Education

KwaZulu-Natal Department of Education

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

SEPTEMBER 2018

PREPARATORY EXAMINATION

MARKS: 150

TIME: 3 hours

N.B. This question paper consists of 8 pages and an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 13 questions.

2. Answer **ALL** questions.

3. Clearly show **ALL** calculations, diagrams, graphs, et cetera that you have used in determining your answers.

4. Answers only will not necessarily be awarded full marks.

5. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.

6. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

8. Number the answers correctly according to the numbering system used in this question paper. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $\frac{x}{2}(x-5)=0$ (2)

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

1.1.3 $\sqrt{2x+3}=x$ (4)

1.1.4 $9^x=4.3^x$, correct to TWO decimal places. (5)

1.2 Solve the following equations simultaneously:

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

1.3 $2^{-x}(x+4)\leq 0$ (4)

[25]

QUESTION 2

The first four terms of a quadratic sequence are 9 ; 19 ; 33 ; 51 ; ...

2.1 Write down the next TWO terms of the quadratic sequence. (2)

2.2 Determine the n^{th} term of the sequence. (4)

2.3 Prove that all the terms of the quadratic sequence are odd. (3)

[9]

QUESTION 3

$3-t\ ;\ -t\ ;\ \sqrt{9-2t}$ are the first three terms of an arithmetic sequence.

3.1 Determine the value of t. (4)

3.2 If $t=-8$, then determine the number of terms in the sequence that will be positive. (3)

[7]

QUESTION 4

4.1 Given the infinite geometric series $(x-3)+(x-3)^2+(x-3)^3+\ldots$

4.1.1 Write down the value of the common ratio in terms of x. (1)

4.1.2 For which value(s) of x will the series converge? (3)

4.2 An arithmetic sequence and a geometric sequence have their first term as 3. The common difference of the arithmetic sequence is p and the common ratio of the geometric sequence is p. If the tenth term of the arithmetic sequence is equal to the sum to infinity of the geometric sequence, determine the value of p. (5)

[9]

QUESTION 5

Given $f(x)=\dfrac{x-3}{x+2}$

5.1 Show that $f(x)=1-\dfrac{5}{x+2}$ (1)

5.2 Write down the equations of the vertical and horizontal asymptotes of f. (2)

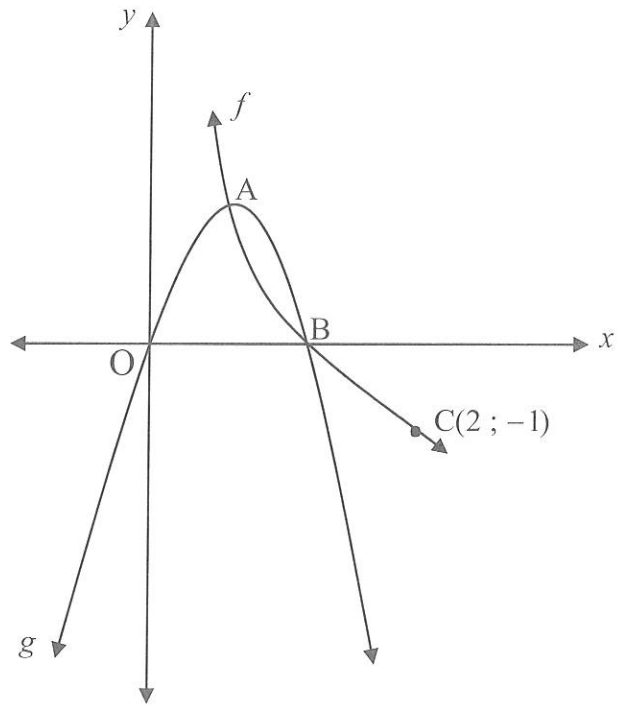
5.3 Determine the intercepts of the graph of f with the x-axis and y-axis. (2)

5.4 Write down the value of c if $y=x+c$ is a line of symmetry to the graph of f. (2)

[7]

QUESTION 6

$f(x)=\log_p x$ and $g(x)=ax^2+bx$ are sketched below. A is the turning point of g and B is the common x – intercept of f and g. The point C(2;–1) lies on the graph of f. The graph of f passes through the point A.



6.1 Calculate the value of p. (2)

6.2 Write down the co-ordinates of B. (1)

6.3 If $p=\frac{1}{2}$, determine the co-ordinates of A. (3)

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

6.5 Write down the equation of f^{-1}, inverse of f, in the form $y=\ldots$ (2)

6.6 Determine the values of x for which $f(x)\geq -1$. (2)

6.7 Determine the values of x for which $f(x).g'(x)\leq 0$. (2)

[16]

QUESTION 7

7.1 Consider the curve $y = -2x^3 + 3x^2 + 32x + 15$
Calculate the equation of the tangent to this curve at the point $(-2;-21)$. (5)

7.2 Determine the x – value of another point on this curve where the tangent calculated in question 7.1 intersects this curve again. (5)

[10]

QUESTION 8

8.1 A tractor costing R180 000 depreciates on the reducing balance method to R65 000 at the end of 8 years. Determine the rate at which the tractor is depreciating per annum. (3)

8.2 Tebogo buys a flat at the beach front for R850 000. She takes out a loan from the bank at an interest rate of 14,25 % per annum compounded monthly. Her first instalment will commence in one month after she has taken out the loan.

8.2.1 Calculate the monthly repayments over a period of 20 years. (4)

8.2.2 If the monthly repayment is increased by 20 % before the first payment is being made towards the loan, determine the number of payments that will now be made to settle the loan. (4)

8.2.3 Calculate the final payment to settle the loan in question 8.2.2. (4)

[15]

QUESTION 9

9.1 Determine the derivative of $f(x) = -5x^2 + 3x$ from first principles. (5)

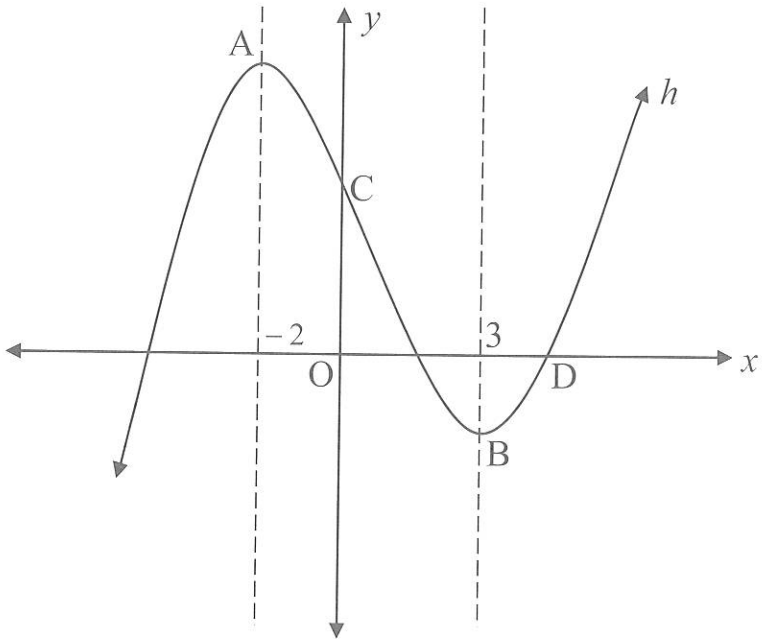
9.2 Calculate $g'(4)$ if $g(x) = \dfrac{1}{2\sqrt{x}}$ (4)

9.3 Determine $D_x[(2x-3)^3]$ (4)

[13]

QUESTION 10

$h(x) = x^3 - \frac{3}{2}x^2 + cx + d$ is sketched below. A and B are the turning points of h at $x = -2$ and $x = 3$ respectively. C is the y – intercept of h. D is the point (4 ; 0).



10.1 Show that $c = -18$ and $d = 32$. (5)

10.2 Calculate the co-ordinates of A. (2)

10.3 Determine the x – value of the point of inflection. (2)

10.4 Write down the value(s) of x for which h is concave up. (1)

10.5 If $g(x) = h(-x)$, write down the co-ordinates of the turning point of g that is the image of A. (2)

10.6 Determine the values of k for which $h(x) = k$ has 2 unequal negative real roots and one positive real root. (2)

[14]

QUESTION 11

The depth of water (in metres) left in the dam, t hours, after the sluice gate was opened to allow the flow of water to drain from the dam is given by the equation.

$$D(t) = 28 - \frac{1}{9}t^2 - \frac{1}{27}t^3.$$

11.1 Calculate the average rate of change in the depth of the water during the first 2 hours. (4)

11.2 Determine the rate at which the level of the water is decreasing after 16 hours. (4)
[8]

QUESTION 12

Study the table below and answer the questions that follow.

	Like Sport	Do not like Sport	Totals
Males	**80**	*b*	*c*
Females	*a*	**90**	*d*
Totals	**200**	**150**	**350**

12.1 Write down the values of *a*, *b*, *c* and *d*. (4)

12.2 Is the event liking a sport independent of gender? Show all working. (4)
[8]

QUESTION 13

Consider the letters of the word "DEPENDENT". Determine, using all letters

13.1 the number of unique arrangements of the letters that can be formed? (3)

13.2 the number of unique arrangements of letters that can be formed in 13.1 starting with the letter "N"? (3)

13.3 the number of unique arrangements of letters that can be formed in 13.1 starting and ending with the letter "N"? (3)
[9]

TOTAL MARKS: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

$$(x-a)^2 + (y-b)^2 = r^2$$

$$\text{In } \Delta ABC: \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A \qquad \text{area } \Delta ABC = \frac{1}{2}ab.\sin C$$

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

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

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

$$\bar{x} = \frac{\sum f.x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

$$\mathrm{P}(A) = \frac{n(\mathrm{A})}{n(\mathrm{S})} \qquad \mathrm{P(A \text{ or } B)} = \mathrm{P(A)} + \mathrm{P(B)} - \mathrm{P(A \text{ and } B)}$$

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

Education

KwaZulu-Natal Department of Education

REPUBLIC OF SOUTH AFRICA

MATHEMATICS

SEPTEMBER PREPARATORY 2018

MEMORANDUM

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 150

TIME: 3 hours

This memorandum consists of 14 pages.

QUESTION 1

1.1.1	$x=0$ *or* $x=5$	A✓ 0 A✓ 5	(2)
1.1.2	$3x^2+4x-2=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{-(4)\pm\sqrt{(4)^2-4(3)(-2)}}{2(3)}$ $=0{,}39$ *or* $-1{,}72$	A✓formula A✓substitution in correct formula CACA✓✓answers (penalize 1 mark if rounding off is incorrect-once for whole paper)	(4)
1.1.3	$\sqrt{2x+3}=x$ $2x+3=x^2$ $x^2-2x-3=0$ $(x+1)(x-3)=0$ $x=-1$ *or* $x=3$ *n/a*	A✓ squaring both sides CA✓standard form CA✓factors CA✓answers and rejecting	(4)
1.1.4	$9^x=4.3^x$ $3^{2x}-4.3^x=0$ $3^x(3^x-4)=0$ $3^x=0$ *or* $3^x=4$ *n/s* $x=\log_3 4=1{,}26$ **OR** $9^x=4.3^x$ $3^{2x}-4.3^x=0$ $(3^x-4)=0$ $3^x=4$ $x=\log_3 4=1{,}26$	A✓writing 9^x as prime base 3 CA✓factors CA✓$3^x=0$ and $3^x=4$ A✓use of logs CA✓1,26 or $\log_3 4$ **OR** A✓ writing 9^x as prime base 3 A✓dividing by $3^x:3^x\neq 0$ CA✓ and $3^x=4$ A✓use of logs CA✓1,26 or $\log_3 4$	(5) (5)

1.2	$x=2y$ and $\frac{-4}{x}+\frac{y}{2}=1\frac{1}{2}$ $\frac{-4}{2y}+\frac{y}{2}=\frac{3}{2}$ $-4+y^2=3y$ $y^2-3y-4=0$ $(y-4)(y+1)=0$ $y=4$ *or* $y=-1$ $x=8$ *or* $x=-2$	A✓substitution CA✓simplification CA✓standard form CA✓factors CA✓ both y – values CA✓ both x – values	(6)
1.3	$2^{-x}(x+4)\leq 0$ $2^{-x}>0$ for all $x\in R$ $\therefore x+4\leq 0$ $x\leq -4$	AA✓✓ $2^{-x}>0$ CA✓ $x+4\leq 0$ CA✓ answer **OR** If graphical Solution is used: 2 Marks for sketches (AA) 2 Marks for solution (CACA)	(4)
			[25]

QUESTION 2

2.1	73 ; 99	AA✓✓answers	(2)
2.2	**9** **19** **33** **51** **1D** **10** **14** **18** **2D** **4** **4** $2a=4$ $a=2$ $3a+b=10$ $b=4$ $a+b+c=9$ $c=3$ $T_n=2n^2+4n+3$	A✓ a value CA✓b value CA✓ c value CA✓answer	(4)

	OR $T_n = T_1 + (n-1)d_1 + \frac{(n-1(n-2)}{2}d_2$ $= 9 + (n-1)(10) + \frac{(n-1(n-2)}{2}(4)$ $= 9 + 10n - 10 + 2n^2 - 6n + 4$ $= 2n^2 + 4n + 3$	**OR** A✓formula CA✓substitution into correct formula CA✓simplifying CA✓answer	(4)
2.3	$T_n = 2n^2 + 4n + 3$ $= 2(n^2 + 2n + 1) + 1$ $2(n^2 + 2n + 1)$ is even for all $n \in N$ $\therefore 2(n^2 + 2n + 1) + 1$ is odd for all $\in$ N **OR** For the first difference $T_n = 4n + 6 = 2(2n + 3)$ An even number of the first difference is always added to first term of the quadratic sequence to get an odd number. This process continues to produce all odd numbers of the sequence.	CA✓rewriting n^{th} term A✓reasoning A✓ reasoning **OR** CA✓ for nth term of first difference A✓reasoning A✓reasoning NB. If a candidate presents the following argument: The first term (9) is odd. To get next term , an even number is always added. This will give an odd number all the time. Award 1/3	(3) (3)
			[9]

QUESTION 3

3.1	$3-t\ ;\ -t\ ;\ \sqrt{9-2t}$ $-t-(3-t)=\sqrt{9-2t}-(-t)$ $-t-3+t=\sqrt{9-2t}+t$ $-3-t=\sqrt{9-2t}$ $9+6t+t^2=9-2t$ $t^2+8t=0$ $t(t+8)=0$ $t=0 \quad or \quad t=-8$ n/a	A✓ equating differences CA✓standard form of equation CA✓factors CA✓answers with rejection	(4)
3.2	Pattern is $11\ ;\ 8\ ;\ 5\ ;\ 2\ ;\ -1\ ;\ ...$ $\therefore$ 4 terms are positive. **OR** $11\ ;\ 8\ ;\ 5$ $T_n=-3n+14>0$ $n<\frac{14}{3}$ $i.e.\ n<4\frac{2}{3}$ 4 terms are positive. Answer only full marks	AA✓✓all 5 terms listed CA✓answer CA✓n^{th} term > 0 CA✓ $n<4\frac{2}{3}$ CA✓ conclusion	(3) (3)
			[7]

QUESTION 4

4.1.1	$r=(x-3)$	A✓answer	(1)
4.1.2	$-1<r<1$ $-1<x-3<1$ $2<x<4$	A✓condition CA✓substitution of common ratio CA✓answer	(3)

4.2	$3\ ;\ 3+p\ ;\ 3+2p\ ;\ \ldots$ *and* $3\ ;\ 3p\ ;\ 3p^2\ ;\ \ldots\ldots$ $T_{10}=3+9p$ $S_\infty=\frac{3}{1-p}$ $T_{10}=3+9p=\frac{3}{1-p}$ $(3+9p)(1-p)=3$ $3+6p-9p^2=3$ $9p^2-6p=0$ $3p(3p-2)=0$ $p=0 \quad or \quad p=\frac{2}{3}$ n/a	A✓ $3+9p$ A✓ $\frac{3}{1-p}$ CA✓equating CA✓standard form CA✓ p – values and rejecting	(5)
			[9]

QUESTION 5

5.1	$f(x)=\frac{x+2}{x+2}-\frac{5}{x+2}$ $=1-\frac{5}{x+2}$	A✓writing numerator as $x+2-5$	(1)
5.2	$x=-2$ *and* $y=1$	A✓ $x=-2$ A✓ $y=1$	(2)
5.3	y – intercept: $\left(0\ ;-\frac{3}{2}\right)$ x – intercept: $(3\ ;0)$	A✓ y – intercept A✓ x – intercept (co-ordinate form not needed)	(2)
5.4	$y=x+c$ $1=-2+c \quad \therefore c=3$ **OR** $f(x)=\frac{x-3}{x+2}=\frac{x+2-5}{x+2}=\frac{-5}{x+2}+1$ $y=x+2+1=x+3$ $c=3$	CA✓substitution of the point $(-2\ ;1)$ CA✓ answer **OR** CA✓$y=x+3$ (m must be 1) CA✓ answer	(2) (2)
			[7]

QUESTION 6

6.1	$f(x) = \log_p x$ $-1 = \log_p 2$ $p^{-1} = 2$ $p = \frac{1}{2}$	A✓ substitution of the point $(2 ; -1)$ A✓ answer	(2)
6.2	$B(1 ; 0)$	A✓ answer	(1)
6.3	At A the x – co-ordinate is the same as the axis of symmetry value of the graph of g. $x = \frac{1}{2}$ $\therefore y = \log_{\frac{1}{2}} \frac{1}{2}$ $= 1$ $A\left(\frac{1}{2} ; 1\right)$	CA✓ x – value CA✓ substitution CA✓ answer	(3)
6.4	$y = a(x-0)(x-1)$ $1 = a\left(\frac{1}{2}-0\right)\left(\frac{1}{2}-1\right)$ $1 = -\frac{1}{4}a \quad \therefore a = -4$ $y = -4x(x-1)$ $y = -4x^2 + 4x$ $b = 4$ **OR**	CA✓substitution of x intercepts and TP CA✓a – value $(a < 0)$ CA✓substitution into equation CA✓b – value **OR**	(4)

	$y = a(x+p)^2 + q$ $y = a\left(x - \frac{1}{2}\right)^2 + 1$ $B(1\,;0)$: $0 = a\left(-\frac{1}{2}\right)^2 + 1$ $-1 = \frac{1}{4}a$ $a = -4$ $y = -4\left(x - \frac{1}{2}\right)^2 + 1$ $= -4\left(x^2 - x + \frac{1}{4}\right) + 1$ $= -4x^2 + 4x - 1 + 1$ $= -4x^2 + 4x$ $\therefore b = 4$ **OR** $B(1;0): 0 = a + b \quad \rightarrow (1)$ $A\left(\frac{1}{2};1\right): 1 = \frac{1}{4}a + \frac{1}{2}b \quad \rightarrow (2)$ $(2): 4 = a + 2b \quad \rightarrow (3)$ Substituting $a = -b$ into (3) $4 = -b + 2b$ $\therefore b = 4$ $a = -4$	CA✓ substitution of pt. B and TP. CA✓ a – value CA✓equation of parabola CA✓ b – value **OR** CA✓ subst. B(1 ; 0) to form eq. (1) CA✓subst. $A\left(\frac{1}{2};1\right)$ to form eq. (2) CA✓ b – value CA✓ a – value	(4) (4)
6.5	$y = \left(\frac{1}{2}\right)^x \quad or \quad y = 2^{-x}$	AA✓✓ answer	(2)
6.6	(0 ; 2]	AA✓✓ answer (penalize 1 for incorrect notation)	(2)
6.7	$\frac{1}{2} \leq x \leq 1$	CACA✓✓answer (penalize 1 for incorrect notation)	(2)
			[16]

QUESTION 7

7.1	$y = -2x^3 + 3x^2 + 32x + 15$ $\frac{dy}{dx} = -6x^2 + 6x + 32$ $m = -6(-2)^2 + 6(-2) + 32 = -4$ $y = mc + c$ $-21 = -4(-2) + c$ $c = -29$ $y = -4x - 29$	A✓derivative CA✓substitution of $x = -2$ into derivative and equating to gradient CA✓substituting $m = -4$ and given point CA✓c – value CA✓answer	(5)
7.2	$-2x^3 + 3x^2 + 32x + 15 = -4x - 29$ $-2x^3 + 3x^2 + 36x + 44 = 0$ $2x^2 - 3x^2 - 36x - 44 = 0$ $(x+2)(x+2)(2x-11) = 0$ $x = -2 \quad or \quad x = \frac{11}{2} = 5.5 = 5\frac{1}{2}$ $x = \frac{11}{2} = 5.5 = 5\frac{1}{2}$	CA✓equating CA✓standard form CA✓factors CA✓x – values CA✓choosing answer	(5)
			[10]

QUESTION 8

8.1	$A = P(1-i)^n$ $65000 = 180\ 000(1-i)^8$ $\frac{65\ 000}{180\ 000} = (1-i)^8$ $1-i = \sqrt[8]{\frac{65\ 000}{180\ 000}}$ $i = 1-\sqrt[8]{\frac{65\ 000}{180\ 000}}$ $i = 0{,}1195491715$ Therefore the interest rate is 11,95 % p.a.	A✓substitution into correct formula A✓ i – value A✓answer	(3)
8.2.1	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $850\ 000 = \frac{x\left[1-\left(1+\frac{0{,}1425}{12}\right)^{-240}\right]}{\frac{0{,}1425}{12}}$ $x = R10\ 724{,}61$	A✓formula A✓ substitution of P value A✓substitution of i and n values CA✓ answer N.B. Substituting i and n in the future value formula – Award 1/4	(4)
8.2.2	$120\%\ of\ \frac{10724{,}61}{1} = R12869{,}53$ $P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $850\ 000 = \frac{12869{,}53\left[1-\left(1+\frac{0{,}1425}{12}\right)^{-n}\right]}{\frac{0{,}1425}{12}}$ $\left(1+\frac{0{,}1425}{12}\right)^{-n} = 0{,}2156861983$ $-n = \log_{\left(1+\frac{0{,}1425}{12}\right)} 0{,}2156861983$ $-n = -129{,}938569$ $\therefore n = 129{,}938569$ $n = 130$ payments	CA✓ x = 12869,53 CA✓ substitution into correct formula CA✓use of logs CA✓answer	(4)

8.2.3	Balance on loan $P_v = \dfrac{12869{,}53\left[1-\left(1+\dfrac{0{,}1425}{12}\right)^{-0{,}938569}\right]}{\dfrac{0{,}1425}{12}}$ $= R11\,941{,}51$ Final Instalment $= 11941{,}51\left(1+\dfrac{0{,}1425}{12}\right) = 12083{,}32$ **OR** Balance on loan = A - F $= 850000\left(1+\dfrac{0{,}1425}{12}\right)^{129} - \dfrac{12869{,}53\left[\left(1+\dfrac{0{,}1425}{12}\right)^{129}-1\right]}{\dfrac{0{,}1425}{12}}$ $= R11\,941{,}51$ Final Instalment $= 11941{,}51\left(1+\dfrac{0{,}1425}{12}\right) = 12083{,}32$	CA✓ n – value CA✓ substitution into present value formula CA✓ $R11\,941{,}51$ CA✓ R12083,32 **OR** CA✓ n – value CA✓ substitution into formulae CA✓ $R11\,941{,}51$ CA✓ R12083,32	(4) (4)
			[15]

QUESTION 9 (penalize 1 mark once for incorrect notation in this question)

9.1	$f'(x) = \lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $= \lim\limits_{h\to 0}\dfrac{-5(x+h)^2+3(x+h)-\left(-5x^2+3x\right)}{h}$ $= \lim\limits_{h\to 0}\dfrac{-5x^2-10xh-5h^2+3x+3h+5x^2-3x}{h}$ $= \lim\limits_{h\to 0}\dfrac{h(-10x-5h+3)}{h}$ $= -10x+3$	A✓formula A✓substitution CA✓ simplification of numerator CA✓factorization CA✓answer	(5)

9.2	$g(x)=\frac{1}{2\sqrt{x}}=\frac{1}{2}x^{-\frac{1}{2}}$ $g'(x)=-\frac{1}{4}x^{-\frac{3}{2}}$ $g'(4)=-\frac{1}{4}(4)^{-\frac{3}{2}}=-\frac{1}{4}\left(2^2\right)^{-\frac{3}{2}}$ $=-\frac{1}{4}.\frac{1}{8}=-\frac{1}{32}$	A✓rewriting in exponential form CA✓derivative CA✓substituting 4 into derivative CA✓answer	(4)
9.3	$D_x\left[(2x-3)^3\right]$ $=D_x\left[8x^3-36x^2+54x-27\right]$ $=24x^2-72x+54$	A✓cubing the binomial CACACA✓✓✓each answer	(4)
			[13]

QUESTION 10

10.1	$h(x)=x^3-\frac{3}{2}x^2+cx+d$ $h'(x)=3x^2-3x+c$ $h'(3)=3(3)^2-3(3)+c=0$ $27-9+c=0$ $c=-18$ $h(x)=x^3-\frac{3}{2}x^2-18x+d$ $h(4)=(4)^3-\frac{3}{2}(4)^2-18(4)+d=0$ $64-24-72+d=0$ $d=32$ **OR** $h'(x)=3x^2-3x+c$ $h'(x)=3(x+2)(x-3)=3x^2-3x-18$ $c=-18$ $h(x)=x^3-\frac{3}{2}x^2-18x+d$ $h(4)=64-24-72+d=0$ $d=32$	**OR** $h'(-2)=3(-2)^2-3(-2)+c=0$ $12+6+c=0$ $c=-18$	A✓derivative A✓subst. 3 or – 2 into derivative and equating to 0 A ✓simplifying A✓subst. 4 into h and equating to 0 A✓simplifying **OR** A✓derivative A✓derivative using stationary values A✓ simplifying A✓equating coefficients of polynomials to get c – value A✓substituting $x=4$ onto equation to get d – value	(5) (5)

10.2	$h(x) = x^3 - \frac{3}{2}x^2 - 18x + 32$ $h(-2) = (-2)^3 - \frac{3}{2}(-2)^2 - 18(-2) + 32 = 54$ $A(-2\,;54)$	A✓subst. $x = -2$ into h A✓ y – value	(2)
10.3	$x = \frac{-2+3}{2}$ $x = \frac{1}{2}$ **OR** $h(x) = x^3 - \frac{3}{2}x^2 - 18x + 32$ $h'(x) = 3x^2 - 3x - 18$ $h''(x) = 6x - 3 = 0$ $x = \frac{1}{2}$	A✓ $x = \frac{-2+3}{2}$ CA✓answer **OR** A✓second derivative equal to 0 CA✓ x – value	(2) (2)
10.4	$x > \frac{1}{2}$	CA✓answer	(1)
10.5	$(2\ ;\ 54)$	A x=2 CA y=54✓✓answer	(2)
10.6	$32 < k < 54$	CACA✓✓answer	(2)
			[14]

QUESTION 11

11.1	$D\left[28-\frac{1}{9}t^2-\frac{1}{27}t^3\right]$. $D(2)=28-\frac{1}{9}(2)^2-\frac{1}{27}(2)^3=\frac{736}{27}=27\frac{7}{27}=27{,}26$ Average Rate of change $=\frac{27{,}26-28}{2-0}=-\frac{10}{27}=-0{,}37$	A✓subst. t = 2 A✓27,26 CA✓subst. into average rate of change CA✓answer	(4)
11.2	$D=28-\frac{1}{9}t^2-\frac{1}{27}t^3$. $D'(t)=-\frac{2}{9}t-\frac{1}{9}t^2$ $D'(16)=-\frac{2}{9}(16)-\frac{1}{9}(16)^2$ $=-32m/h$ The water level is decreasing at 32 *m/h*.	A✓ A✓derivative CA✓subst. t = 16 CA✓ $-32m/h$	(4)
			[8]

QUESTION 12

12.1	$a = 120$; $b = 60$; $c = 140$; $d = 210$	A✓a – value and A✓b – value A✓c – value and A✓d – value	(4)
12.2	$\text{P(Male)} = \frac{140}{350}$ $\text{P(liking sport)} = \frac{200}{350}$ $\text{P(Male and liking sport)} = \frac{80}{350} = \frac{8}{35}$ $\text{P(Male)} \times \text{P(liking sport)}$ $= \frac{140}{350} \times \frac{200}{350} = \frac{8}{35}$ P(Male liking sport) = P(Male)× P(liking sport) ∴ The events are independent. **OR** $\text{P(Female)} = \frac{210}{350}$ $\text{P(liking sport)} = \frac{200}{350}$ $\text{P(Female and liking sport)} = \frac{120}{350} = \frac{12}{35}$ $\text{P(Female)} \times \text{P(liking sport)}$ $= \frac{210}{350} \times \frac{200}{350} = \frac{12}{35}$ P(Female liking sport) = P(Female)× P(liking sport) ∴ The events are independent.	CA✓ $\text{P(Male)} = \frac{140}{350}$ CA✓ $\text{P(Male and liking sport)} = \frac{8}{35}$ $\text{P(Male)} \times \text{P(liking sport)}$ CA✓ $= \frac{140}{350} \times \frac{200}{350} = \frac{8}{35}$ CA✓conclusion **OR** CA✓ $\text{P(Female)} = \frac{140}{350}$ CA✓ $\text{P(Female and liking sport)} = \frac{12}{35}$ $\text{P(Female)} \times \text{P(liking sport)}$ CA✓ $= \frac{140}{350} \times \frac{200}{350} = \frac{12}{35}$ CA✓conclusion	(4) (4)
			[8]

QUESTION 13

13.1	There are 9 letters: 3 Es, 2Ds and 2Ns. The number of different words are $= \frac{9!}{3! \times 2! \times 2!}$ $= 15120$	A✓ $9!$ A✓ $3! \times 2! \times 2!$ A✓answer	(3)
13.2	If we take one of the letters for the first letter, there are seven letters remaining, of which there are 3Es and 2 Ds. Hence the number of words $= \frac{1.8!}{3! \times 2!}$ $= 3360$	A✓ $8!$ A✓ $3! \times 2!$ A✓answer	(3)
13.3	If both Ns are used for the first and last , there are 7 letters remaining of which there are 3Es and 2Ds. Hence the number of word $= \frac{1.7!.1}{3! \times 2!}$ $= 420$	A✓ $7!$ A✓ $3! \times 2!$ A✓answer	(3)
			[9]

Total Marks : 150