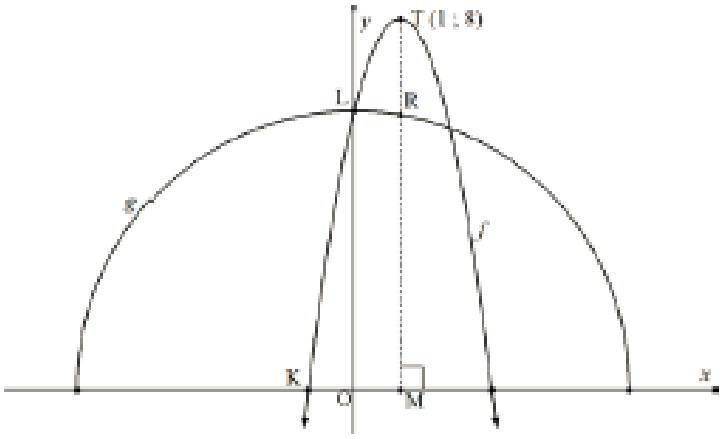
4.1.3 Sketch the graphs of g and h on the same set of axes on the ANSWER SHEET provided. Clearly show the asymptotes and the intercepts with the axes. (5)

4.1.4 Show that $(-2\,;3)$ is a point on the graph of g. (1)

4.1.5 Write down the range of g. (1)

4.1.6 Write down the domain of h. (1)

4.2 Sketched below are the graphs defined by $f(x) = a(x+p)^2 + q$ and $g(x) = \sqrt{36 - x^2}$ with $T(1\,;8)$ the turning point of f. Line TM is drawn such that TM is perpendicular to the x-axis. Points L and K are the intercepts of f. Point L is a point of intersection of f and g. Point R lies on both line TM and the graph of g.



4.2.1 Write down the coordinates of M. (1)

4.2.2 Determine the length of TR. (leave your answer in surd form). (3)

4.2.3 Show that $(0\,;6)$ are the coordinates of L. (1)

4.2.4 Hence, show that the graph of f is defined by $f(x) = -2(x+1)(x-3)$. (4)

4.2.5 Hence, give the coordinates of K. (1)

4.2.6 Determine the values of x for which $f(x) \times g(x) > 0$ and $x < 0$ (2)

[24]

NOV 2019

QUESTION 4

4.1 Given functions k and q defined by $k(x) = (x - 5)(x + 3)$ and $q(x) = \frac{12}{x} - 2$ respectively.

4.1.1 Write down the x-intercepts of k. (1)

4.1.2 Determine the x-intercept of q. (2)

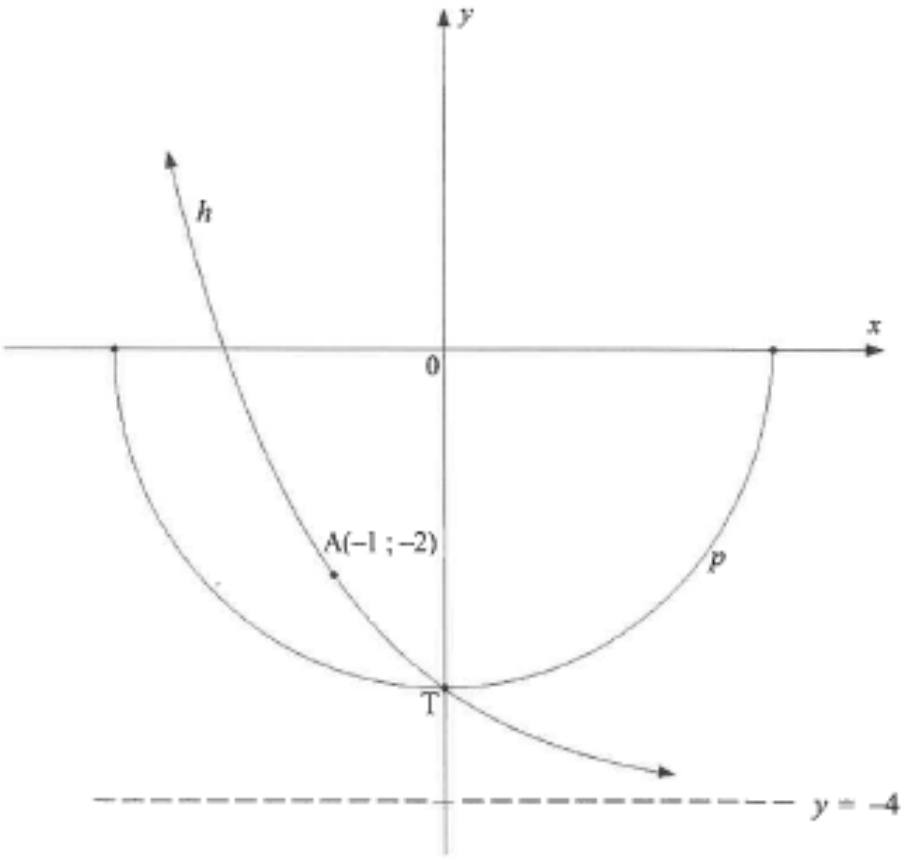
4.1.3 Determine the coordinates of the turning point of k. (3)

4.1.4 Write down the equations of the asymptotes of q. (2)

4.1.5 Sketch the graphs of k and q on the same set of axes provided on the ANSWER SHEET. Clearly show the asymptotes, the intercepts with the axes, as well as the coordinates of any turning points. (7)

4.2 Sketched below are the graphs of p and h defined by $p(x) = -\sqrt{r^2 - x^2}$ and $h(x) = a^x + d$ respectively.

T is the point of intersection of p and h.
A(–1 ; –2) is a point on h.
The asymptote of h is indicated by the dotted line.



4.2.1 Write down the numerical value of d. (1)

4.2.2 Show that $h(x) = \left(\frac{1}{2}\right)^x - 4$ (2)

4.2.3 Hence, determine the coordinates of T. (2)

4.2.4 Write down the range of p. (1)

4.2.5 Hence, determine the defining equation $w(x)$ of function w, such that w is the reflection of p in the x-axis. (2)

4.2.6 Determine for which values of x will $h(x) < p(x)$ (2)
[25]

FINANCE, GROWTH AND DECAY

EXEMPLAR 2018

QUESTION 5

5.1 The nominal interest rate charged on an investment is 7,2 % compounded half yearly. Calculate the annual effective interest rate for the investment. (3)

5.2 The air pressure of a punctured tyre deflated from 220 kPa to 70 kPa at a decreasing rate of 8% per minute. Determine (to the nearest minute) how long it took the tyre to deflate from 220 kPa to 70 kPa. (5)

5.3 Mrs Rethabile invested an amount of R150 000 to buy a drilling machine for her engineering company. Interest, compounded quarterly, is calculated at a rate of 10,5% p.a. for 5 years. At the end of the third year, Mrs Rethabile withdrew an amount of R30 000 from the investment account and then continued investing the balance for the remaining period.

Determine the value of the investment at the end of the investment period. (6)

[14]

NOV 2018

QUESTION 5

5.1 The annual effective interest rate charged by a financial institution is 6,7%. Calculate the nominal interest rate charged per annum if compounded monthly. (4)

5.2 A company bought a new 3D wheel-alignment machine for R240 000. The machine depreciated at a rate of 16% per annum to half its original value over a certain period.

5.2.1 Give the depreciated value of the machine at the end of the period. (1)

5.2.2 Determine how long it will take for the machine to depreciate to half its original value. Give your answer to the nearest year. (5)

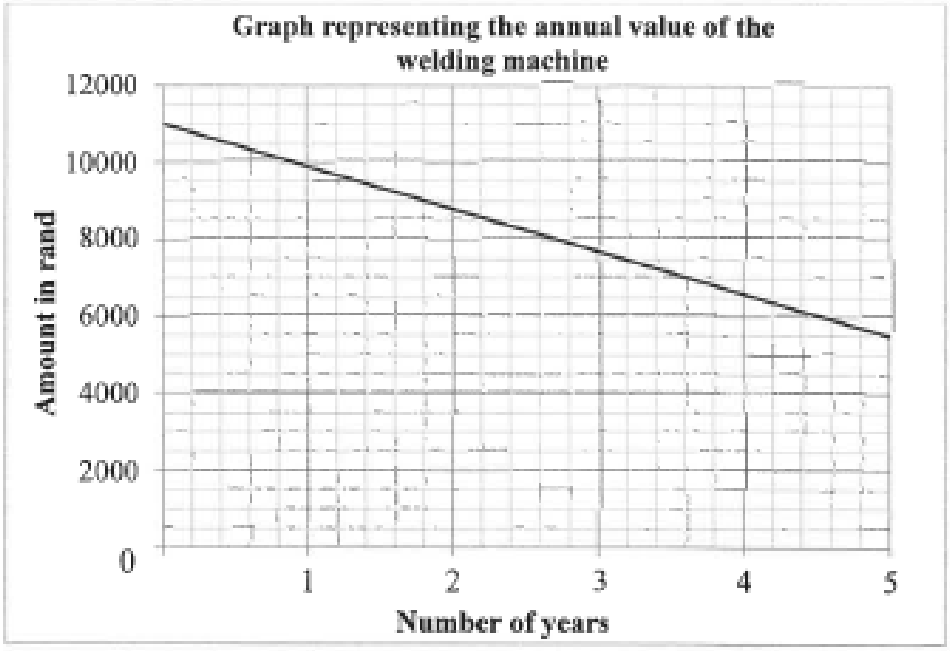
5.3 Mr Bohlale invested R40 000 at a bank for 7 years. The interest rate for the first 4 years was 11,2% per annum, compounded quarterly. The interest rate then changed to 13% per annum compounded annually for the remaining years. Calculate the total amount of money that Mr Bohlale will receive at the end of the investment period. (5)

[15]

NOV 2019

QUESTION 5

5.1 A small engineering business purchased a new welding machine. The value of the welding machine depreciated annually over a period of 5 years, as shown in the graph below.



Use the graph above to answer the following questions:

5.1.1 Write down the value of the welding machine when it was new. (1)

5.1.2 Calculate the annual constant percentage rate of depreciation. (3)

5.2 A mechanic of Model X cars found a data sheet showing that 200 Model X cars had been serviced by the workshop during 2009. The annual compound growth rate of the number of Model X cars serviced by this workshop is 3,5% per annum.

Determine, showing ALL calculations, the year during which 273 Model X cars were serviced by this workshop. (5)

5.3 Anita planned to purchase a truck for her company in 8 years' time and decided to open an investment account to provide for the purchase of the truck. She deposited an initial amount of R293 000 into the account.

At the end of 2 years, Anita made a further deposit of R95 000 into the account. The interest rate for the first 4 years was 6,7% per annum, compounded quarterly, and for the remaining period the interest rate was 7,5% per annum, compounded monthly. The projected value of the truck at the end of 8 years will be R660 580.

Determine, showing ALL calculations, whether her investment would accumulate enough funds for her to purchase the truck at the end of the 8-year investment period. (8)
[17]

DIFFERENTIAL CALCULUS

EXEMPLAR 2018

QUESTION 6

6.1 Determine the average gradient of $f(x) = 2x^2 - 3$ between the points where $x = -2$ and $x = 1$. (4)

6.2 Determine $f'(x)$ from FIRST PRINCIPLES if $f(x) = 4 - 3x$. (5)

6.3 Determine $\frac{dy}{dx}$ if $y = \frac{2}{x^3} + \sqrt{x}$ (4)

6.4 Determine the equation of the tangent to the curve defined by $g(x) = -x^2 - x$ at the point where $x = 2$. (5)

[18]

QUESTION 7

Given: $f(x) = x^3 + 2x^2 - 7x + 4$

7.1 Show that $(x - 1)$ is a factor of $f(x)$. (2)

7.2 Hence, or otherwise, find the x-intercepts of f. (3)

7.3 Determine the coordinates of the turning points of f. (5)

7.4 Sketch the graph of f on the ANSWER SHEET provided. Clearly show ALL the intercepts with the axes and the turning points. (4)

[14]

QUESTION 8

8.1 An industrial open water tank, as shown in the picture below, has an inlet pipe and an outlet pipe. The depth of the water in the tank changes continually.

The equation $D(t) = 4 + 0,5t^2 - 0,25t^3$ gives the depth (in metres) of the water, where t represents the time (in hours) that has lapsed since the depth reading was taken at 09:00.

Determine:

8.1.1 The depth of the water in the tank at 11:00 (2)

8.1.2 The rate of change of the depth of the water in the tank at 12:00 (3)

8.2 The profit (in R1000s) yielded by a company, using a machine that produces bottle caps, is dependent on the average speed at which the machine runs.

The profit (P) is calculated using the formula:

$P = -3v^2 + 30v$,

where v is the average speed (in kilometres per hour) and $v > 0$.

8.2.1 Calculate the average speed at which neither a profit, nor a loss is yielded. (3)

8.2.2 Determine at what average speed the machine should run so that the maximum profit is obtained. (3)

8.2.3 Hence, or otherwise, calculate the resulting maximum profit. (2)
[13]

NOV 2018

QUESTION 6

6.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = 7x - 2$ (5)

6.2 Determine:

6.2.1 $\frac{d}{dx}(\pi^2)$ (1)

6.2.2 $D_x\left(x^4 - \sqrt[3]{x}\right)$ (3)

6.2.3 $\frac{dy}{dx}$ if $y = \frac{x^5+2}{x^2}$ (4)

6.3 The tangent to the curve of the function defined by $p(x) = x^3 + 1$ passes through point $A(2; k)$.

6.3.1 Calculate the numerical value of k. (2)

6.3.2 Determine $p'(x)$ (1)

6.3.3 Hence, determine the equation of the tangent to the curve of the function at point A. (3)

[19]

QUESTION 7

Given: $f(x) = -x(x-3)(x-3)$

7.1 Write down the coordinates of the x-intercepts of f. (2)

7.2 Write down the y-intercept of f. (1)

7.3 Show that $f(x) = -x^3 + 6x^2 - 9x$ (2)

7.4 Determine the coordinates of the turning points of f. (5)

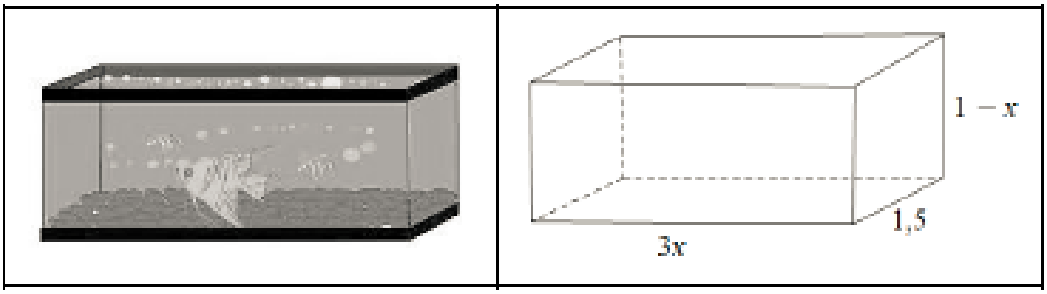
7.5 Sketch the graph of f on the ANSWER SHEET provided. Clearly show ALL the intercepts with the axes and the turning points. (4)

7.6 Determine the values of x for which the graph of f is increasing. (2)

[16]

QUESTION 8

8.1 Mr Alexander built a rectangular fish tank. The length, breadth and height of the tank are $3x$ metres, 1,5 metres and $(1-x)$ metres respectively, as shown in the diagram below.



8.1.1 Determine a formula for the volume of the tank in terms of x. (3)

8.1.2 Hence, determine the value of x that will maximise the volume of the tank. (3)

8.2 During an experiment, learners must record the velocity (v) of an electronic toy car over a distance (m), t seconds after the experiment has begun. The velocity of the electronic toy car is given by $v(t) = 8 + 4t - t^2$

Determine:

8.2.1 The initial velocity of the toy car (1)

8.2.2 The velocity of the toy car when $t = 0,2$ seconds (2)

8.2.3 The rate at which the velocity changes with respect to time when $t = 1,2$ seconds (4)

[13]

NOV 2019
QUESTION 6

6.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = 5 - \frac{1}{2}x$ (5)

6.2 Determine the following:

6.2.1 $f'(x)$ if $f(x) = a^3 - 0,5x^3 - x^{-1}$ (3)

6.2.2 $D_x\left[x\left(\sqrt{x} + 2\right)\right]$ (4)

6.3 Given: $xy + 2x^3 = 7x^6$

6.3.1 Make y the subject of the equation. (2)

6.3.2 Hence, determine $\frac{dy}{dx}$. (2)

6.4 A factory producing light bulbs makes a daily profit $P(x)$ in rands for x number of light bulbs produced. The formula to calculate the factory's daily profit is given by $P(x) = 0,8x^2 - 200x$, where $x > 0$.

Calculate:

6.4.1 The daily profit if 300 light bulbs are produced in one day (1)

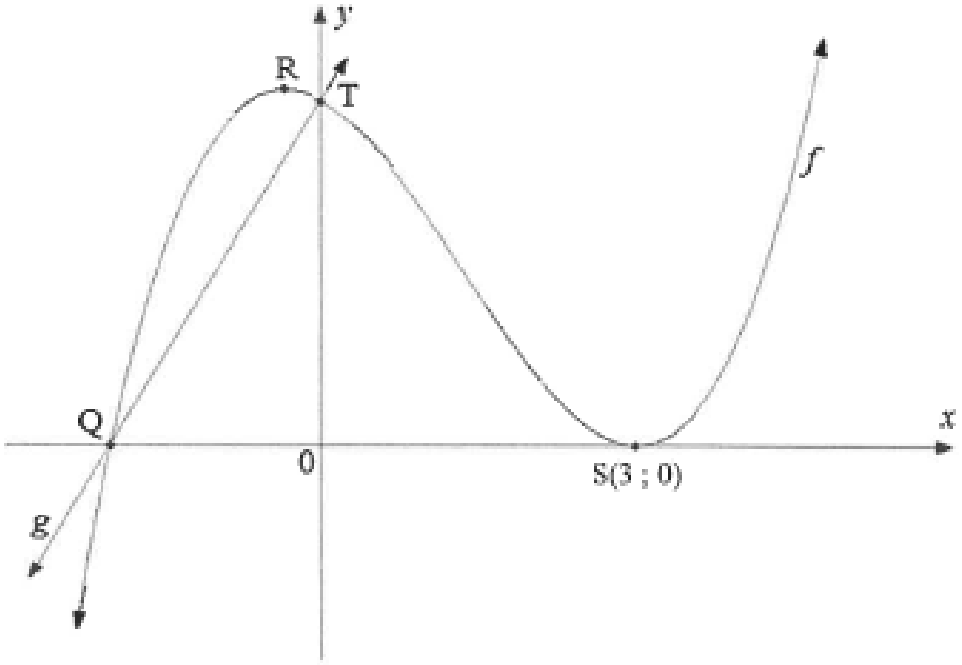
6.4.2 The number of light bulbs produced that will yield a zero daily profit (2)

6.4.3 The rate of change of the daily profit with respect to the number of light bulbs produced, if 200 light bulbs are produced (3)
[22]

QUESTION 7

The sketch below represents the graphs of functions g and f defined by $g(x) = 9x + 18$ and $f(x) = x^3 + bx^2 + cx + d$ respectively.

S(3 ; 0) and R are the turning points of f.
T is the y-intercept of both f and g.
Q is the x-intercept of both f and g.



7.1 Determine the coordinates of Q and T. (3)

7.2 Show that $b = -4$, $c = -3$ and $d = 18$. (3)

7.3 Hence, determine the coordinates of R. (5)

7.4 Determine:

7.4.1 The equation of the tangent to the curve of function f at point R (1)

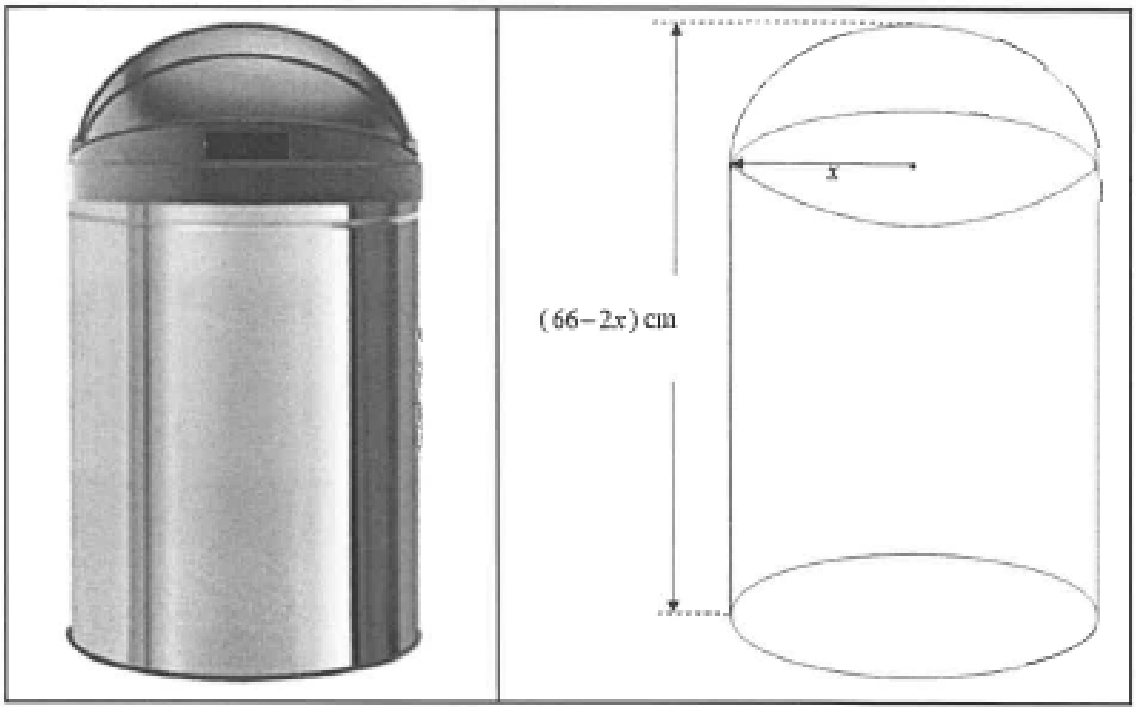
7.4.2 The values of x for which $g(x) > 0$ (1)

7.4.3 The values of x for which $f'(x) < 0$ (2)

[15]

QUESTION 8

A container consists of a right cylindrical part and a hemispherical part at the top, as shown in the picture and diagram below. The radius of both shapes is x cm and the total height of the container is $(66-2x)$ cm.



The following formulae may be used:

$$\text{Volume of a right cylinder} = \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

8.1 Write down, in terms of x, the height of the cylindrical part of the container. (1)

8.2 Show that the formula for the total volume (in cm^3) of the container is given by:

$$V = 66\pi x^2 - \frac{7}{3}\pi x^3$$ (3)

8.3 Hence, calculate the value of x that will maximise the total volume of the container. (4)

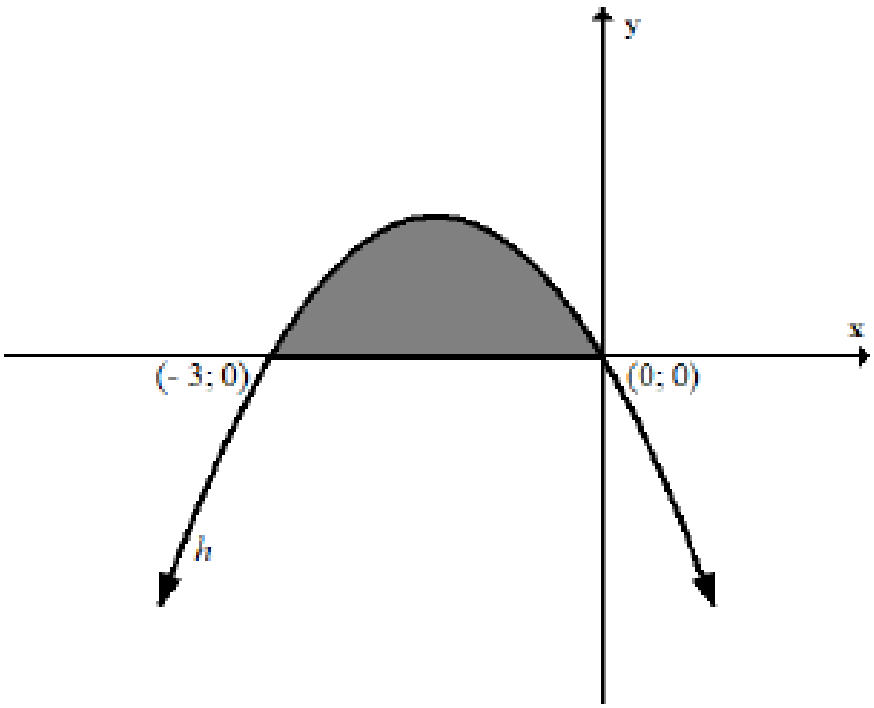
8.4 Hence, determine the maximum total volume of the container. (2)

[10]

INTEGRATION
EXEMPLAR 2018
QUESTION 9

9.1 Determine the following integral: $\int\left(x^{-4}+\frac{7}{x}-1\right)dx$ (4)

9.2 The sketch below represents the graph of the function defined by $h(x)=-2x^2-6x$.



Determine the shaded area bounded by a curve defined by $h(x)=-2x^2-6x$ and the x-axis. (5)
[9]

NOV 2018

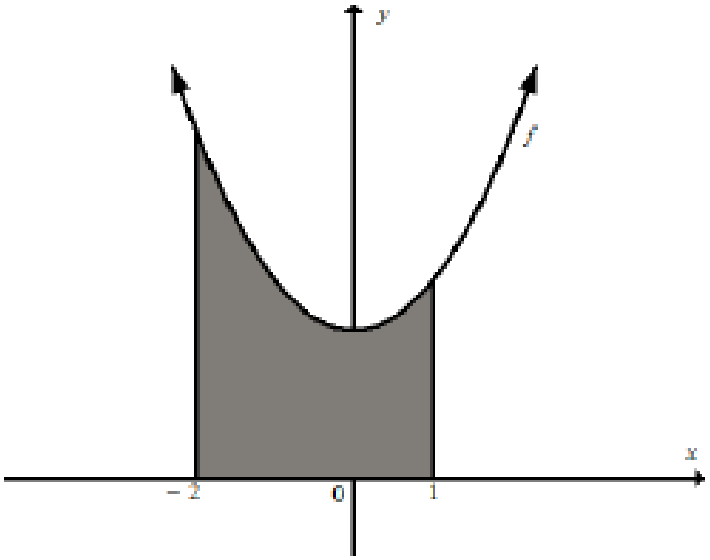
QUESTION 9

9.1 Determine the following integrals:

9.1.1 $\int\left(-\frac{6}{x}\right)dx$ (2)

9.1.2 $\int(x-1)^2\,dx$ (4)

9.2 The sketch below represents the bounded area of the curve of the function defined by $f(x) = x^2 + 3$



Determine the shaded area bounded by the curve and the x-axis between the points where $x = -2$ and $x = 1$ (6)

[12]

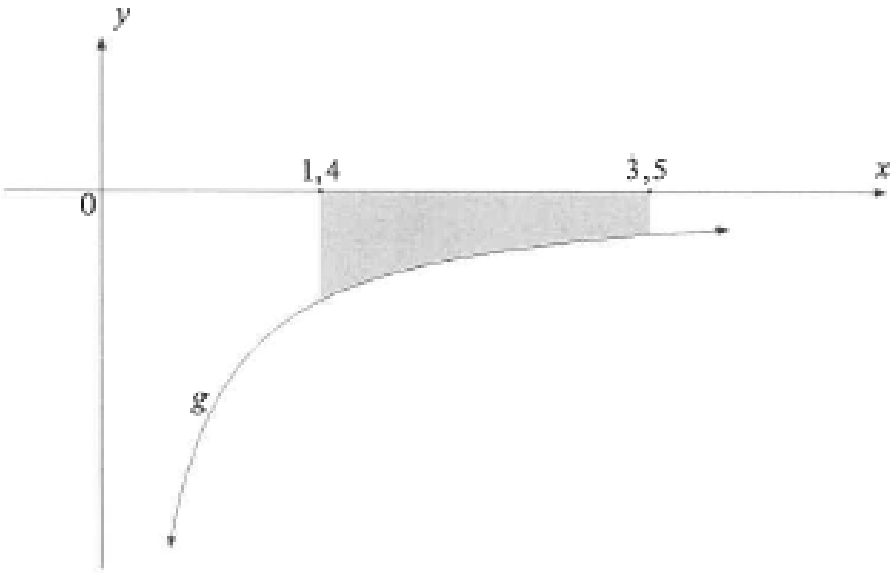
NOV 2019
QUESTION 9

9.1 Determine the following integrals:

9.1.1 $\int mx^p dx$ where $p \neq -1$ (2)

9.1.2 $\int \left(\frac{x^{-3} + x^2}{x^{-1}} - 2 \right) dx$ (4)

9.2 The sketch below shows the shaded bounded area of the curve of the function defined by $g(x) = -\frac{4}{x}$, where $x > 0$.



Determine (showing ALL calculations) the shaded area bounded by the curve and the x-axis between the points where $x = 1,4$ and $x = 3,5$. (6)
[12]

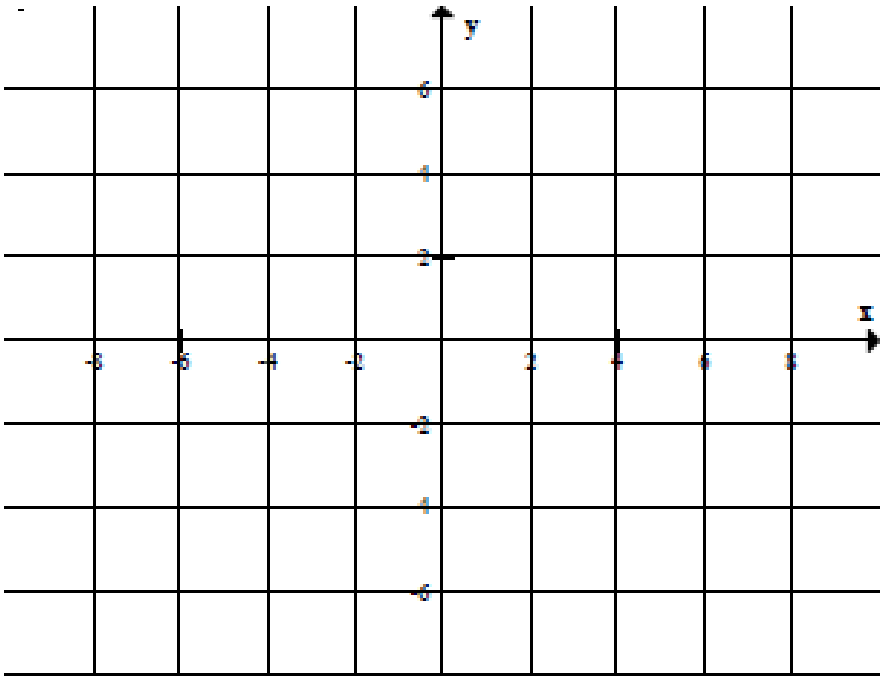
ANSWER SHEETS

EXEMPLAR 2018

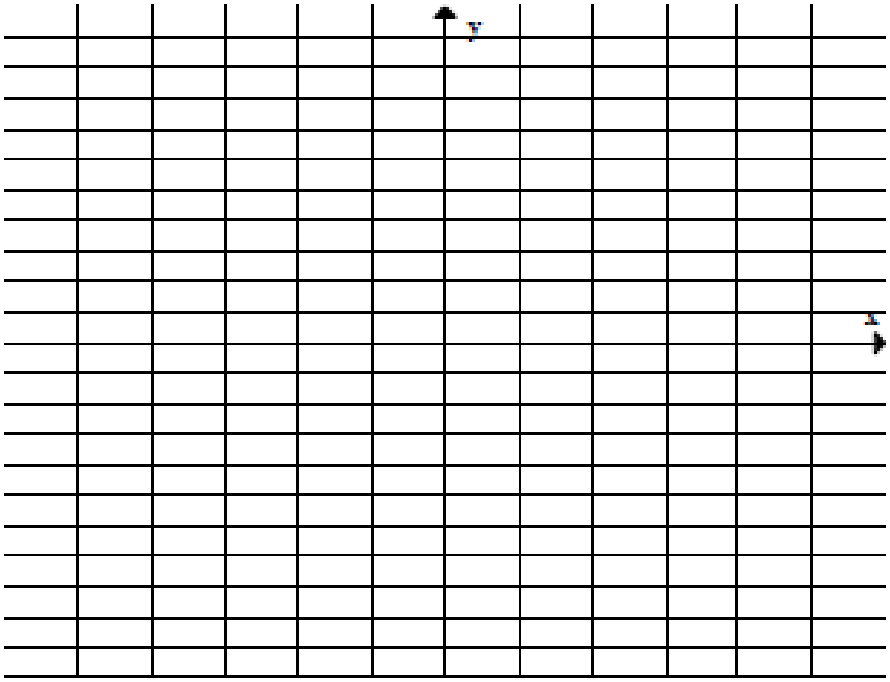
ANSWER SHEET

NAME:.....**SCHOOL:**.....

QUESTION 4.2.4



QUESTION 7.4



NOV 2018

CENTRE NUMBER								

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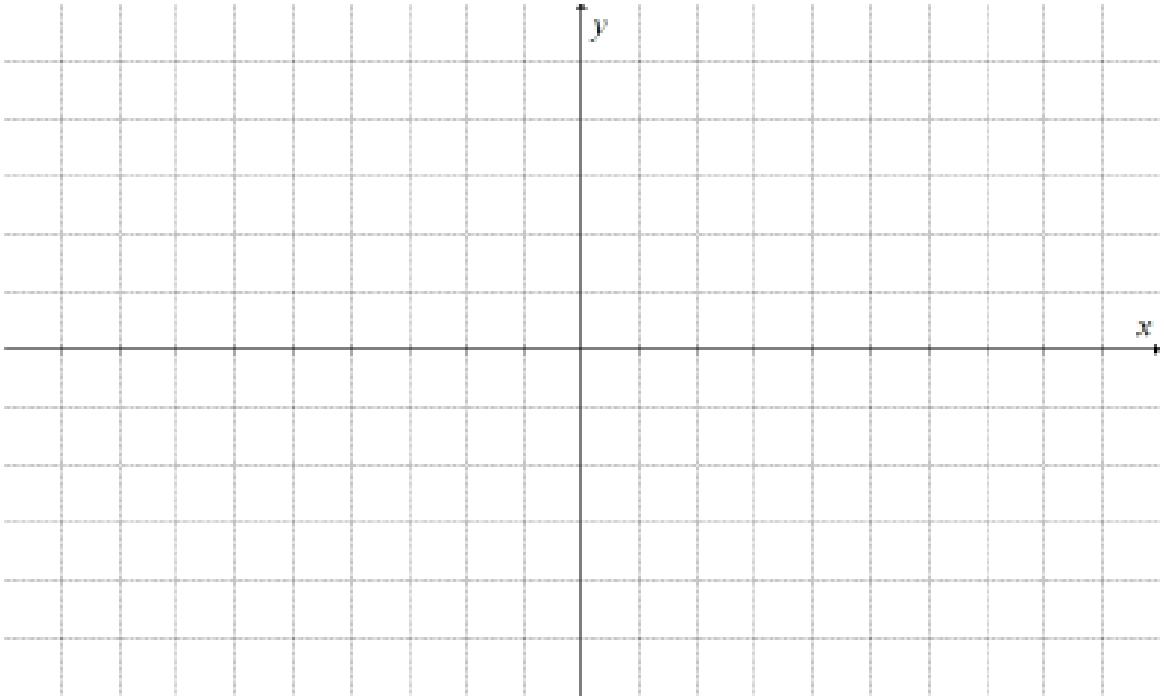
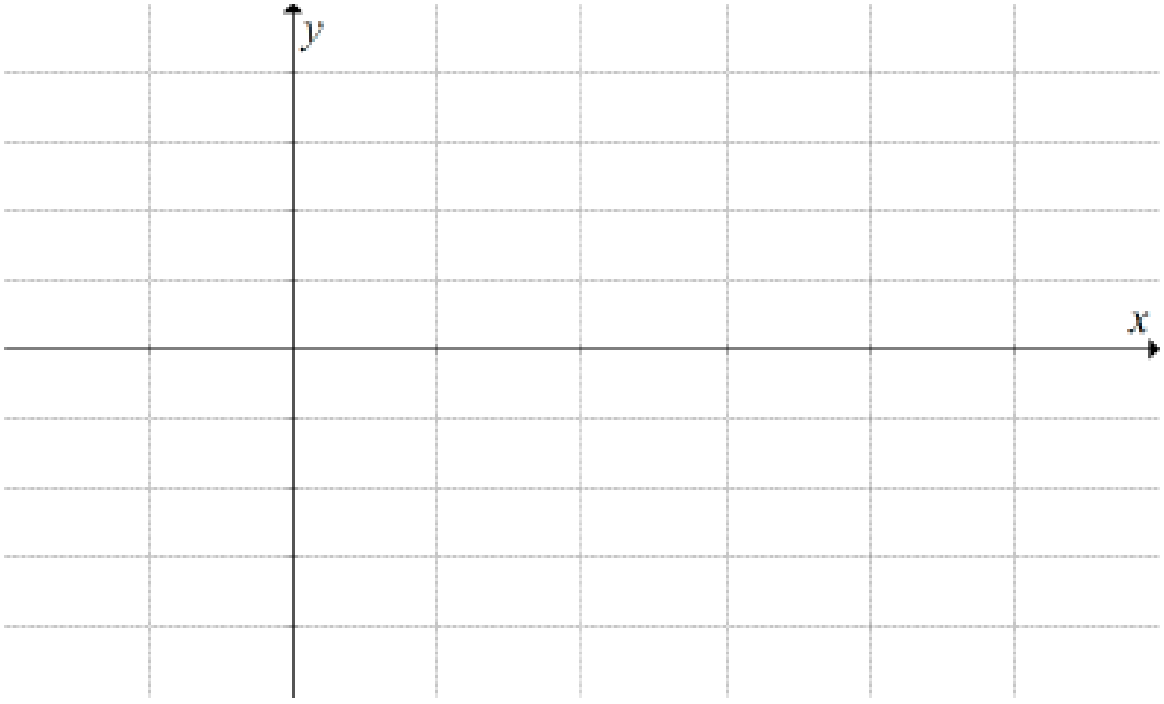
QUESTION 4.1.3



QUESTION 7.5



NOV 2019

ANSWER SHEET

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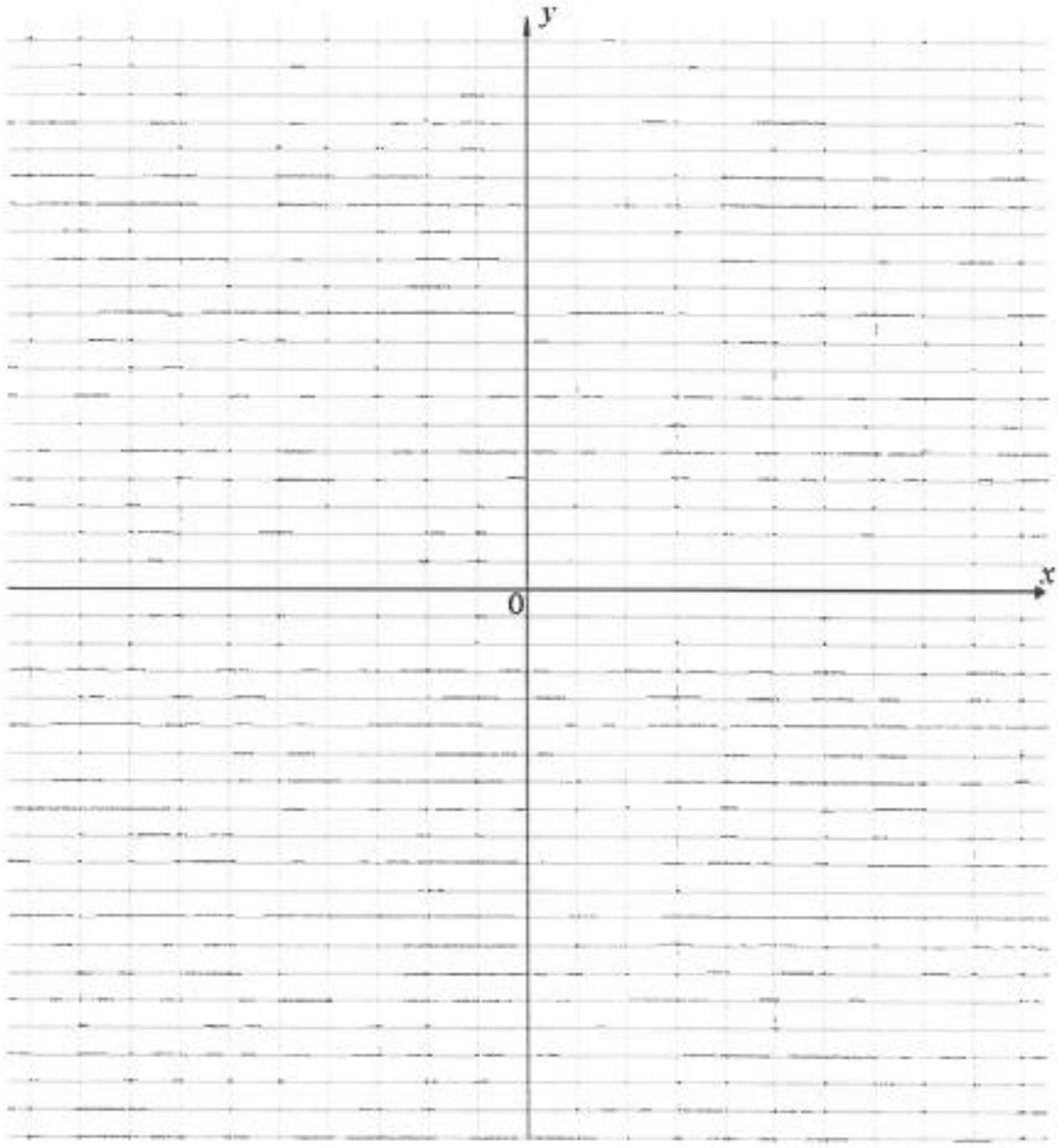
EXAMINATION NUMBER													

QUESTION 4.1.5



ANNEXURE A: INFORMATION SHEET

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$$a^x=b \Leftrightarrow x=\log_a b\ , \quad a>0\ ,\ a\neq 1 \text{ and } b>0$$

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

$$i_{eff}=\left(1+\frac{i}{m}\right)^m-1$$

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

$$\int x^n dx=\frac{x^{n+1}}{n+1}+C \quad , \quad n\neq -1$$

$$\int\frac{1}{x}dx=\ln x+C, \qquad x>0 \qquad\qquad \int a^x dx=\frac{a^x}{\ln a}+C \quad , \quad a>0$$

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

$$y=mx+c \qquad y-y_1=m(x-x_1) \qquad m=\frac{y_2-y_1}{x_2-x_1} \qquad m=\tan\theta$$

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

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

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

$$\sin^2\theta+\cos^2\theta=1 \qquad 1+\tan^2\theta=\sec^2\theta \qquad \cot^2\theta+1=\mathrm{cosec}^2\theta$$

$\pi rad = 180°$

Angular velocity $= \omega = 2\pi n = 360°n$ where n = rotation frequency

Circumferencial velocity $= v = \pi Dn$ where D = diameter and n = rotation frequency

$s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \frac{rs}{2} = \frac{r^2\theta}{2}$ where r = radius, s = arc length and θ = central angle in radians

$4h^2 - 4dh + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

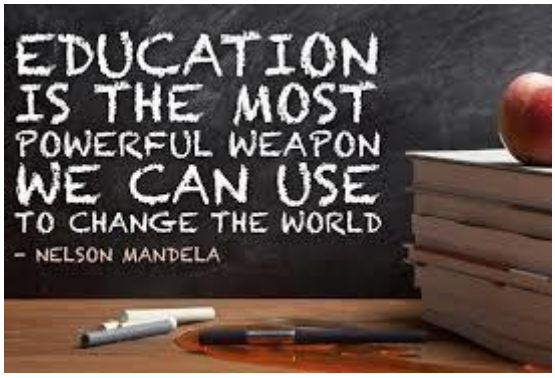
$A_T = a(m_1 + m_2 + m_3 + \ldots + m_n)$ where a = equal parts, $m_1 = \frac{o_1 + o_2}{2}$ and n = number of ordinates

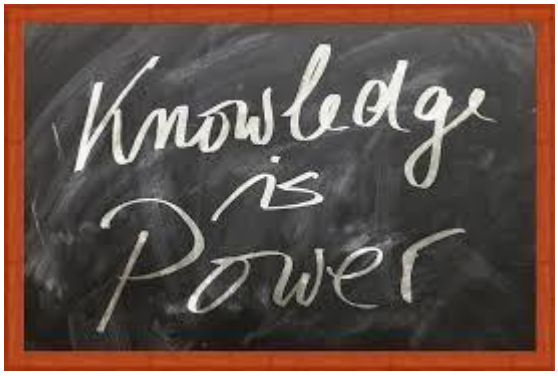
OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \ldots + o_{n-1}\right)$ where a = equal parts, $o_i = i^{th}$ ordinate and n = number of ordinates

Province of the
EASTERN CAPE
EDUCATION

EC CURRICULUM: FET MATHEMATICS, MATHEMATICAL LITERACY AND TECHNICAL MATHEMATICS





MEMORANDA GROUPED ACCORDING TO TOPICS

ALGEBRA
EXEMPLR 2018

QUESTION 1

1.1.1	$x(x+2)=0$ $\therefore x=0$ or $x=-2$	✓ $x=0$ ✓ $x=-2$ (2)
1.1.2	$x(x+2)\geq 0$ $\therefore x\leq -2$ OR $x\geq 0$  	✓ $x\leq -2$ ✓ $x\geq 0$ ✓ OR ✓Graphical representation (4)
1.2	$5x^2=2+x$ $5x^2-x-2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(5)(-2)}}{2(5)}=\frac{1\pm\sqrt{41}}{10}$ $\therefore x\approx 0{,}74$ or $x\approx -0{,}54$	✓Standard form ✓Substitution into the quadratic formula ✓ $x\approx 0{,}74$ ✓ $x\approx -0{,}54$ (4
1.3	$m-t-1=0$ $m=t+1$ $m^2+t^2=5$ $(t+1)^2+t^2=5$ $t^2+2t+1+t^2-5=0$ $2t^2+2t-4=0$ $t^2+t-2=0$ $(t+2)(t-1)=0$ $\therefore t=-2$ or $t=1$ $m=-2+1=-1$ or $m=1+1=2$ **OR** $m-t-1=0$ $t=m-1$ $m^2+t^2=9$ $m^2+(m-1)^2=5$ $m^2+m^2-2m+1-5=0$ $2m^2-2m-4=0$ $m^2-m-2=0$ $(m-2)(m+1)=0$ $\therefore m=2$ or $m=-1$ $t=2-1=1$ or $t=-1-1=-2$	✓Making m the subject ✓Substitution ✓Simplification ✓Factors ✓Both values of t ✓Both values of m **OR** ✓Making t the subject ✓Substitution ✓Simplification ✓Factors ✓Both values of m ✓Both values of t (6)

1.4.1	$s=\frac{L_2-L_1}{L_1}$ $sL_1=L_2-L_1$ $sL_1+L_1=L_2$ $L_1(s+1)=L_2$ $L_1=\frac{L_2}{(s+1)}$ OR $s=\frac{L_2}{L_1}-1$ $s+1=\frac{L_2}{L_1}$ $L_1(s+1)=L_2$ $\therefore L_1=\frac{L_2}{(s+1)}$	✓multiply with LCD ✓common factor ✓divide by factor (3)
1.4.2	$L_1=\frac{L_2}{s+1}$ $=\frac{18}{1+0{,}8}$ cm $=10$ cm	✓Substitution ✓Simplification (2)
1.4.3	$10=8+2=2^3+2$ $=1010_2$	✓ 2^3+2 ✓ 1010_2, (2)
1.5	$12\times 0{,}00361$ $=0{,}04332$ $=4{,}332\times 10^{-2}$	✓ $0{,}04332$ ✓ $4{,}332\times 10^{-2}$ [25]

QUESTION 2

2.1.1	$p=-1$	✓ $p=-1$ (1)
2.1.2	$9-3p<0$ $9<3p$ $\therefore p>3$	✓ $9-3p<0$ ✓ $p>3$ (2)
2.1.3	0 OR 3	✓0 OR 3 (1)
2.2	$x^2-4x+(k-1)=0$ For equal roots, $\Delta=b^2-4ac=0$ $(-4)^2-4(1)(k-1)=0$ $16-4k+4=0$ $-4k=-20$ $\therefore k=5$	✓For equal roots, $\Delta=0$ ✓Substitution ✓Simplification ✓Value of k (4) [8]

QUESTION 3

3.1.1	$\frac{5\times 2^{n-1}-2^n}{2^n}$ $=\frac{2^n\left(5\times 2^{-1}-1\right)}{2^n}$ $=5\times\frac{1}{2}-1=\frac{3}{2}$ OR $\frac{5\times 2^{n-1}-2^n}{2^n}$ $=\frac{5\times 2^{n-1}}{2^n}-\frac{2^n}{2^n}=5\times 2^{-1}-1$ $=2\frac{1}{2}-1=\frac{3}{2}$	✓✓Common factor ✓Simplification ✓✓Dividing each term by the denominator ✓Simplification (3)
3.1.2	$\sqrt{64+16}-\sqrt{20}$ $=\sqrt{80}-\sqrt{4\times 5}$ $=4\sqrt{5}-2\sqrt{5}$ $=2\sqrt{5}$	✓Addition ✓Simplified surd ✓Simplified surd ✓Simplification (4)
3.1.3	$\log_6 216\times\log 0{,}001$ $=\log_6 6^3\times\log\frac{1}{1000}$ $=\log_6 6^3\times\log 10^{-3}$ $=3\log_6 6\times(-3\log 10)$ $=3(1)\times(-3)(1)$ $=-9$	✓$\log_6 6^3$ ✓$\log 10^{-3}$ ✓$3\log_6 6-3\log 10$ ✓Simplification (4)
3.2.2	$\log(x+18)-\log x=1$ $\log\frac{(x+18)}{x}=1$ $\frac{(x+18)}{x}=10$ $10x=x+18$ $9x=18$ $\therefore x=2$	✓Apply log property ✓Change from log form to exp. Form ✓Simplification ✓Value of x (4)
3.3	$z=3+\sqrt{3}i$ $\lvert z\rvert=r=\sqrt{x^2+y^2}$ $=\sqrt{(3)^2+\left(\sqrt{3}\right)^2}=\sqrt{12}$ $\tan\theta=\frac{\sqrt{3}}{3}$ $\theta=30°$ $z=\sqrt{12}\,\text{cis}(30°)$ OR $z=\sqrt{12}\left[\cos 30°+i\sin 30°\right]$	✓Calculating the modulus ✓Simplification ✓$\tan\theta=\frac{\sqrt{3}}{3}$ ✓Argument ✓Correct polar form (5)
3.4	$x+yi=(3+5i)(2-7i)$ $x+yi=6-11i-35i^2$ $x+yi=6-11i-35(-1)$ $x+yi=6-11i+35$ $x+yi=41-11i$ $\therefore x=41$ and $y=-11$	✓$6-11i-35i^2$ ✓$i^2=-1$ ✓$x=41$ ✓$y=-11$ (4) [24]

NOV 2018

QUESTION/*VRAAG* 1

1.1.1	$-2x(x+a)(3-x)=0$ $x=0$ or/of $x=-a$ or/of $x=3$	✓ $x=0$ A ✓ $x=-a$ A ✓ $x=3$ A (3)
1.1.2	$2x=6-x^2$ $x^2+2x-6=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-2\pm\sqrt{2^2-4(1)(-6)}}{2(1)}$ $=\frac{-2\pm\sqrt{28}}{2}$ $\therefore x\approx 1,65$ or/of $x\approx -3,65$ **OR/OF** $2x=6-x^2$ $x^2+2x=6$ $x^2+2x+1=6+1$ $(x+1)^2=7$ $x+1=\pm\sqrt{7}$ $x=-1\pm\sqrt{7}$ $\therefore x\approx 1,65$ or/of $x\approx -3,65$	✓ standard form/ *standaardvorm* ✓ SF CA ✓ S CA ✓ both values of/ *beide waardes van* x CA **OR/OF** ✓ completing square/ *kwadraatsvoltooiing* ✓ square as subject/ *vierkant as onderwerp* CA ✓ square root/ *vierkantswortel* CA ✓ both values of/*beide waardes van* x CA **NPR** **AO**, full marks (exact values)/ *volpunte (eksakte waardes)* (4)

1.1.3	$5x(x-3)\le 0$ Critical values: 0 and 3 $\therefore 0\le x\le 3$ **OR / OF** $x\in[0;3]$ **OR/OF** $x\ge 0$ and $x\le 3$  	✓ both critical values/ *albei kritiese waardes* ✓ notation/*notasie* ✓ graphical representation/ *grafiese voorstelling* CA (3)
1.2	$y-2x=-7$ and $x^2+xy+y^2=21$ $y=2x-7$ $x^2+x(2x-7)+(2x-7)^2=21$ $x^2+2x^2-7x+4x^2-28x+49-21=0$ $7x^2-35x+28=0$ $x^2-5x+4=0$ **OR/OF** $(7x-28)(x-1)=0$ $(x-4)(x-1)=0$ $\therefore x=4$ or $x=1$ $y=2(4)-7$ or $y=2(1)-7$ $y=1$ or $y\neq -5$ $\therefore y=1$ and/en $x=4$ **OR/OF** $y-2x=-7$ $x=\frac{y+7}{2}$ $x^2+xy+y^2=21$ $\left(\frac{y+7}{2}\right)^2+y\left(\frac{y+7}{2}\right)+y^2=21$ $\frac{y^2+14y+49}{4}+\frac{y^2}{2}+\frac{7y}{2}+y^2=21$ $y^2+14y+49+2y^2+14y+4y^2=84$ $7y^2+28y-35=0$ $y^2+4y-5=0$ $(y+5)(y-1)=0$ **OR/OF** $(y+5)(7y-7)=0$ $\therefore y\neq -5$ or $y=1$ $x=1$ or/of $x=4$ $\therefore y=1$ and/en $x=4$	✓ y subject of formula/ *onderwerp van formule* ✓ SF CA ✓ S CA ✓ factors/*faktore* CA ✓ x-values/-*waardes* CA ✓ y-values/-*waardes* CA ✓ $y=1$ and/en $x=4$ CA **OR/OF** ✓ x subject of formula/ *onderwerp van formule* ✓ substitution/ *vervanging* CA ✓ correct standard form/ *korrekte standaardvorm* CA ✓ factors/*faktore* CA ✓ y-value/-*waarde* CA ✓ x-values/-*waardes* CA ✓ $y=1$ and/en $x=4$ CA If not squaring y or x after substitution, then a maximum of 6 marks, *Indien geen kwadrering van* y *of* x *na vervanging , dan 'n maksimum van 6 punte* (7)

1.3.1	$E = \frac{1}{12}ML^2$ $L^2 = \frac{12E}{M}$ $\therefore L = \sqrt{\frac{12E}{M}}$ OR / OF $2\sqrt{\frac{3E}{M}}$ OR / OF $\sqrt{\frac{E}{\frac{1}{12}M}}$	✓ L^2 subject/*onderwerp* ✓ L subject/ *onderwerp* **CA** (2) **AO**, full marks /*volpunte*
1.3.2	$L = \sqrt{\frac{12E}{M}}$ $= \sqrt{\frac{12\left(8,3\times10^{-2}\right)}{1,6\times10^{3}}}$ $\therefore L \approx 0,02$ m **OR/OF** $L = 2\sqrt{\frac{3E}{M}}$ $= 2\sqrt{\frac{3(8,3\times10^{-2})}{1,6\times10^{3}}}$ $\therefore L \approx 0,02$ m **OR/OF** $E = \frac{1}{12}ML^2$ $8,3\times10^{-2} = \frac{1}{12}(1,6\times10^{3})L^2$ $L = \sqrt{\frac{12(8,3\times10^{-2})}{1,6\times10^{3}}}$ $\therefore L \approx 0,02$ m	**CA from Question 1.3.1/ *van Vraag* 1.3.1** ✓ **SF CA** ✓ value of/*waarde van L* **CA** **OR/OF** ✓ **SF CA** ✓ value of/*waarde van L* **CA** **OR/OF** ✓ **SF CA** ✓ value of/*waarde van L* **CA** (2) **NPU** **NPR** **(Accept scientific notation/*Aanvaar wetenskaplike notasie*)**
1.4	$36 = 32 + 4$ $= 100100_2$	✓ $32+4$ **A** ✓ 100100_2 **A** **AO**: Full marks/ *Volpunte* (2) [23]

QUESTION/*VRAAG* 2

2.1	$x = \frac{-8 \pm \sqrt{q-3}}{2}$	
2.1.1	Irrational / *Irrasionaal*	✓ irrational / *irrasionaal* (Accept: real and unequal/ *Aanvaar:reeel en ongelyk*) (1)
2.1.2	Equal / *gelyk*	✓ equal (Accept: real OR rational/ *Aanvaar: reel OF rasionaal*) (1)
2.1.3	Non-real *Nie-reël*	✓ non-real/*nie-reël* (accept imaginary/ *aanvaar imaginer*) (1)
2.2	$3x^2 + 7x = 2x + p$ $3x^2 + 5x - p = 0$ $\Delta = b^2 - 4ac < 0$ $(5)^2 - 4(3)(-p) < 0$ $25 + 12p < 0$ $p < -\frac{25}{12}$	✓standard form/ *standaardvorm* ✓ **SF *in* Δ CA** ✓ correct inequality/ *korrekte ongelykheid* (<0) **A** ✓values of/*waardes van p* **CA** (4) [7]

QUESTION/*VRAAG* 3

3.1.1	$\left(2a^{\frac{7}{3}}\right)^3 - 2^3 \times \left(a^{\frac{7}{3}}\right)^3$ $= 8a^7$ **OR/OF** $\left(2a^{\frac{7}{3}}\right)^3 = \left(2a^{\frac{7}{3}}\right)\left(2a^{\frac{7}{3}}\right)\left(2a^{\frac{7}{3}}\right)$ $= 8a^7$	✓ exponent property/ *eksponenteienskap* **A** ✓ **S CA** **OR/OF** ✓ exponent property/*eksponenteienskap* **A** ✓ **S CA** **AO**: Full marks / Volpunte (2)
3.1.2	$\log_p p + \log_m 1$ $= 1 + 0$ $= 1$	✓**1 A** ✓**0 A** **AO**: only one mark/ *slegs een punt* (2)
3.1.3	$\frac{\sqrt{48}-\sqrt{12}}{2\sqrt{75}}$ $= \frac{\sqrt{3\times16}-\sqrt{3\times4}}{2\sqrt{3\times25}}$ $= \frac{4\sqrt{3}-2\sqrt{3}}{2\times5\sqrt{3}}$ OR $\frac{\sqrt{3}(4-2))}{10\sqrt{3}}$ $= \frac{2\sqrt{3}}{10\sqrt{3}}$ $= \frac{1}{5}$ **OR/OF** $\frac{\sqrt{48}-\sqrt{12}}{2\sqrt{75}}$ $= \frac{\sqrt{48}}{2\sqrt{75}} - \frac{\sqrt{12}}{2\sqrt{75}}$ $= \frac{4\sqrt{3}}{10\sqrt{3}} - \frac{2\sqrt{3}}{10\sqrt{3}}$ $= \frac{2}{5} - \frac{1}{5} = \frac{1}{5}$	✓ $\frac{4\sqrt{3}-2\sqrt{3}}{2.5\sqrt{3}}$ **M** ✓**S CA** ✓**S CA** **OR/OF** ✓ **M** ✓ **S CA** ✓ **S CA** **AO**: Only one mark / *Slegs een punt* (3)

3.2	$\log_2(x+62) - \log_2 x = 5$ $\log_2\left(\frac{x+62}{x}\right) = 5$ $2^5 = \frac{x+62}{x}$ $32 = \frac{x+62}{x} \Rightarrow 32x = x+62$ $x = 2$ **OR/OF** $\log_2(x+62) - \log_2 x = 5$ $\log_2(x+62) = \log_2 x + \log_2 32$ $\log_2(x+62) = \log_2(32x)$ $x+62 = 32x$ $x = 2$ **OR/OF** $\log_2(x+62) - \log_2 x = 5$ $\log_2 \frac{x+62}{2^5} = \log_2 x$ $\frac{x+62}{32} = x$ $32x = x + 62$ $x = 2$ **OR/OF** $\log_2(x+62) - \log_2 x = 5$ $\frac{\log(x+62)}{\log 2} - \frac{\log x}{\log 2} = 5$ $\log(x+62) - \log x = 5\log 2$ $\log \frac{x+62}{x} = \log 2^5$ $\frac{x+62}{x} = 32 \Rightarrow x + 62 = 32x$ $x = 2$ **OR/OF** $\log_2(x+62) - \log_2 x = 5$ $\log_2(x+62) - \log_2 x - \log_2 32 = 0$ $\log_2 \frac{x+62}{x(32)} = 0$ $\frac{x+62}{x(32)} = 1$ $31x = 62 \quad \therefore x = 2$	✓log property/*log-eienskape* **M** ✓exponential form/ *eksponensiële vorm* **M** ✓**S CA** ✓value of/*waarde van x* **CA** **OR/OF** ✓log property/ *log-eienskap e* **M** ✓apply log property *pas log-eienskap toe* **M** ✓**S CA** ✓value of/*waarde van x* **CA** **OR/OF** ✓log property/ *log-eienskap* **M** ✓log property/ *log-eienskap* **M** ✓**S CA** ✓value of/*waarde van x* **CA** **OR/OF** ✓ log property/ *log-eienskap* **M** ✓ log property/*log-eienskap* **M** ✓**S CA** ✓value of/*waarde van x* **CA** **OR/OF** ✓ $\log_2 32$ **M** ✓log property / *log-eienskap* **M** ✓**S CA** ✓value of/*waarde van x* **CA** **AO**: only one mark / *slegs een punt* (4)

3.3	$z = -\sqrt{2}+\sqrt{2}\,i$ $\lvert z\rvert = r = \sqrt{x^2+y^2}$ $= \sqrt{\left(-\sqrt{2}\right)^2+\left(\sqrt{2}\right)^2} = \sqrt{4}$ $= 2$ $\theta = \tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$ OR any other trig. ratio to find θ *OF* enige ander trig verh, of θ te bepaal $= 45°$ OR/OF $\frac{\pi}{4}$ $\theta = 180° - 45° = 135°$ OR/OF $\frac{3\pi}{4}$ $\therefore z = 2cis(135°)$ OR/OF $z = 2cis\left(\frac{3\pi}{4}\right)$	✓calculating the modulus/ *berekan die modulus* **M** ✓**S** **CA** ✓ $\theta = \tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$ **M** ✓ref. angle/*verwysingshoek* **CA** ✓correct quadrant/ *korrekte kwadrant* **CA** ✓polar form/*polêre vorm* **CA** Accept/Aanvaar: $z = 2[\cos 135° + i\sin 135°]$ $z = 2\left[\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right]$ (6)
3.4	$p+qi = (2-3i)^2$ $= 4 - 12i + 9i^2$ $= 4 - 12i + 9(-1)$ $= -5 - 12i$ $\therefore p = -5$ and/en $q = -12$	✓expansion/*uitbreiding* ✓$i^2 = -1$ **A** ✓ $p = -5$ ✓ $q = -12$ **CA** (4) [21]

NOV 2019

QUESTION/*VRAAG* 1

1.1.1	$p(x) = 2x^2 - \frac{8}{81}$ $= 2\left(x^2 - \frac{4}{81}\right)$ $= 2\left(x-\frac{2}{9}\right)\left(x+\frac{2}{9}\right)$ **OR/*OF*** $p(x) = \frac{162x^2-8}{81}$ $= \frac{2(81x^2-4)}{81}$ $= \frac{2(9x-2)(9x+2)}{81}$	✓common factor/*gemene faktor* **A** ✓ both factors/*beide faktore* **CA** **OR/*OF*** ✓common factor/*gemene faktor* **A** ✓ both factors/*beide faktore* **CA** (2)	
1.1.2	$p(x) = 2\left(x-\frac{2}{9}\right)\left(x+\frac{2}{9}\right) = 0$ $\therefore x = \frac{2}{9}$ or/*of* $x = -\frac{2}{9}$ **OR/*OF*** $\therefore x = \pm\frac{2}{9}$ **OR/OF** $x \approx \pm 0{,}22$ **OR/OF** $x = \frac{-(0) \pm \sqrt{(0)^2 - 4(2)\left(-\frac{8}{81}\right)}}{2(2)}$ $\therefore x = \frac{2}{9}$ or/*of* $x = -\frac{2}{9}$ **OR/*OF*** $\therefore x = \pm\frac{2}{9}$ OR/OF $x \approx \pm 0{,}22$	✓ both values of/*beide waardes van* x **CA** **OR/OF** ✓ both values of/*beide waardes van* x **CA** (1)	

1.2.1	$(3x-5)(x+2)=-13$ $3x^2+x-10+13=0$ $3x^2+x+3=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(1)\pm\sqrt{(1)^2-4(3)(3)}}{2(3)}$ $x=\frac{-1\pm\sqrt{-35}}{6}$ $x=\frac{-1\pm\sqrt{35}\,i}{6}$ OR/*OF* $x\approx\frac{-1\pm5{,}92i}{6}$ OR/*OF* $x=-\frac{1}{6}+\frac{\sqrt{35}}{6}i$ or/*of* $-\frac{1}{6}-\frac{\sqrt{35}}{6}i$ OR/*OF* $x\approx-0{,}17+0{,}99i$ or/*of* $x\approx-0{,}17-0{,}99i$ OR/*OF* $x=-\frac{1}{6}\pm\frac{\sqrt{35}}{6}i$ OR/*OF* $x\approx-0{,}17\pm0{,}99i$	✓ standard form/*standaard vorm* A ✓ SF CA ✓S CA ✓ $\sqrt{-35}=\sqrt{35}\,i$ CA ✓ both x-values/*beide x-waardes* CA (5)	
1.2.2	$(4-x)(x+3)<0$ OR/*OF* $(x-4)(x+3)>0$ CV: $x=-3$ and $x=4$ $x<-3$ or/*of* $x>4$ OR/*OF* $x\in(-\infty;-3)\cup(4;\infty)$ Accept Number Line/ *Aanvaar getallelyn*  	✓ both critical values/ *beide kritiese waardes* A ✓✓correct notation for each interval/*korrekte notasie vir elke interval* CA (3)	

1.3	$y=3x-8$ $x^2-xy+y^2=39$ $x^2-x(3x-8)+(3x-8)^2=39$ $x^2-3x^2+8x+9x^2-48x+64-39=0$ $7x^2-40x+25=0$ $(x-5)(7x-5)=0$ OR/*OF* $x=\frac{-(-40)\pm\sqrt{(40)^2-4(7)(25)}}{2(7)}$ $\therefore x=5$ or/*of* $x=\frac{5}{7}$ OR / OF 0,71 $y=3(5)-8=7$ or/*of* $y=3\left(\frac{5}{7}\right)-8=-\frac{41}{7}$ OR / *OF* $y\approx-5{,}86$ OR/*OF* $y=3x-8$ $x^2-xy+y^2=39$ $x=\frac{y+8}{3}$ $x^2-xy+y^2=39$ $\left(\frac{y+8}{3}\right)^2-y\left(\frac{y+8}{3}\right)+y^2=39$ $\frac{y^2+16y+64}{9}-\frac{y^2}{3}-\frac{8y}{3}+y^2=39$ $y^2+16y+64-3y^2-24y+9y^2=351$ $7y^2-8y-287=0$ $(y-7)(7y+41)=0$ OR/*OF* $x=\frac{-(-40)\pm\sqrt{(40)^2-4(7)(25)}}{2(7)}$ $\therefore y=7$ or/*of* $y=-\frac{41}{7}$ OR / *OF* $y\approx-5{,}86$ $x=\frac{7+8}{3}=5$ or/*of* $x=\frac{-\frac{41}{7}+8}{3}=\frac{5}{7}$ OR / *OF* $x\approx0{,}71$	✓ substitution/*vervanging* A ✓ S CA ✓ standard form/*standaard vorm* CA ✓ factors or formula/*faktore* CA ✓both x-values/*beide x-waardes* CA ✓both y-values/*beide y-waardes* CA OR/*OF* ✓ substitution/*vervanging* A ✓ S CA ✓ standard form/*standaard vorm* CA ✓ factors/ formula/*faktore* CA ✓ both y-values/*beide y-waardes* CA ✓both x-values/*beide x-waardes* CA (6)	

1.4.1	$V = I \times Z$ $I = \frac{V}{Z}$ **OR/*OF*** $I = VZ^{-1}$	✓ dividing by/*deel deur* Z **A** **(1)**	
1.4.2	$I = \frac{V}{Z}$ $= \frac{7i}{3-i}$ $= \frac{7i}{3-i} \times \frac{3+i}{3+i}$ $= \frac{21i + 7i^2}{9 - i^2}$ $= \frac{21i + 7(-1)}{9 - (-1)}$ $= \frac{-7+21i}{10}$ **OR/*OF*** $-0,7 + 2,1i$ **OR/*OF*** $\frac{-7}{10} + \frac{21i}{10}$	✓ substitution/*vervanging* **CA** ✓ **M** multiply by/ *vermenigvuldig met* $\frac{3+i}{3+i}$ **A** ✓**S** **CA** ✓ value of/*waarde van* i^2 **A** ✓ value of current/*waarde van. stroom* **CA** **NPU** **(5)**	
1.5	$\begin{array}{r} 1\ 0\ 1_2 \\ \times\ 1\ 1_2 \\ \hline 1\ 0\ 1_2 \\ +1\ 0\ 1\ 0_2 \\ \hline 1\ 1\ 1\ 1_2 \end{array}$ **OR/*OF*** $101_2 \times 11_2 = 5 \times 3 = 15$ **OR/*OF*** 1111_2	✓ **M** **A** ✓1111_2 **A** **OR/*OF*** ✓ both/*beide* 5 and/*en* 3 **A** ✓1111_2 **OR/*OF*** 15 **A** **AO: Full marks/*Volpunte*** **(2)** **[25]**	

QUESTION/*VRAAG* 2

2.1.1	$G = \sqrt{\frac{p+1}{2p-1}}$ $2p - 1 = 0$ $\therefore p = \frac{1}{2}$	✓ $p = \frac{1}{2}$ **A** **(1)**	
2.1.2	$p + 1 = 0$ $p = -1$	✓ $p = -1$ **A** **(1)**	
2.2	$x^2 - k + 4 = 5x$ $x^2 - 5x - k + 4 = 0$ $b^2 - 4ac \geq 0$ $(-5)^2 - 4(1)(-k+4) \geq 0$ $25 + 4k - 16 \geq 0$ $4k + 9 \geq 0$ $k \geq -\frac{9}{4}$	✓standard form/ *standard vorm* **A** ✓ the discriminant/*die diskriminant* ≥ 0 **A** ✓ **SF** **A** ✓**S** **CA** ✓ values of/*waardes van k* **CA** **(5)** **[7]**	

QUESTION/*VRAAG* 3

3.1	$\left(-2\sqrt[4]{a^3}\right)^8$ $=(-2)^8\left(a^3\right)^{\frac{8}{4}}$ $=256a^6$	✓ 256 **A** ✓ a^6 **A** (2)	
3.2 #	$\log_2(3x-2)+\log_2 0,5=3$ $\log_2(3x-2)+\log_2 2^{-1}=3$ $\log_2(3x-2)-1=3$ $\log_2(3x-2)=4$ $(3x-2)=2^4$ $3x-2=16$ $x=6$ **OR/*OF*** $\log_2(3x-2)+\log_2 0,5=3$ $\log_2(0,5)(3x-2)=3$ $(0,5)(3x-2)=2^3$ $(0,5)(3x-2)=8$ $3x-2=16$ $x=6$ **OR/*OF*** $\log_2(3x-2)+\log_2 0,5=3$ $\log_2(3x-2)=3-\log_2 0,5$ $\log_2(3x-2)=3\log_2 2-\log_2 0,5$ $\log_2(3x-2)=\log_2 8-\log_2 0,5$ $\log_2(3x-2)=\log_2\left(\frac{8}{0,5}\right)$ $3x-2=16$ $x=6$ **OR/*OF***	✓ $\log_2 0,5=-1$ **A** ✓ S **CA** ✓ exponential form/*eksponent vorm* **CA** ✓correct value/*korrekte waarde* **CA** **OR/*OF*** ✓log property/*eienskap* **A** ✓exponential form/*eksponent vorm* **A** ✓ S **CA** ✓correct value/*korrekte waarde* **CA** **OR/*OF*** ✓log property/*eienskap* **A** ✓ log property/*eienskap* **A** ✓ S **CA** ✓correct value/*korrekte waarde* **CA**	

	$\log_2 0,5(3x-2)=\log_2 2^3$ $\log_2 0,5(3x-2)=\log_2 8$ $0,5(3x-2)=8$ $3x-2=16$ $x=6$ **OR/*OF*** $\log_2(3x-2)+\log_2 0,5=3$ $\log_2(3x-2)-\log_2 2=3$ $\log_2\frac{(3x-2)}{2}=3$ $\frac{(3x-2)}{2}=2^3$ $3x-2=16$ $x=6$	**OR/*OF*** ✓log property/*eienskap* **A** ✓ log property/*eienskap* **A** ✓ S **CA** ✓correct value/*korrekte waarde* **CA** **OR/*OF*** ✓log property/*eienskap* **A** ✓ log property/*eienskap* **A** ✓ S **CA** ✓correct value/*korrekte waarde* **CA** (4)	

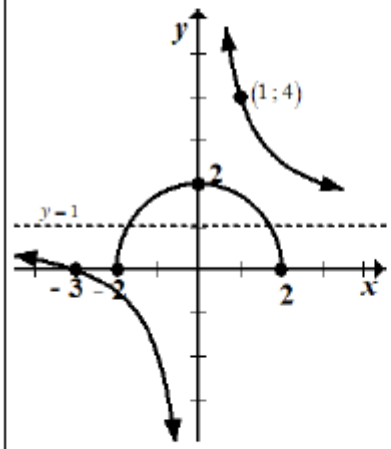
3.3	$\log\sqrt{0,6}$ $=\log(0,6)^{\frac{1}{2}}$ **OR/*OF*** $\log(0,3\times2)^{\frac{1}{2}}$ **OR/*OF*** $\log(0,2\times3)^{\frac{1}{2}}$ $=\frac{1}{2}\log\left(\frac{6}{10}\right)$ **OR/*OF*** $\frac{1}{2}\log(0,3\times2)$ **OR/*OF*** $\frac{1}{2}\log(0,2\times3)$ $=\frac{1}{2}\log\left(\frac{3\times2}{10}\right)$ $=\frac{1}{2}(\log3+\log2-\log10)$ $=\frac{1}{2}(b+a-1)$ **OR/*OF*** $\frac{1}{2}b+\frac{1}{2}a-\frac{1}{2}$ **OR/*OF*** $\log\sqrt{0,6}=\log\sqrt{\frac{3}{5}}$ $=\frac{1}{2}\log3-\frac{1}{2}\log5$ $\therefore\log\sqrt{0,6}=\frac{1}{2}\log3+\frac{1}{2}(\log2-\log10)$ $=\frac{1}{2}(b+a-1)$ **OR/*OF*** $\frac{1}{2}b+\frac{1}{2}a-\frac{1}{2}$	✓ exp. form/*eksp. vorm* **A** ✓ conversion of / *herleiding van* 0,6 **A** ✓ log property/*eienskap* **A** ✓ log10=1 **CA** ✓ substitution/*vervanging* **CA** **OR/*OF*** ✓ conversion of / *herleiding van* 0,6 **A** ✓ log property/*eienskap* **A** ✓ conversion of log 5 **A** ✓ log10=1 **CA** ✓ substitution/*vervanging* **CA** (5)	
3.4.1	$V=2(\cos240°+i\sin240°)$ **OR/*OF*** $V=2\left(\cos\frac{3}{4}\pi+i\sin\frac{3}{4}\pi\right)$	✓ value of/ *waarde van* V **A** (1)	

3.4.2	$V=2(\cos240°+i\sin240°)$ **OR/*OF*** $V=2\left(\cos\frac{3}{4}\pi+i\sin\frac{3}{4}\pi\right)$ $V=2\left(-\frac{1}{2}-\frac{\sqrt{3}}{2}i\right)$ $\therefore V=-1-\sqrt{3}i$ **OR/*OF*** $\theta=60°$ [ref angle/ *verw. hoek*] $\tan60°=\sqrt{3}=\frac{-\sqrt{3}}{-1}$ $V=-1-\sqrt{3}\,i$	**CA from/*vanaf* Q/V3.4.1** ✓ value of/*waarde van* $\cos240°$ **OR/*OF*** $\cos\frac{3}{4}\pi$ **CA** ✓ value of/*waarde van* $\sin240°$ **OR/*OF*** $\sin\frac{3}{4}\pi$ **CA** ✓ V in rect. form/ *in regh.vorm* **CA** **OR/*OF*** ✓ ref. angle/*verw. hoek* **A** ✓ tan ratio/verhouding **A** ✓ V in rect form/ *in regh.vorm* **CA** **AO: Full marks/*Volpunte*** (3)	
3.5	$m+ni=2(6-4i)-(-7i)$ $=12-8i+7i=12-i$ $m=12$ and/ *en* $n=-1$ **OR/OF** $m=2(6)=12$ and/ *en* $n=2(-4)-(-7)=-1$	✓ value of *m*/ *waarde van m* **A** ✓value of *n*/ *waarde van n* **A** **OR/OF** ✓ value of *m*/ *Waarde van m* **A** ✓value of *n*/ *Waarde van n* **A** (2) **AO: Full marks/*Volpunte*** **[17]**	

FUNCTIONS AND GRAPHS
EXEMPLAR 2018

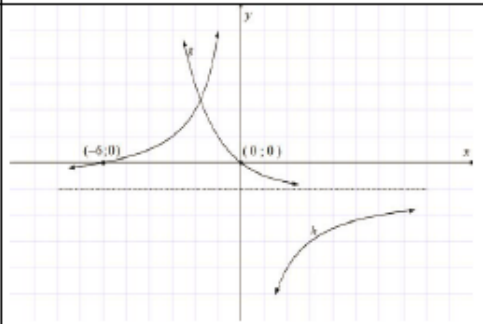
QUESTION 4

4.1.1	x–intercepts, $f(x)=0$ $2x^2+4x-6=0$ $2(x+3)(x-1)=0$ OR $(x+3)(2x-21)=0$ $\therefore x=-3$ or $x=1$ $\therefore$ B(1 ; 0)	✓Finding other factor ✓Coordinates of B. (2)
4.1.2	$f(x)=2x^2+4x-6$ $\left(\frac{-b}{2a};\frac{4ac-b^2}{4a}\right)=\left(\frac{-4}{2(2)};\frac{4(2)(-6)-(4)^2}{4(2)}\right)$ $\therefore$ D(−1 ; −8) **OR** $x=\frac{-b}{2a}=\frac{-4}{2(2)}$ $\therefore x=-1$ $f(-1)=2(-1)^2+4(-1)-6=-8$ $\therefore$ D(−1 ; −8) **OR** $x_D=\frac{-3+1}{2}=-1$ $f(-1)=2(-1)^2+4(-1)-6=-8$ $\therefore$ D(−1 ; −8) **OR** $f(x)=2x^2+4x-6$ $f'(x)=4x+4=0$ $\therefore x=-1$ $f(-1)=2(-1)^2+4(-1)-6=-8$ $\therefore$ D(−1 ; −8)	✓✓Substitution in formula ✓Coordinates of D **OR** ✓Substitution in formula ✓Substitution to find y ✓Coordinates of D **OR** ✓Using x-intercepts ✓Substitution to find y ✓Coordinates of D **OR** ✓Using the derivative ✓Substitution to find y ✓Coordinates of D (3)
4.1.3	$g(x)=k^x+q$ $10=k^2+6$ $k^2=4$ $\therefore k=2$	✓Substituting coordinates of Q ✓Simplified equation ✓Correct value of k. (3)
4.1.4	$y=6$	✓ $y=6$ (1)
4.1.5	$-3<x<1$	✓Correct critical values ✓Correct notation (2)

4.2.1	$x=0$ and $y=1$	✓ $x=0$ ✓ $y=1$ (2)
4.2.2	$h(x)=\frac{3}{x}+1$ $0=\frac{3}{x}+1$ $-1=\frac{3}{x}$ $\therefore x=-3$	✓Substituting coordinates of Q ✓Value of x (2)
4.2.3	$r=2$	✓ $r=2$ (1)
4.2.4		✓Shape of h ✓Asymptote ✓x-intercept ✓Any other point on the graph of h ✓Shape of g ✓x-intercepts of g ✓y-intercept of g (7)
4.2.5	$0\leq y\leq 2$	✓ $0\leq y$ ✓ $y\leq 2$ (2) [25]

NOV 2018

QUESTION/*VRAAG* 4

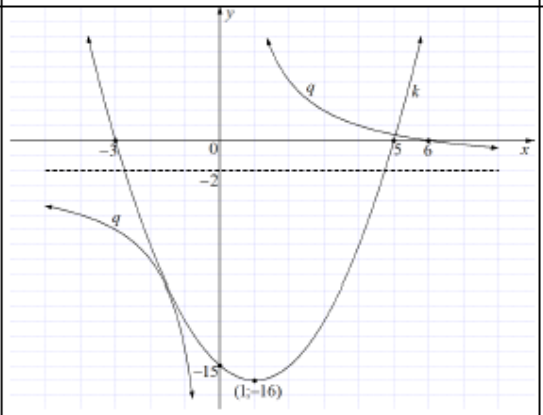
	Q4.1.2: Penalty of ONE mark if intercepts are not given as coordinates (refer also to Question 7.1) ***V 4.1.2: Penaliseer EEN punt indien afsnitte nie as ko-ordinate gegee (verwys ook na Vraag 7.1)***	
4.1.1	$x = 0$ and/en $y = -1$	✓vertical asymptote/ *vertikale asimptoot* **A** ✓ horizontal asymptote/ *horisontale asimptoot* **A** (2)
4.1.2	$h(x) = -\frac{6}{x} - 1$ $0 = -\frac{6}{x} - 1$ $\therefore x = -6$ $(-6; 0)$	✓ $0 = -\frac{6}{x} - 1$ **M** ✓ -6 **A** (2)
4.1.3		✓horizontal asymptote/ *horisontale asimptoot* **CA** from /van Q/*V* 4.1.1 *g*: ✓ intercept/*afsnit* (0 ; 0) **A** ✓ shape/*vorm* **A** *h*: ✓ *x*-intercept/*-afsnit* **CA** ✓ both curves/*beide kromme* **A** (5)
4.1.4	$g(-2) = 2^{-(-2)} - 1 = 3$ **OR/OF** $3 = 2^{-x} - 1$ $2^2 = 2^{-x}$ $\therefore x = -2$	✓**SF A** **OR/OF** ✓**SF A** (1)
4.1.5	$y > -1$ **OR/OF** $y \in (-1; \infty)$	✓ $y > -1$ **A** (1)
4.1.6	$x \neq 0$ **OR/OF** $x \in (-\infty; 0) \cup (0; \infty)$ **OR/OF** $x \in R; x \neq 0$ **OR/OF** $x < 0$ or $x > 0$ **OR/OF** $x \in R - \{0\}$	✓ **A** (1)

4.2.1	M(1;0)	✓ (1;0) **A** (1)
4.2.2	MT = 8 MR = $g(1) = \sqrt{36-(1)^2} = \sqrt{35}$ $\therefore$ TR = MT – MR = 8 – $\sqrt{35}$	✓length of/*lengte van* MT **A** ✓length of/*lengte van* MK **SF** ✓length of/*lengte van* TR **CA** (3)
4.2.3	$g(0) = \sqrt{36-(0)^2} = 6$ $\therefore$L(0;6) **OR/OF** $r = \sqrt{36} = 6$ L(0;6)	✓**SF A** **OR/OF** ✓ calculating radius/*bereken radius* **A** (1)
4.2.4	$f(x) = y = a(x+p)^2 + q$ $y = a(x-1)^2 + 8$ $6 = a(0-1)^2 + 8$ $a = -2$ $\therefore f(x) = -2(x-1)^2 + 8$ $= -2(x^2 - 2x + 1) + 8$ $= -2x^2 + 4x + 6$ $= -2(x^2 - 2x - 3)$ $\therefore f(x) = -2(x+1)(x-3)$	✓**SF** (1 ; 8) ✓$a = -2$ **CA** ✓**S CA** ✓common factor/ *gemeene faktor* **M** (4)
4.2.5	$\therefore$ K (–1 ; 0)	✓coordinates of/ *koördinate van* K **A** (1)
4.2.6	$x \in (-1; 0)$ **OR/OF** $-1 < x < 0$	**CA** from /van Q4.2.5 ✓critical values/ *kritiese waardes* **CA** **OR/OF** ✓notation/*notasie* **CA** (2) **[24]**

NOV 2019

QUESTION/*VRAAG 4*

4.1.1	$(x-5)(x+3)=0$ $x=5$ or/*of* $x=-3$ **OR/OF** $(5;0)$ and/*en* $(-3;0)$	✓ both values of/*beide waardes van x* **A** **(1)**	
4.1.2	$q(x)=\frac{12}{x}-2$ $\frac{12}{x}-2=0$ $2x=12$ $x=6$ **OR/*OF*** $(6;0)$ **OR/*OF*** $q(x)=\frac{a}{x}+p$ $x=\frac{a}{-p}$ $[q(x)=0]$ $=\frac{12}{-(-2)}$ $=6$ **OR/*OF*** $(6;0)$	✓ $y=0$ **A** ✓ x-value/*waarde* **CA** **OR/*OF*** ✓ $y=0$ **A** ✓ x-value/*waarde* **CA** **(2)** **AO**: Full marks /*Volpunte*	

4.1.3	$x=\frac{5-3}{2}=1$ $k(1)=(1-5)(1+3)=-16$ $\therefore$ TP/*DP* $(1;-16)$ **OR/*OF*** $(x-5)(x+3)=0$ $x^2-2x-15=0$ $x=\frac{-b}{2a}=\frac{-(-2)}{2(1)}=1$ $k(1)=(1)^2-2(1)-15=-16$ **OR/*OF*** $y=\frac{4ac-b^2}{4a}=\frac{4(1)(-15)-(-2)^2}{4(1)}=-16$ $\therefore$ TP/*DP* $(1;-16)$ **OR/*OF*** $k'(x)=2x-2$ $2x-2=0$ $\therefore x=1$ $k(1)=(1)^2-2(1)-15=-16$ $\therefore$ TP/*DP* $(1;-16)$	✓ M **CA** ✓ $x=1$ **A** ✓ $y=-16$ **CA** **OR/*OF*** ✓ M **CA** ✓ $x=1$ **A** ✓ $y=-16$ **A** **OR/*OF*** ✓ M **A** ✓ $x=1$ **A** ✓ $y=-16$ **CA** **(3)**	
4.1.4	$y=-2$ $x=0$	✓ $y=-2$ **A** ✓ $x=0$ **A** **(2)**	
4.1.5		*Graph / grafiek k:* ✓x-intercepts/*afsnitte* **CA** ✓y-intercept/*afsnitte* **CA** ✓shape/*vorm* **A** ✓turning point/*draaipunt* **CA** *Graph / grafiek q:* ✓ hor. asympt/*asimpt* **A** ✓ x-intercepts/*afsnit* **CA** ✓ shape/*vorm* **A** **(7)**	

4.2.1	$d = -4$	✓ value of/*waarde van d* **A** Accept/ Aanvaar $y = -4$ **(1)**	
4.2.2	$h(x) = a^x - 4$ $-2 = a^{-1} - 4$ $a = \frac{1}{2}$ $\therefore h(x) = \left(\frac{1}{2}\right)^x - 4$	✓ substitution/*vervanging* **CA** ✓ correct value of/ *korrekte waarde van a* **CA** **(2)**	
4.2.3	$h(0) = a^0 - 4$ **OR / OF** $h(0) = (0{,}5)^0 - 4$ T(0 ; −3)	✓ $x = 0$ **A** ✓ $y = -3$ **CA** **(2)**	
4.2.4	$y \in [-3\,;\,0]$ **OR/*OF*** $-3 \leq y \leq 0$	✓ range/ *waardeversm(terrein)* **CA** **(1)**	
4.2.5	$p(x) = -\sqrt{9 - x^2}$ $\therefore w(x) = \sqrt{9 - x^2}$ **OR/OF** $\therefore w(x) = \sqrt{r^2 - x^2}$	✓ equation of/ *vergelyking van p* **CA** ✓ equation of/ *vergelyking van w* **CA** **(2)** **AO: Full marks/*Volpunte***	
4.2.6	$0 < x \leq 3$ **OR/*OF*** $x \in (0\,;\,3]$	✓ endpoints/*eindpunte* **A** ✓ correct notation/ *korrekte notasie* **A** **(2)** **[25]**	

FINANCE, GROWTH AND DECAY
EXEMPLAR 2018

QUESTION 5

5.1	$i_{eff} = \left(1+\frac{i}{m}\right)^m - 1$ $i_{eff} = \left(1+\frac{0,072}{2}\right)^2 - 1$ $\approx 0,073296$ $\therefore$ annual effective interest rate is 7,33%	✓Correct substitution ✓Simplification ✓Effective rate as % (3)
5.2	$A = P(1-i)^n$ $70 = 220(1-0,08)^n$ $\frac{7}{22} = (0,92)^n$ $n = \log_{0,92}\frac{7}{22}$ $\therefore n \approx 13,73363166$ It will take approximately 14 minutes.	✓Correct formula ✓Correct substitution ✓Simplified power form ✓Using logarithms ✓Nearest minute (5)
5.2.2	Value of A after 3 years: $A = P(1+i)^n$ $A = R150000\left(1+\frac{10,5\%}{4}\right)^{3\times4}$ $= R204705,40$ Value of P after withdrawal: $P = R204\,705,40 - R30\,000 = R174\,705,40$ Amount received at the end of the investment period: $A = R174705,40\left(1+\frac{10,5\%}{4}\right)^{2\times4}$ $\therefore A = R214\,947,15$	✓Correct formula ✓Correct substitution ✓R204705,40 ✓P = R174 705,40 ✓Correct substitution ✓Final amount (6) [14]

NOV 2018

QUESTION/*VRAAG* 5

5.1	$i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m - 1$ $0,067 = \left(1+\frac{i_{nom}}{12}\right)^{12} - 1$ $1,067 = \left(1+\frac{i_{nom}}{12}\right)^{12}$ $\sqrt[12]{1,067} = \left(1+\frac{i_{nom}}{12}\right)$ $i_{nom} = 12\left(\sqrt[12]{1,067}-1\right) \approx 0,065$ $\therefore$ nominal interest rate is/*no min ale rentekoers is* 6,5 %	✓SF ✓$\sqrt[12]{1,067} = \left(1+\frac{i_{nom}}{12}\right)$ CA ✓$12(\sqrt[12]{1,067}-1) = i_{nom}$ CA ✓ 6,5 % CA (Accept/*aanvaar* 0 ,065) (4)
5.2.1	R120 000	✓ R120 000 A (1)
5.2.2	Reducing balance method/*verminderde balans-metode*: $A = P(1-i)^n$ $120000 = 240000(1-16\%)^n$ $0,5 = (0,84)^n$ $n = \log_{0,84} 0,5$ $\therefore n \approx 3,98$ $\therefore$ it will take 4 years/*dit sal* 4 *jaar neem* **OR/OF** Straight line - method/ Re *guitlynmetode*: $A = P(1-i\times n)$ $120000 = 240000(1-16\%\times n)$ $-0,5 = (-16\%\, n)$ $n = \frac{-0,5}{-16\%}$ $\therefore n \approx 3,125$ $\therefore$ it will take 3 years/*dit sal* 3 *jaar neem*	✓ SF ✓ $0,5 = (0,84)^n$ CA ✓ logs/ *logs* CA ✓ $n = 3,98$ CA ✓ R **OR/OF** ✓ SF ✓ $-0,5 = (-16\%\, n)$ CA ✓ making n the subject/ *maak n de onderwerp* CA ✓ $n = 3,125$ CA ✓ R (5)

5.3	For the first 4 years/*Vir eerste 4 jaar* : $A = P(1+i)^n = 40000\left(1+\frac{11,2\%}{4}\right)^{4\times4}$ $\therefore A \approx R\,62\,222,83...$ For the last 3 years/*Vir laaste 3 jaar* : $A = 62222,83...(1+13\%)^3$ $\approx R\,89\,781,15$ **OR/OF** $A = P(1+i)^n\cdot(1+i)^n$ $= 40000\left(1+\frac{11,2\%}{4}\right)^{4\times4}\cdot\times\ (1+13\%)^3$ $\approx R\,89\,781,15$	✓ value of/*waarde van i and/en n* A ✓ SF CA ✓ 62 222,83... CA ✓ SF CA ✓ 89 781,15 CA **OR/OF** ✓ $A = P(1+i)^n\cdot(1+i)^n$ M ✓ value of/*waarde van i and/en n* A ✓ value of/*waarde va i and/en n* A ✓ SF CA ✓ 89 781,15 CA (5) **[15]**

NOV 2019

QUESTION/*VRAAG* 5

5.1.1	R11 000	✓ new value/ *nuwe waarde* A (1)	
5.1.2	$A = R5\,500\ \ P = R11\,000\ \ n = 5\ \ i = ?$ $A = P(1-in)$ $R5\,500 = R11\,000(1-i\times(5))$ $i = \frac{\frac{R5\,500}{R11\,000}-1}{-5}$ $= 0,10$ $= 10\%$	✓SF CA ✓making *i* the subject/ *maak i die onderwerp* CA ✓ interest rate/ *rentekoers* CA **AO: Full marks/*Volpunte*** (3)	
5.2 #	$A = P(1+i)^n$ $273 = 200(1+3,5\%)^n$ $\frac{273}{200} = (1,035)^n$ $n = \frac{\log\frac{273}{200}}{\log(1,035)}$ **OR/*OF*** $n = \log_{1,035}\frac{273}{200}$ $\approx 9,04$ years/ *jaar* $\therefore$ the year 2018 / *die jaar* 2018 **OR/*OF*** $A_1 = R200\,(1+3,5\%)^1 \approx R207$ $A_2 = R200\,(1+3,5\%)^2 \approx R214,25$ . . $A_9 = R200\,(1+3,5\%)^9 \approx R272,58$ $A_{10} = R200\,(1+3,5\%)^{10} \approx R282,12$ $\therefore$ the year 2018 / *die jaar 2018*	✓SF A ✓S CA ✓ log property/ *eienskap* CA ✓value of/waarde van *n* CA ✓ correct year/ *korrekte jaar* CA **OR/*OF*** ✓SF A ✓S CA ✓SF A ✓S CA ✓ correct year/ *korrekte jaar* CA **NOTE/ *NOTA*: Accept/*Aanvaar* 2019** **NPR** (5)	

5.3 #	Value of the investment after initial deposit/ *waarde van die belegging na die aanvangs deposito*: $A = P(1+i)^n$ $= R293\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}$ $\approx R334\,642,4791$ $R334\,642,4791 + R95\,000 = R429\,642,4791$ Value of the investment after adding/*waarde van die belegging na byvoeging van* R95 000 : $= 429\,642,4791\left(1+\frac{6,7\%}{4}\right)^{2\times4}$ $\approx R490\,705,2026$ Value of the investment after change in interest rate/*waarde van die belegging na verandering van rentekoers :* $= R490\,705,2026\left(1+\frac{7,5\%}{12}\right)^{4\times12}$ $\approx$ R661 764,62 > R660580 ∴ Yes she has accumulated sufficient funds./*Ja, sy het genoeg fondse geakkumuleer* **OR/*OF*** $A=\left[293\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}+95\,000\right]\times\left(1+\frac{6,7\%}{4}\right)^{2\times4}\left(1+\frac{7,5\%}{12}\right)^{4\times12}$ $\approx$ R 661 764 , 62 > R 660 580 ∴ Yes she has accumulated sufficient funds./ *Ja, sy het genoeg fondse geakkumuleer* **OR/*OF***	✓SF A ✓ S CA ✓ S CA ✓SF A ✓ S CA ✓ value of *i* and *n*/ *waarde van i en n* A ✓ S CA ✓ conclusion/ *gevolgtrekking* CA **OR/*OF*** ✓ M A ✓✓SF A ✓ value of *i* and *n*/ *waarde van i en n* A ✓adding/*byvoeging* R95 000 A ✓change of rate/ *verandering van koers* A ✓S CA ✓ conclusion/ *gevolgtrekking* CA **OR/*OF***	

$A = R293\,000\left(1+\frac{6,7\%}{4}\right)^{4\times4}\cdot\left(1+\frac{7,5\%}{12}\right)^{4\times12} + R95\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}\left(1+\frac{7,5\%}{12}\right)^{4\times12}$ $\approx$ R 661 764 , 62 > R 660 580 ∴ Yes she has accumulated sufficient funds./ *Ja, sy het genoeg fondse geakkumuleer* **OR/OF** $P = R660\,580\left(1+\frac{6,7\%}{4}\right)^{-4\times2}\cdot\left(1+\frac{7,5\%}{12}\right)^{-4\times12} - R95\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}\left(1+\frac{7,5\%}{12}\right)^{4\times12}$ $\approx$ R 282 547 , 91 < R 293 000 *Yes she has accumulated sufficient funds./* *Ja, sy het genoeg fondse geakkumuleer* **OR/*OF*** $1+i_{eff}=\left(1+\frac{i_{nom}}{m}\right)^m=\left(1+\frac{6,7\%}{4}\right)^4\approx0,068...$ 2 years/*jaar*: $A=P(1+i)^n=R293\,000(1+0,068...)^2+R95\,000$ $\approx R429\,642,48$ 4th year/*jaar*: $A=R429\,642,48\,(1+0,068...)^2\approx R490\,705,20$ 5 – 8 years/*jaar*: $A=R490\,705,20\left(1+\frac{7,5\%}{12}\right)^{4\times12}$ $\approx$ R661 764,62 > R660580 ∴ Yes she has accumulated sufficient funds./ *Ja, sy het genoeg fondse geakkumuleer* **OR/OF**	✓ M A ✓✓SF A ✓ value of *i* and *n*/ *waarde van i en n* A ✓adding/*byvoeging* R95 000 with interests/*met rente* A ✓change of rate/ *verandering van koers* A ✓S CA ✓ conclusion/ *gevolgtrekking* CA **OR/*OF*** ✓ M A ✓✓SF A ✓ value of *i* and *n*/ *waarde van i en n* A ✓subtracting R95 000 with interests A ✓change of rate/ *verandering van koers* A ✓S CA ✓ conclusion/ *gevolgtrekking*CA **OR/OF** ✓SF A ✓ S CA ✓ SF CA ✓S CA ✓ S CA ✓ value of *i* and *n*/ *waarde van i en n* A ✓ S CA

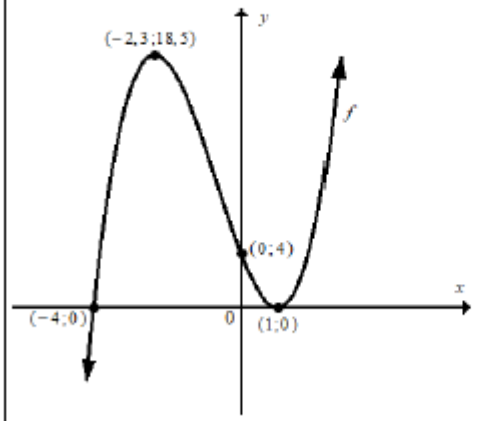
	✓ conclusion/ *gevolgtrekking* CA OR/OF	
$A = P(1+i)^n$		
$A_0 = R293\,000\left(1+\frac{0,067}{4}\right)^{4\times4}$		
$\approx R382\,203,3749$	✓SF	A
$A_1 = R382\,203,3749\left(1+\frac{0,075}{12}\right)^{4\times12}$	✓ S	CA
$\approx R515\,439,147$	✓SF	A
$A_2 = R95\,000\left(1+\frac{0,067}{4}\right)^{2\times4}$	✓ S	CA
$\approx R108\,501,8277$		
$A_3 = R108\,501,8277\left(1+\frac{0,075}{12}\right)^{4\times12}$	✓ S	CA
$\approx R146\,325,4728$	✓ value of i and n/ *waarde van i en n*	A
$A_1 + A_3 \approx R661\,764,62 > R660\,580$		
∴ Yes she has accumulated sufficient funds./ *Ja, sy het genoeg fondse geakkumuleer*	✓ S	CA
NOTE/*NOTA*: **1) Max. 4 marks if Simple Interest is used./** *Maks 4 punte indien enkelvoudige rente* **2) Max. 2 marks if any Depreciation is used./** *Maks 2 punte indien enkelvoudige rente*		
		(8)
		[17]

DIFFERENTIAL CALCULUS
EXEMPLAR 2018

QUESTION 6

6.1	$f(x)=2x^2-3$ Average gradient $=\frac{f(x_2)-f(x_1)}{x_2-x_1}$ $=\frac{[2(1)^2-3]-[2(-2)^2-3]}{1-(-2)}$ $=\frac{-1-5}{3}$ $=-2$	✓Corresponding y-value ✓Corresponding y-value ✓Substitution in formula ✓Simplification (4)
6.2	$f(x)=4-3x$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{[4-3(x+h)]-(4-3x)}{h}$ $=\lim_{h\to 0}\frac{4-3x-3h-4+3x}{h}$ $=\lim_{h\to 0}\frac{-3h}{h}$ $=\lim_{h\to 0}(-3)$ $=-3$	✓Definition ✓Substitution in the definition ✓Simplification (removing brackets) ✓Simplification (division) ✓Simplification (5)
6.3	$y=\frac{2}{x^3}+\sqrt{x}$ $y=2x^{-3}+x^{\frac{1}{2}}$ $\frac{dy}{dx}=-6x^{-4}+\frac{1}{2}x^{-\frac{1}{2}}$	✓$2x^{-3}$ ✓$x^{\frac{1}{2}}$ ✓$-6x^{-4}$ ✓$\frac{1}{2}x^{-\frac{1}{2}}$ (4)
6.4	$g(x)=-x^2-x$ $g(2)=-(2)^2-2=-6$ The point of contact is $(2;-6)$ $g'(x)=-2x-1$ $\therefore m_{tan}=g'(2)=-2(2)-1=-5$ $y=mx+c$ OR $y-y_1=m(x-x_1)$ $-6=-5(2)+c$ OR $y-(-6)=-5(x-2)$ $c=4$ OR $y+6=-5x+10$ $\therefore y=-5x+4$	✓value of y ✓$m_{tan}=-5$ ✓Correct substitution ✓Value of c (simplification) ✓Equation (any form) (5) **[18]**

QUESTION 7

7.1	$f(x)=x^3+2x^2-7x+4$ $f(1)=(1)^3+2(1)^2-7(1)+4$ $\therefore f(1)=0$ $\therefore x-1$ is a factor of f	✓Substitution ✓0 (2)
7.2	x-intercepts: $f(x)=0$ $x^3+2x^2-7x+4=0$ $(x-1)(x^2+3x-4)=0$ $(x-1)(x-1)(x+4)=0$ $x=1$ or $x=-4$	✓(x^2+3x-4) (quadratic) ✓$(x-1)(x-1)(x+4)$ (linear) ✓x-intercepts (3)
7.3	$f(x)=x^3+2x^2-7x+4$ $f'(x)=3x^2+4x-7$ $f'(x)=0$ $\therefore 3x^2+4x-7=0$ $(3x+7)(x-1)=0$ $\therefore x=-\frac{7}{3}$ or $x=1$ $(-2,3;18,5)$ and $(1;0)$	✓Derivative ✓$f'(x)=0$ ✓Factorisation ✓Both values of x ✓Coordinates of the turnings (5)
7.4		✓Shape ✓Intercepts with x-axis ✓y-intercept ✓Turning points (4) **[14]**

QUESTION 8

8.1.1	After 2 hrs $D(2) = 4 + 0,5(2)^2 - 0,25(2)^3$ m $= 4$m	✓Substituting 2 ✓Simplification (2)
8.1.2	$D = 4 + 0,5t^2 - 0,25t^3$ $D'(t) = t - 0,75t^2$ At 12:00 (3 hours later): $D'(3) = (3) - 0,75(3)^2$ $= -3,75\,\text{m.h}^{-1}$ $\therefore$	✓Derivative ✓Substitution of 3 ✓Simplified rate (3)
8.2.1	$P = -3v^2 + 30v$ Neither profit nor loss at $P = 0$ $-3v^2 + 30v = 0$ $-3v(v - 10) = 0$ $\therefore v = 0$ or $v = 10$ $v = 10\,\text{km.h}^{-1}$	✓ $P = 0$ ✓Factors ✓Correct value of v (3)
8.2.2	$P = -3v^2 + 30v$ $\frac{dP}{dv} = -6v + 30 = 0$ $\therefore v = 5\,\text{km.h}^{-1}$	✓Derivative ✓Equating to 0 ✓Value of v (3)
8.2.3	P_{max} (in R1000) $= -3(5)^2 + 30(5) = 75$ OR R75 000	✓Substitution ✓Profit in R1 000 (2) [13]

NOV 2018

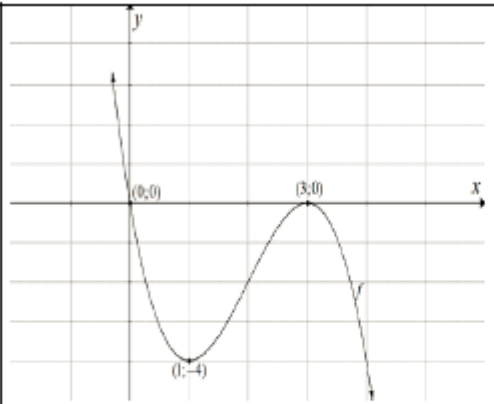
QUESTION/*VRAAG 6*

6.1	$f(x) = 7x - 2$ $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\frac{[7(x+h)-2]-(7x-2)}{h}$ $= \lim_{h\to 0}\frac{7x+7h-2-7x+2}{h}$ $= \lim_{h\to 0}\frac{7h}{h}$ $= \lim_{h\to 0}(7)$ $\therefore f'(x) = 7$	✓definition/*definisie* **A** ✓ **SF** ✓ **S CA** ✓**S CA** ✓7 **CA** **AO** only one mark/*slegs een punt* Penalty of one mark incorrect notation *Penaliseer een punt indien notasie foutief is.* (5)
	Penalty of only one mark only once for incorrect notation (last step) for sub-questions 6.2.1 , 6.2.2 & 6.2.3 ***Penaliseer slegs een punt vir foutiewe notasie (laaste stap) vir subvrae 6.2.1 , 6.2.2 & 6.2.3***	
6.2.1	$\frac{d}{dx}(\pi^2) = 0$	✓0 **A** (1)
6.2.2	$D_x\left(x^4 - \sqrt[3]{x}\right)$ $= D_x\left(x^4 - x^{\frac{1}{3}}\right)$ $= 4x^3 - \frac{1}{3}x^{-\frac{2}{3}}$	✓ power form/*magsvorm* ✓$4x^3$ **A** ✓ $\frac{1}{3}x^{-\frac{2}{3}}$ **CA** (3)
6.2.3	$y = \frac{x^5 + 2}{x^2}$ $= x^3 + 2x^{-2}$ $\frac{dy}{dx} = 3x^2 - 4x^{-3}$	✓ x^3 **A** ✓ $2x^{-2}$ **A** ✓ $3x^2$ **CA** ✓ $-4x^{-3}$ **CA** (4)

6.3.1	$p(x) = x^3 + 1$ $p(2) = (2)^3 + 1 = k$ $\therefore k = 9$	✓ S ✓ 9 A (2)
6.3.2	$p(x) = x^3 + 1$ $p'(x) = 3x^2$	✓ derivative/*afgeleide* A (1)
6.3.3	$p'(x) = 3x^2$ $m = 3(2)^2$ $= 12$ $y - 9 = 12(x - 2)$ **OR / OF** $9 = 12(2) + c$ $y = 12x - 24 + 9$ $c = -15$ $\therefore y = 12x - 15$ $\therefore y = 12x - 15$ **OR/OF** $y - 12x + 15 = 0$	✓ gradient/*gradient* CA ✓ SF CA ✓ $y = 12x - 15$ CA (3) **[19]**

QUESTION/*VRAAG 7*

	Q7.1: Penalty of ONE mark if intercepts not given as coordinates (refer also to Question 4) ***V 7.1 : Penaliseer EEN punt indien afsnitte nie as koordinate gegee (verwys ook na Vraag 4)***	
7.1	$f(x) = -x(x-3)(x-3)$ $x = 0$ and/en $x = 3$ (0;0) and/en (3;0)	✓ (0 ; 0) A ✓ (3 ; 0) A (2)
7.2	$f(x) = -x(x-3)(x-3)$ $y = f(0) = -(0)(0-3)(0-3) = 0$	✓ 0 A (1) Accept/*Aanvaar*: (0 ; 0)
7.3	$f(x) = -x(x-3)(x-3)$ $= -x(x^2 - 6x + 9)$ **OR/OF** $= (-x^2 + 3x)(x - 3)$ **OR/OF** $= (x^2 - 3x)(-x + 3)$ $\therefore f(x) = -x^3 + 6x^2 - 9x$	✓✓ $-x(x^2 - 6x + 9)$ M A **OR/OF** ✓✓ $(-x^2 + 3x)(x - 3)$ M A **OR/OF** ✓✓ $(x^2 - 3x)(-x + 3)$ M A (2)
7.4	$f(x) = -x^3 + 6x^2 - 9x$ $f'(x) = -3x^2 + 12x - 9$ $-3x^2 + 12x - 9 = 0$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $\therefore x = 3$ or/of $x = 1$ $f(1) = -(1)^3 + 6(1)^2 - 9(1) = -4$ (3;0) and/en (1; – 4)	✓ derivative/*afgeleide* M ✓ equating derivative to 0/ *stel afgeleide gelyk aan 0* M ✓ factors/formula/*faktore* CA ✓ both values of /*beide waardes van x* CA ✓ both values of/*beide waardes van y* CA AO: Full marks/*Volpunte* Coordinates of one turning point only: two marks/ *Koordinate van een draaipunt slegs: twee punte* (5)

7.5		✓correct shape/*korrekte vorm* **A** ✓*y*-intercept/*-afsnit* **CA** ✓*x*-intercepts/- *afsnitte* **CA** ✓turning points/*draaipunte* **CA** (4)
7.6	$1 < x < 3$ **OR/OF** $x \in (1;3)$	✓critical values/ *kritieke waardes* : 1 and/en 3 **CA** ✓notation/*notasie* (2) **[16]**

QUESTION/*VRAAG* 8

8.1.1	$V = l \times b \times h$ $= 3x(1,5)(1-x)$ **OR/OF** $V = 4,5x - 4,5x^2$	✓formula/*formule* ✓✓**SF** (3)
8.1.2	$V = 4,5x - 4,5x^2$ $\frac{dV}{dx} = 4,5 - 9x$ $4,5 - 9x = 0$ $9x = 4,5$ $\therefore x = 0,5$ **OR/OF** $x = -\frac{b}{2a}$ $= -\frac{4,5}{2(-4,5)}$ $= 0,5$	**CA from Question/ Vraag 8.1.1** ✓derivative/*afgeleide* **M** ✓equating to 0/ *stel gelyk aan* 0 **M** ✓value of/*waarde van x* **CA** **OR/OF** ✓ using a formula/*gebruik 'n formule* ✓S ✓value of/*waarde van x* CA (3)
8.2.1	$v(0) = 8 + 4(0) - (0)^2$ m/s $= 8$ m/s $\therefore$ the initial velocity of the car/ die aanvanklike snelheid van die motor 8 m/s	✓8 m/s **A** **NPU** (1)
8.2.2	$v(t) = 8 + 4t - t^2$ $v(0,2) = 8 + 4(0,2) - (0,2)^2$ m/s $= 8,76$ m/s $\therefore$ the velocity of the car when 0, 2 seconds will be 8, 76 m/s die snelheid van die motor wanneer 0,2 sekondes sal 8,76 m/s wees	✓S ✓8,76m/s **A** **NPU** (2)
8.2.3	$v(t) = 8 + 4t - t^2$ $v'(t) = 4 - 2t$ $v'(1,2) = 4 - 2(1,2)$ m/s^2 $= 1,6$ m/s^2	✓ 4 **A** ✓ $-2t$ **A** ✓SF into a derivative/ *in 'n afgeleide* **CA** ✓1,6m/s^2 **CA** **NPU** (4) **[13]**

NOV 2019

QUESTION/*VRAAG 6*

6.1	$f(x)=5-\frac{1}{2}x$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{\left[\left(5-\frac{1}{2}(x+h)\right)\right]-\left(5-\frac{1}{2}x\right)}{h}$ $=\lim_{h\to 0}\frac{5-\frac{1}{2}x-\frac{1}{2}h-5+\frac{1}{2}x}{h}$ $=\lim_{h\to 0}\frac{-\frac{1}{2}h}{h}$ $=\lim_{h\to 0}\left(-\frac{1}{2}\right)$ $\therefore f'(x)=-\frac{1}{2}$	✓definition/*definisie* A ✓ SF A ✓ S CA ✓ $\lim_{h\to 0}\frac{-\frac{1}{2}h}{h}$ CA ✓ $-\frac{1}{2}$ CA **AO: ONLY 1 mark/ SLEGS 1 *punt*** **Penalty of 1 mark for incorrect notation/ *penaliseer 1 punte vir verkeerde notasie*** (5)	
No penalty for notation in the remaining questions/ *Geen penaliseering vir notasie in die*			
6.2.1	$f(x)=a^3-0,5x^3-x^{-1}$ $f'(x)=0-1,5x^2+x^{-2}$ **OR / *OF*** $-1,5x^2+x^{-2}$	✓ derivative of/ *afgeleide van* a^3 A ✓ $-1,5x^2$ A ✓ x^{-2} A (3)	
6.2.2	$D_x\left[x\left(\sqrt{x}+2\right)\right]$ $=D_x\left[x\left(x^{\frac{1}{2}}+2\right)\right]$ $=D_x\left[x^{\frac{3}{2}}+2x\right]$ $=\frac{3}{2}x^{\frac{1}{2}}+2$	✓ $x^{\frac{1}{2}}$ A ✓ product/*produk* CA ✓ $\frac{3}{2}x^{\frac{1}{2}}$ CA ✓ 2 CA (4)	

6.3.1	$xy+2x^3=7x^6$ $y=\frac{7x^6-2x^3}{x}$ **OR / OF** $y=7x^5-2x^2$	✓M A ✓ making *y* the subject/*maak y die onderwerp* A (2)	
6.3.2	$y=7x^5-2x^2$ $\frac{dy}{dx}=35x^4-4x$	✓ $35x^4$ CA ✓ $-4x$ CA (2)	
6.4.1	$P(300)=0,8(300)^2-200(300)$ $=$R12 000	✓profit/*wins* A (1)	
6.4.2	$P(x)=0,8x^2-200x$ $0,8x^2-200x=0$ $x(0,8x-200)=0$ $x=0$ or $x=250$ $\therefore$ 250 light bulbs/*gloeilampe* **OR/OF** $0,8x^2-200x=0$ $0,8x^2=200x$ $x=\frac{200x}{0,8x}$; $x\neq 0$ $\therefore x=250$ $\therefore$ 250 light bulbs/*gloeilampe*	✓ factors/*faktore* M A ✓correct value of/*korrekte waarde van x* CA **OR/OF** ✓ isolating/ *isoleer x* M A ✓correct value of/*korrekte waarde van x* CA **AO: Full marks/*Volpunte*** (2)	
6.4.3	$P(x)=0,8x^2-200x$ $P'(x)=1,6x-200$ $P'(200)=1,6(200)-200$ $=-120$ bulbs per day / *gloeilampe per dag*	✓derivative/*afgeleide* A ✓ substitution/*vervanging* CA ✓rate/*tempo* CA **NPU** (3) [22]	

QUESTION/*VRAAG* 7

7.1	$g(x) = 9x + 18$ x-intercept/ *qftnit*, $g(x) = 0$ $0 = 9x + 18$ $-9x = 18$ $x = -2$ $Q(-2\,;0)$ y-intercept/*qftnit*, $x = 0$ $T(0\,;18)$ **OR / *OF*** $(x+2)(x-3)(x-3) = 0$ $Q(-2\,;0)$ y-intercept/*qftnit*, $x = 0$ $T(0\,;18)$	✓ $0 = 9x + 18$ A ✓ coordinates of/*koördinate van* Q A ✓ coordinates of/*koördinate van* T A **OR/*OF*** ✓ M A ✓ coordinates of/*koördinate van* Q A ✓ coordinates of/*koördinate van* T A (3) **AO: Full marks/*Volpunte***	
7.2	$f(x) = (x+2)(x-3)(x-3)$ $= (x+2)(x^2 - 6x + 9)$ **OR/*OF*** $(x-3)(x^2 - x - 6)$ $f(x) = x^3 - 4x^2 - 3x + 18$ $b = -4 \quad c = -3 \quad d = 18$ **OR/OF** $f(x) = x^3 + bx^2 + cx + d$ $f(x) = x^3 + bx^2 + cx + 18$ $f(-2) = 0: \quad 2b - c = -5 \quad \ldots(1)$ $f(3) = 0: \quad 3b + c = -15 \quad \ldots(2)$ $(1) + (2): \quad 5b = -20$ $\therefore b = -4$ $2(-4) - c = -5$ $c = -3$ **OR/OF**	✓ repeated factor/*herhalde faktor* A ✓ quadratic factor/ *kwadratiese faktor* A ✓ expanding/ *uitbrei* A **OR/OF** ✓ $d = 18$ A ✓ S A ✓ S A **OR/OF**	

	$f(x) = x^3 + bx^2 + cx + d$ $f(x) = x^3 + bx^2 + cx + 18$ $0 = (3)^3 + b(3)^2 + c(3) + 18$ $0 = 45 + 9b + 3c$ $c = -15 - 3b$ $f'(c) = 3x^2 + 2bx + c$ $f'(3) = 3(3)^2 + 2b(3) + c$ $c = -27 - 6b$ $-15 - 3b = -27 - 6b$ $\therefore b = -4$ $c = -27 - 6(-4)$ $\therefore c = -3$	✓ $d = 18$ A ✓ S A ✓ S A (3)	
7.3	$f(x) = x^3 - 4x^2 - 3x + 18$ $f'(x) = 3x^2 - 8x - 3 = 0$ $3x^2 - 8x - 3 = 0$ $(3x+1)(x-3) = 0$ **OR / *OF*** $x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(-3)}}{2(3)}$ $x = -\frac{1}{3}$ or/*of* $x = 3$ $y = f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 - 4\left(-\frac{1}{3}\right)^2 - 3\left(-\frac{1}{3}\right) + 18 = \frac{500}{27}$ $\therefore R\left(-\frac{1}{3}; \frac{500}{27}\right)$ **OR / *OF*** $R(-0{,}33; 18{,}52)$	✓ $f'(x)$ CA ✓ $f'(x) = 0$ CA ✓ factors/formula/*faktore/form* CA ✓ correct value of/*korrekte waarde van* x CA ✓ R coordinates/*koördinate* CA (5)	
7.4.1	$y = \frac{500}{27}$ **OR / *OF*** $y \approx 18{,}52$	✓ equation/*vergelyking* CA (1)	
7.4.2	$x > -2$ **OR/*OF*** $x \in (-2\,;\infty)$	✓ correct inequality/*korrekte ongelykheid* A (1)	
7.4.3	$-\frac{1}{3} < x < 3$ **OR/*OF*** $x \in \left(-\frac{1}{3}; 3\right)$	✓ critical values/*kritiese waardes* CA ✓ correct notation/*korrekte notasie* CA (2) **[15]**	

QUESTION/*VRAAG* 8

8.1	$h=(66-2x-x)\text{ cm}$ $=(66-3x)\text{ cm}$	✓ height/*hoogte* A (1) NPU	
8.2	$V(\text{in cm}^3)=\pi r^2h+\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$ $=\pi x^2(66-3x)+\frac{1}{2}\left(\frac{4}{3}\pi x^3\right)$ $=66\pi x^2-3\pi x^3+\frac{2}{3}\pi x^3$ $=66\pi x^2-\frac{7}{3}\pi x^3$	✓ F A ✓ SF CA ✓ S CA NPU (3)	
8.3	$V(\text{in cm}^3)=66\pi x^2-\frac{7}{3}\pi x^3$ $\frac{dV}{dx}=-7\pi x^2+132\pi x$ $0=-7\pi x^2+132\pi x$ $0=-\pi x(7x-132)$ **OR / OF** $x=\frac{-(132\pi)\pm\sqrt{(132\pi)^2-4(-7\pi)(0)}}{2(-7\pi)}$ $-\pi x=0$ or/*of* $x=\frac{132}{7}$ $x\neq 0$ $\therefore x=\frac{132}{7}$	✓ derivative/*afgeleide* CA ✓ equating $f'(x)$ to/*stel gelyk aan* 0 A ✓ factors/ formula *faktore/form* CA ✓ correct value of/ *korrekte waarde van x* CA (4)	
8.4	$V(\text{in cm}^3)=66\pi x^2-\frac{7}{3}\pi x^3$ $=66\pi\left(\frac{132}{7}\right)^2-\frac{7}{3}\pi\left(\frac{132}{7}\right)^3$ $\approx 24\,576{,}74$ **OR/*OF*** $7823{,}02\,\pi$	✓ SF CA ✓ max/*maks* volume CA NPR (2) **[10]**	

INTEGRATION
EXEMPLAR 2018

QUESTION 9

9.1	$\int\left(x^{-4}+\frac{7}{x}-1\right)dx$ $=\int x^{-4}\,dx+7\int\frac{1}{x}dx-\int dx$ $=\frac{x^{-3}}{-3}+7\ln x-x+C$	✓$\frac{x^{-5}}{-5}$ ✓$7\ln x$ ✓$-x$ ✓C (4)
9.2	$h(x)=-2x^2-6x$ $\int_{-3}^{0}(-2x^2-6x)dx$ $=\left[-\frac{2x^3}{3}-3x^2\right]_{-3}^{0}$ $=\left[\left(-\frac{2(0)^3}{3}-3(0)^2\right)-\left(-\frac{2(-3)^3}{3}-3(-3)^2\right)\right]$ $=-18+27$ $=9$ units square	✓$-\frac{2x^3}{3}$; ✓$-3x^2$ ✓Substituting 0 ✓Substituting -3 ✓Simplification (5) **[9]**

NOV 2018

QUESTION/*VRAAG 9*

	Penalty of one mark once only if the constant in Questions 9.1.1 & 9.1.2 is omitted/ *Penalisering met slegs een punt, indien konstante in Vrae 9.1.1 & 9.1.2 weggelaat is.*	
9.1.1	$\int-\frac{6}{x}dx$ $=-6\int\frac{1}{x}dx$ $=-6\ln x+C$ OR $\ln\frac{1}{x^6}+C$ OR $-6\log_e x+C$	✓$-6\ln x$ **OR/OF** $\ln\frac{1}{x^6}$ **OR/OF** $-6\log_e x$ ✓ C (2)
9.1.2	$\int(x-1)^2dx$ $=\int(x^2-2x+1)dx$ $=\frac{x^3}{3}-x^2+x+C$	✓ product / product **M** ✓$\frac{x^3}{3}$ **CA** ✓$-x^2$ **CA** ✓$x+C$ **CA** (4)
9.2		✓Area notation using intergrals/ *Area-notasie met gebruik van integrale* **M** ✓ $\frac{x^3}{3}$ **A** ✓ $3x$ **A** ✓✓ **SF CA** ✓bounded area/ *begrensde oppervakte* **CA** **NPU** **AO**: 3 marks/punte (6) **[12]**

NOV 2019

QUESTION/*VRAAG 9*

9.1.1	$\int mx^p dx$ $= m\left(\frac{x^{p+1}}{p+1}\right) + C \qquad p \neq -1$ **OR/*OF*** $= \frac{mx^{p+1}}{p+1} + C \qquad p \neq -1$	✓ $m\left(\frac{x^{p+1}}{p+1}\right)$ A ✓ C A **OR/*OF*** ✓ $\frac{mx^{p+1}}{p+1}$ A ✓ C A (2)	
9.1.2	$\int\left(\frac{x^{-3}+x^2}{x^{-1}} - 2\right)dx$ $= \int\left(x^{-2} + x^3 - 2x^0\right)dx$ $= -x^{-1} + \frac{x^4}{4} - 2x^1 + C$	✓ S A ✓ $-1x^{-1}$ CA ✓ $\frac{x^4}{4}$ CA ✓ $-2x^1 + C$ CA (4)	

9.2	$A = \int_{1,4}^{3,5}\left(-\frac{4}{x}\right)dx$ $= [-4\ln x]_{1,4}^{3,5}$ $= [-4\ln(3,5)] - [-4\ln(1,4)]$ $\approx -3,67$ $\therefore 3,67$ square units *vierkante eenhede* **OR/OF** $A = -\int_{1,4}^{3,5}\left(-\frac{4}{x}\right)dx$ $= -[-4\ln x]_{1,4}^{3,5}$ $= [4\ln(3,5)] - [4\ln(1,4)]$ $\approx 3,67$ $\therefore 3,67$ square units/ *vierkante eenhede* **OR/OF** $A = \int_{1,4}^{3,5}\left[0 - \left(-\frac{4}{x}\right)\right]dx$ $= \int_{1,4}^{3,5} 0\,dx + \int_{1,4}^{3,5}\left(\frac{4}{x}\right)dx$ $= [4\ln x]_{1,4}^{3,5}$ $= [4\ln(3,5)] - [4\ln(1,4)]$ $\approx 3,67$ $\therefore 3,67$ square units/ *vierkante eenhede*	✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* A ✓ integral/*integraal* A ✓ substitution/*vervanging* CA ✓ substitution/*vervanging* CA ✓ S CA ✓ correct positive value of the bounded area/ *korrekte positiewe waarde van die begrensde oppervlakte* CA **OR/OF** ✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* A ✓ integral/*integraal* A ✓ substitution/*vervanging* CA ✓ substitution/*vervanging* CA ✓ S CA ✓ correct positive value of the bounded area/*korrekte positiewe waarde van die begrensde oppervlakte* CA ✓ correct positive value of the **OR/OF** ✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* A ✓ integral/*integraal* A ✓ substitution/*vervanging* CA ✓ substitution/*vervanging* CA ✓ S CA ✓ correct positive value of the bounded area/*korrekte positiewe waarde van die begrensde oppervlakte* CA **NPR & NPU** (6) [12]	

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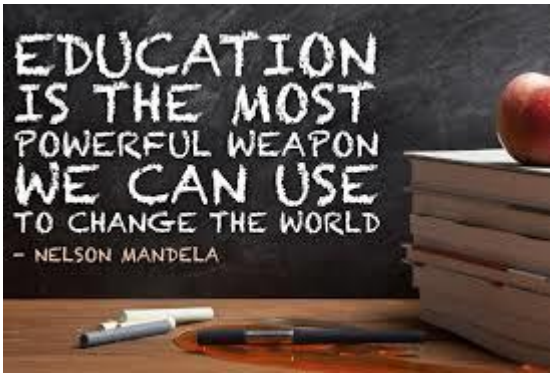

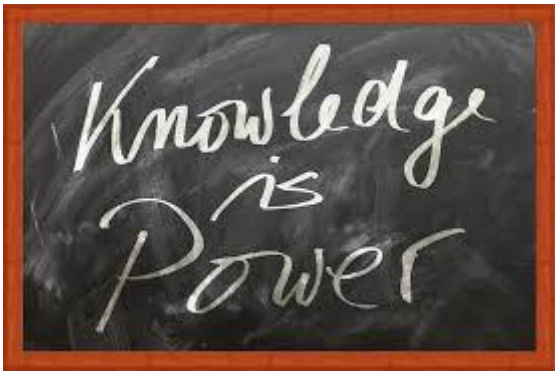

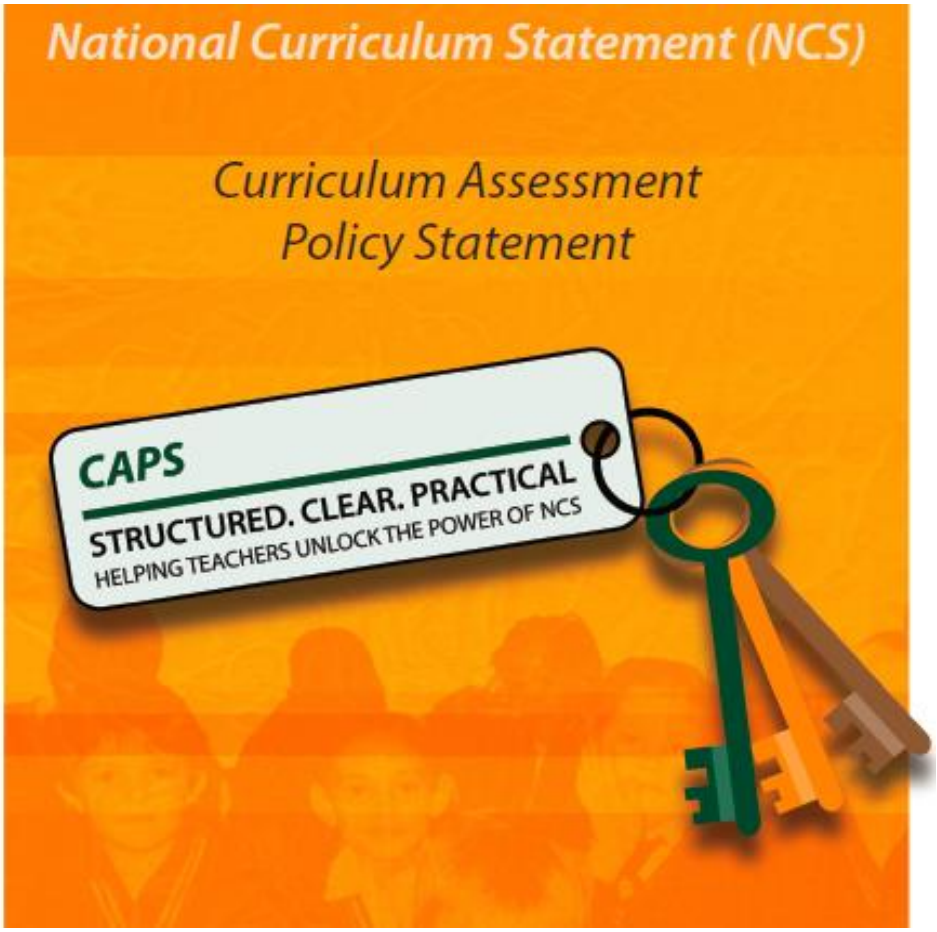

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