KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

COMMON TEST

JUNE 2023

MARKS: 150

TIME: 3 hours

Stanmorephysics

N.B. This question paper consists of 11 pages, and an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1.   This question paper consists of 11 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 the following equations.

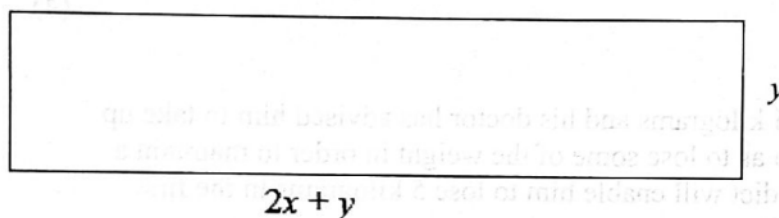1.1.1 $x^2 - 2x = 0$ (3)

1.1.2 $5x^2 = -11x + 3$ (give your answer to 2 decimal places)   (3)

1.1.3 $x^2 - 2x \le 8$ (4)

1.1.4 $\sqrt{\dfrac{2^{2023} + 2^{2022}}{2^{2022}} + x^2 - x} = x$ (4)

1.2   The roots of a quadratic equation are:

$x = \dfrac{10 \pm \sqrt{-m-8}}{2}$, for which values of m are the roots non real?   (2)

1.3   A rectangle has a length of $(2x + y)$ metres and a width of y metres as shown in the diagram. The perimeter of the rectangle is 24 metres and the area is 32m^2.

```
 _____
|                                |
|                                | y
|_____|
            2x + y
```

1.3.1   Show that the expression for the perimeter is: $24 = 4x + 4y$ (1)

1.3.2   Show that the expression for the area is : $32 = y^2 + 2xy$ (1)

1.3.3   Determine the dimensions of the rectangle if $x > 0$.   (6)

                                                                                                           [24]

QUESTION 2

$T_n = -2n^2 + 40n + 103$ is the general term of a quadratic sequence.

2.1   Determine T_1 the first term of the quadratic sequence.   (2)

2.2   Determine the second difference of this quadratic sequence.   (2)

2.3   Which term of the quadratic sequence has a value of 301?   (3)

2.4   Which term is the largest term in this quadratic sequence?   (2)
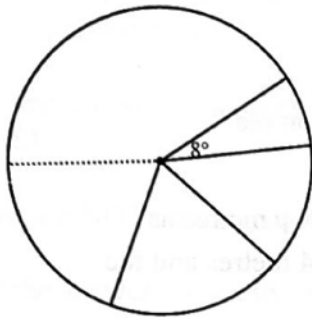
                                                                                                           [9]

QUESTION 3

3.1   The following sequence is a combination of arithmetic and geometric
        sequence: 3 ; 3 ; 9 ; 6 ; 15 ; 12 ; ....

        3.1.1   Write down the next two terms.   (2)

        3.1.2   Determine $T_{20} - T_{21}$ (5)

3.2   The given circle is completely divided into n sectors in such a way that the
        angles are in arithmetic sequence. If the smallest angle is 8° and the largest
        angle is 52°, calculate n, the number of sectors.

                                                                                                    (4)

3.3   George is currently 115 kilograms and his doctor has advised him to take up
        a healthy eating plan so as to lose some of the weight in order to maintain a
        healthy body. His new diet will enable him to lose 5 kilograms in the first

        week, thereafter he would lose $\frac{3}{4}$ of the previous week's weight loss each

        week.

        3.3.1   If he follows the new eating plan, how many kilograms will he
                   lose on the eighth day? Give your answer correct to 3 decimal
                   places.   (2)

        3.3.2   If he follows the new eating plan indefinitely, write his weight loss
                   in sigma notation.   (2)

        3.3.3   If he follows the new eating plan indefinitely, what will his new
                   weight eventually be?   (3)

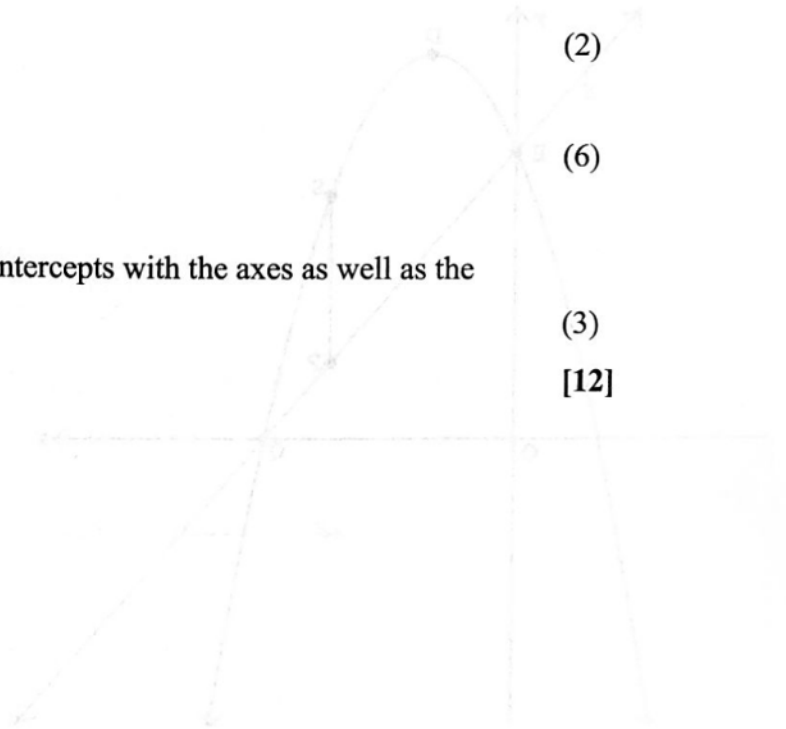   **[18]**

QUESTION 4

The graph of $h(x) = \dfrac{a}{3-x} + p$ passes through points $(2; -5)$ and $(0; -1)$.

4.1   Write down the equation of the vertical asymptote of h.   (1)

4.2   Write down the domain of h.   (2)

4.3   Determine the values of a and q.   (6)

4.4   Draw the graph of h, showing the intercepts with the axes as well as the asymptotes.   (3)
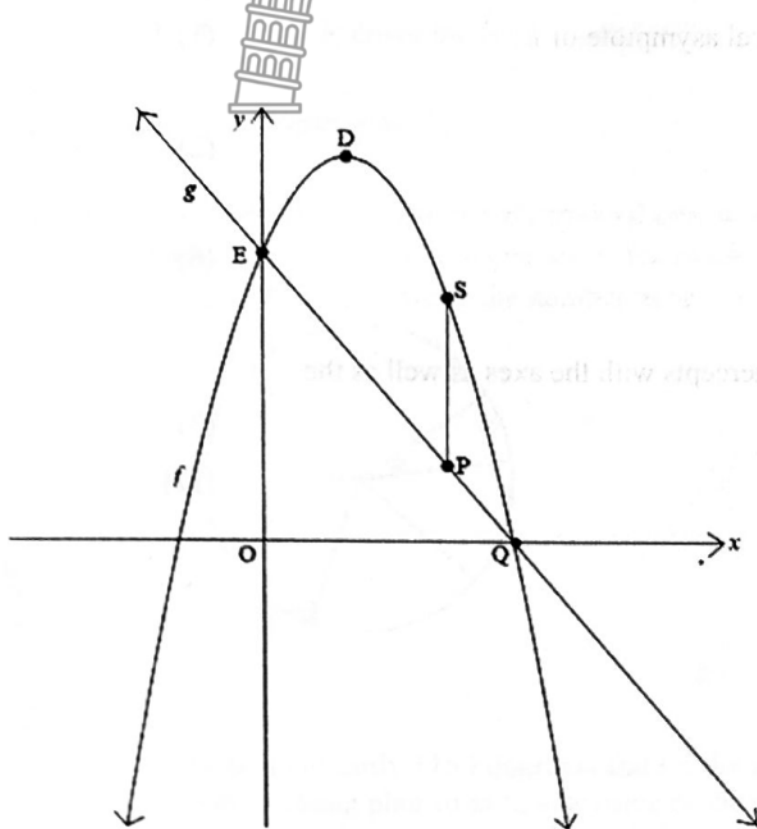
[12]

QUESTION 5

The graphs of $f(x) = -2(x-3)(x+1)$ and $g(x) = mx + c$ are drawn below.
Q is the x - intercept of both graphs and E is the y - intercept of both graphs.
D is the turning point of f. SP is parallel to the y - axis.

5.1   Show that the coordinates of E are $(0; 6)$ (1)

5.2   Determine the coordinates of D, the turning point of f.   (4)

5.3   If $h(x) = -f(x+3)$, determine the coordinates of the turning point of h.   (2)

5.4   Write down the coordinates of Q   (1)

5.5   Determine the equation of g.   (3)

5.6   Determine the value of x, for which the length of SP between E and Q is a
       maximum.   (3)

5.7   Determine the value of k for which $f(x) = k$ has one negative and one
       positive roots.   (1)

                                                                                          [15]

QUESTION 6

The graph of $h(x) = ax^2$ for $x \geq 0$ is drawn below. Point A $(1;3)$ lies on the graph of h.
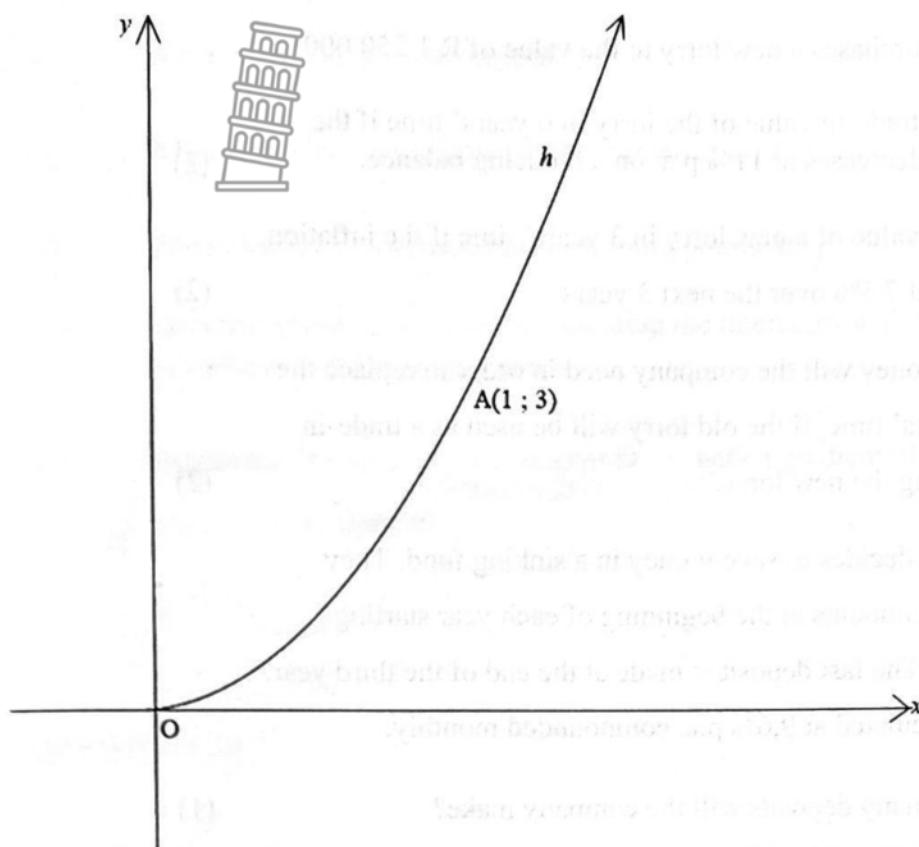
6.1   Determine the value of a.   (2)

6.2   Determine the equation of h^{-1} the inverse of h in the form $y = \ldots\ldots\ldots$ (2)

6.3   Draw the graph of h^{-1}, showing the coordinates of another point.   (2)

6.4   Is h^{-1} a function? Motivate your answer.   (2)

[8]

QUESTION 7

7.1   Convert a nominal interest rate of 7,12% p.a. compounded quarterly to a
        yearly effective interest rate.   (3)

7.2   A transport company purchases a new lorry to the value of R 1 250 000.

        7.2.1   Calculate the trade-in value of the lorry in 6 years' time if the
                  lorry's value decreases at 11% p.a. on a reducing balance.   (2)

        7.2.2   Calculate the value of a new lorry in 3 years' time if the inflation
                  rate remains at 7,5% over the next 3 years.   (2)

        7.2.3   How much money will the company need in order to replace the
                  lorry in 3 years' time, if the old lorry will be used as a trade-in
                  towards buying the new lorry.   (2)

        7.2.4   The company decides to save money in a sinking fund. They
                  deposit equal amounts at the beginning of each year starting
                  immediately. The last deposit is made at the end of the third year.
                  Interest is calculated at 9,6% p.a. compounded monthly.

                  (a)   How many deposits will the company make?   (1)

                  (b)   How much will the company deposit each time?   (5)

                                                                                         [15]

QUESTION 8

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

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

        8.1.2   Determine the average gradient of $f(x)$ between $x = -1$ and
                  $x = 2$ (3)

8.2   Determine the following:

        8.2.1 $g'(x)$ if $g(x) = (7x - 1)(3 - x)$ (2)

        8.2.2 $\dfrac{dy}{dx}$ if $\dfrac{y}{\sqrt{x}} = 5\sqrt{x} + \dfrac{1}{2\sqrt{x}} - \dfrac{6}{x}$ (4)

                                                                                         [14]

QUESTION 9

Given: $f(x) = (x-3)(x-3)(x+2) = x^3 - 4x^2 - 3x + 18$

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

9.2   Write down the co-ordinates of the x intercepts of f.   (3)

9.3   Determine the co-ordinates of the turning points of f.   (4)

9.4   Draw the graph of f, clearly indicating the intercepts with the axes and the
        co-ordinates of the turning points.   (3)

9.5   Determine the equation of a tangent to f with a gradient of -3 at the point
        where x is an integer.   (4)

                                                                                                          [15]

QUESTION 10

In 2020, the scientists stated that the number of people infected with the Covid 19 Virus in a
certain country was given by the equation $N(t) = -\frac{1}{2}t^3 + 3t^2$, where $N(t)$ was the number of
infected people in thousands and t was the number of months.

10.1   How many people were infected at the beginning? (at zero months).   (1)

10.2   At what rate was the virus spreading in the second month?   (2)

10.3   After how many months did the virus reach its peak?   (4)

10.4   How many people were infected when the virus reached its peak?   (2)

                                                                                                          [9]

QUESTION 11

11.1 A study on the favorite cell phone of Grade 11 and Grade 12 learners at Greendale High School yielded the following results.

	I PHONE	SAMSUNG	TOTAL
GRADE 11	a	d	50
GRADE 12	b	c	100
TOTAL	60	90	150

11.1.1 Are events Samsung and Grade 11 learners mutually exclusive? Motivate your answer. (2)

11.1.2 If the learners' preference for cell phones is independent of their grade, determine the value of d. (4)

11.2 During a TV Game Show, contestants have to answer randomly generated questions within a fixed time:

- The probability of the first question being answered correctly is 0,8.

- Whenever a question is answered correctly, the next question is more
- difficult and the probability of a correct answer is reduced by 0,1.

- This means that the probability of getting the second answer correct is 0,7.

- Whenever the question is answered incorrectly, the next question is of the same standard and the probability of it being answered correctly remains unchanged.

11.2.1 After how many consecutive correct answers will the probability of getting the next question correct, be zero? (1)

11.2.2 Calculate the probability of getting the second answer correct (4)

[11]

TOTAL MARKS: 150

INFORMATION SHEET: MATHEMATICS
INLIGTING BLADSY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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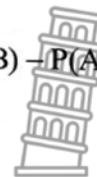
FINAL

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NATIONAL
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GRADE 12

MATHEMATICS P1

MARKING GUIDELINE

COMMON TEST

JUNE 2023

MARKS: 150

This memorandum consists of **20** pages.

QUESTION 1

1.1.1	$x(x-2)=0$	A✓ factors	
	$x=0$ or $x=2$	A✓ $x=0$	
		A✓ $x=2$	(3)
1.1.2	$5x^2+11x-3=0$	A✓ standard form	
	$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$		
	$x=\dfrac{-11\pm\sqrt{(11)^2-4(5)(-3)}}{2(5)}$	CA✓ substitution	
	$x=0,25$ or $-2,45$	CA✓ answers	(3)
1.1.3	$x^2-2x-8\le 0$	A✓ standard form	
	$(x-4)(x+2)\le 0$	CA✓ factors	
		CA✓ critical values	
	$x\in[-2;4]$ OR $-2\le x\le 4$	A✓ correct notation	
	OR	**OR**	
	$x^2-2x-8\le 0$	A✓ standard form	
	$(x-4)(x+2)\le 0$	CA✓ factors	
		CA✓ end values	
	$x\in[-2;4]$ OR $-2\le x\le 4$	A✓ correct notation	(4)
1.1.4	$\sqrt{\dfrac{2^{2022}(2+1)}{2^{2022}}+x^2-x}=x$	A✓ factors on the numerator	
	$\sqrt{3+x^2-x}=x$	CA✓ simplifying	
	$\left(\sqrt{3+x^2-x}\right)^2=x^2$	CA✓ squaring	
	$3+x^2-x=x^2$		

	$3 - x = 0$ $x = 3$	CA✓answer	(4)
1.2	$-m - 8 < 0$ $-8 < m$ **OR** $-m - 8 < 0$ $-m < 8$ $m > -8$	A✓ A✓ answer **OR** A✓ A✓answer	(2)
1.3.1	Perimeter $= 2l + 2b$ $24 = (2x + y) + y + (2x + y) + y$ $24 = 4x + 4y$	A✓	(1)
1.3.2	Area $= lb$ $32 = y(2x + y)$ $32 = y^2 + 2xy$	A✓	(1)
1.3.3	$24 = 4x + 4y \dots \dots \dots (1)$ $6 = x + y$ $x = 6 - y$ \hspace{2em} (3) $32 = y^2 + 2xy \dots \dots \dots (2)$ $32 = 2y(6 - y) + y^2$ $32 = 12y - 2y^2 + y^2$ $32 = 12y - y^2$ $y^2 - 12y + 32 = 0$ $(y - 4)(y - 8) = 0$ $y = 4$ or 8 $y = 4$ only $x = 6 - 4 = 2$ $\therefore$ length = 8m and width = 4m	A✓ equation 3 CA✓substitution CA✓factors CA✓ y values CA✓ x value CA✓ answer	(6)
			[24]

QUESTION 2			
2.1	$T_1 = -2(1)^2 + 40(1) + 103$ $T_1 = 141$	A✓ substitution A✓ answer	(2)
2.2	141 ; 175 ; 205 ; 231 ; .... 34 ; 30 ; 26 ; .... −4 ; −4 ; .... The second difference is −4 **OR** $2a =$ second difference $2(-2) = -4$ The second difference is −4	A✓ first difference A✓ answer **OR** A✓ A✓ answer	(2)
2.3	$301 = -2n^2 + 40n + 103$ $2n^2 - 40n + 198 = 0$ $n^2 - 20n + 99 = 0$ $(n-9)(n-11) = 0$ $n = 9$ or 11	A✓ equating A✓ standard form CA✓ answers **(conditional if answers are natural numbers)**	(3)
2.4	The maximum value is at the turning point At turning point $n = -\dfrac{b}{2a}$ $n = \dfrac{-40}{2(-2)} = 10$ $\therefore T_{10}$ has the maximum value. **OR** $\dfrac{dT_n}{dn} = -4n + 40$ $0 = -4n + 40$ $4n = 40$	A✓ substitution CA✓ answer **OR** A✓ derivative	
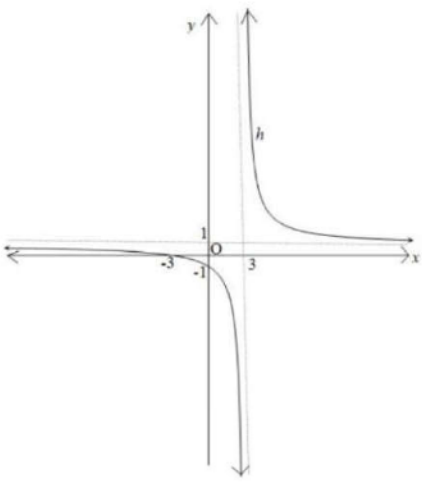
		CA✓ answer	
	$\therefore T_{10}$ has the maximum value.		
	$T_n = -2n^2 + 40n + 103$ has a maximum value	A✓ $T_9 = 301$ and	
	$T_9 = 301$		
	$T_{11} = 301$	$T_{11} = 301$	
	$\therefore T_{10}$ has the maximum value.	CA✓ answer	
		CA✓ answer	
	Answer only, full marks		
			(2)
			[9]

QUESTION 3 (DO NOT MARK 3.3.1)

3.1.1	21 ; 24	A✓ A✓	(2)
3.1.2	T_{20} of original sequence is T_{10} of GP In the GP: 3 ; 6 ; 12 $T_n = ar^{n-1}$ $T_{10} = 3.2^9 = 512$ T_{21} of original sequence is T_{11} of AP 3 ; 9 ; 15 $T_n = a + (n-1)d$ $T_{11} = 3 + (11-1)6$ $T_{11} = 63$ $T_{20} - T_{21} = 512 - 63 = 449$	A✓ Sub in formula for GP CA✓ 512 A✓ Sub in formula for AP CA✓ 63 CA✓ answer	(5)
3.2	$a = 8°$ $l = 52°$ $S_n = 360°$ $S_n = \dfrac{n}{2}(a+l)$ $360 = \dfrac{n}{2}(8+52)$ $360 = 30n$ $12 = n$	A✓ $S_n = 360°$ A✓ values of a and l CA✓ substitution CA✓ answer(**on condition, answer is natural**)	(4)

3.3.1	$a = 5 \quad r = \dfrac{3}{4} \quad n = 8$ $T_n = ar^{n-1}$ $T_8 = 5\left(\dfrac{3}{4}\right)^7 = 0{,}667 \text{ kg}$	A✓ $a = 5$ CA✓ answer	(2)
3.3.2	$\displaystyle\sum_{n=1}^{\infty} 5\left(\dfrac{3}{4}\right)^{n-1}$	A✓ $\displaystyle\sum_{n=1}^{\infty}$ A✓ $5\left(\dfrac{3}{4}\right)^{n-1}$	(2)
3.3.3	$115 - \displaystyle\sum_{n=1}^{\infty} 5\left(\dfrac{3}{4}\right)^{n-1} = 115 - \dfrac{5}{1 - \dfrac{3}{4}}$ His weight will eventually reach $= 95\text{kg}$	A✓ $\dfrac{5}{1 - \dfrac{3}{4}}$ CA✓ subtracting CA✓ answer	(3)
			[18]

QUESTION 4 (DO NOT MARK QUESTION 4.3 AND 4.4)			
4.1	$x = 3$	A✔	(1)
4.2	$x \in R$; $x \neq 3$	A✔ A✔	(2)
4.3	$-5 = \dfrac{a}{3-2} + p$ $-5 = a + p \dots\dots\dots(1)$ $-1 = \dfrac{a}{3-0} + p$ $-3 = a + 3p \dots\dots(2)$ $2 = 2p \dots\dots\dots(2) - (1)$ $p = 1$ $-5 = a + 1$ $a = -6$	A✔ sub (2;−5) CA✔ equation 1 A✔ sub (0;−1) CA✔ equation 2 CA✔ value of p CA✔ value of a	(6)
4.4	x-intercept $0 = \dfrac{-6}{3-x} + 1$ $\dfrac{6}{3-x} = 1$ $6 = 3 - x$ $x = -3$ y-intercept $= \dfrac{-6}{3-0} + 1 = -1$ 	CA✔ x-intercept CA✔ y-intercept CA✔ shape	(3)
			[12]
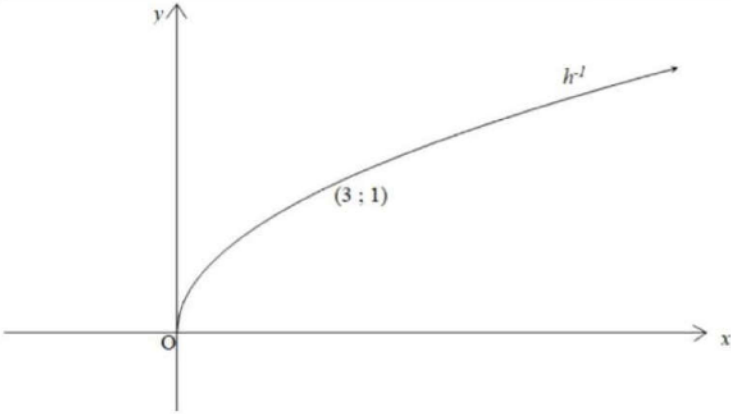
QUESTION 5

5.1	$y = -2(0-3)(0+1)$ $y = -2(-3)(1)$ $y = 6$ $E(0;6)$	A✓ substitute $x = 0$	(1)
5.2	$y = -2(x^2 - 2x - 3)$ $y = -2x^2 + 4x + 6$ Turning point $x = -\dfrac{b}{2a}$ $x = \dfrac{-4}{2(-2)} = 1$ $y = -2(1)^2 + 4(1) + 6 = 8$ $D(1;8)$ **OR** $y = -2[(x^2 - 2x + 1) - 3 - 1]$ $y = -2(x-1)^2 + 8$ $D(1; 8)$ **OR** $y = -2(x-3)(x+1)$ x-intercepts = 3 or -1 midpoint is $x = 1$ $y = -2(1-3)(1+1)$ $y = 8$ $D(1 ; 8)$	A✓ equation CA✓ substitution CA✓ x value CA✓ y value **OR** A✓ completing the square CA✓ simplifying CA✓ x value CA✓ y value **OR** A✓ x intercepts CA✓ midpoint value CA✓ x value CA✓ y value	(4)

5.3	$F(-2;-8)$	A✓ x coordinate A✓ y coordinate	(2)
5.4	$0 = -2(x-3)(x+1)$ $x = 3$ or -1 At Q $x = 3$ $Q(3;0)$	A✓	(1)
5.5	$y = mx + c$ $y = mx + 6$ $0 = m(3) + 6$ $-6 = 3m$ $-2 = m$ $y = -2x + 6$ **OR** $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $m = \dfrac{0-6}{3-0} = \dfrac{-6}{3} = -2$ $c = 6$ $y = -2x + 6$	A✓ y = mx + 6 CA✓ substitute $(3;0)$ CA✓ answer **OR** CA✓ substitute in gradient formula CA✓ m = -2 CA✓ answer	(3)
5.6	$SP = -2x^2 + 4x - 6 - (-2x + 6)$ $SP = -2x^2 + 6x$ Maximum SP is at turning point $x = -\dfrac{b}{2a}$ $x = -\dfrac{6}{2(-2)}$ $x = \dfrac{3}{2}$ **OR**	CA✓ expression for SP CA✓ substitution CA✓ answer **OR**	

		CA✓ expression for SP	
	$SP = -2x^2 + 4x - 6 - (-2x + 6)$		
	$SP = -2x^2 + 6x$	CA✓ derivative	
	$\dfrac{dSP}{dx} = -4x + 6$		
	$0 = -4x + 6$		
	$4x = 6$		
	$x = \dfrac{3}{2}$	CA✓ answer	
	OR	**OR**	
	$SP = -2x^2 + 4x - 6 - (-2x + 6)$	CA✓ expression for SP	
	$SP = -2x^2 + 6x$		
	$SP = -2(x^2 - 3x)$		
	$SP = -2\left[\left(x^2 - 3x + \left(\dfrac{-3}{2}\right)^2\right) - \left(\dfrac{-3}{2}\right)^2\right]$	CA✓ completing the square	
	$SP = -2\left[\left(x - \dfrac{3}{2}\right)^2 - \dfrac{9}{4}\right]$		
	$SP = -2\left(x - \dfrac{3}{2}\right)^2 + \dfrac{9}{2}$		
	Maximum SP is at $x = \dfrac{3}{2}$	CA✓ answer	(3)
5.7	$k < 6$	A✓	(1)
			[15]

QUESTION 6

6.1	$3 = a(1)^2$ $a = 3$	A✓ substitution CA✓ answer	(2)
6.2	$x = 3y^2$ $\dfrac{x}{3} = y^2$ $y = \pm\sqrt{\dfrac{x}{3}}$ $y = \sqrt{\dfrac{x}{3}}$	CA✓ swapping x and y CA✓ answer(+ve)	(2)
6.3		A✓ shape A✓ point	(2)
6.4	Yes, any vertical line cuts the graph at only one place. **OR** Yes, it passes the vertical line test **OR** Yes, it is a one to one function	A✓ answer CA✓ explanation	(2)
			[8]

QUESTION 7

7.1	$(1+i) = \left(1 + \dfrac{i}{m}\right)^{m}$	A✓ formula	
	$1 + \dfrac{r}{100} = \left(1 + \dfrac{7,12}{400}\right)^{4}$	A✓ substitution	
	$r = 100\left[\left(1 + \dfrac{7,12}{400}\right)^{4} - 1\right]$		
	$r = 7,31\%$	CA✓ answer	(3)
7.2.1	$A = P(1-i)^{n}$		
	$A = 1\,2500\,000\left(1 - \dfrac{11}{100}\right)^{3}$	A✓ substitution into correct formula	
	$A = R881\,211,25$	CA✓ answer	(2)
7.2.2	$A = P(1+i)^{n}$		
	$A = 1\,250\,000\left(1 + \dfrac{7,5}{100}\right)^{3}$	A✓ substitution into correct formula	
	$A = R1\,552\,871,10$	CA✓ answer	(2)
7.2.3	$R1\,552\,871,10 - R881\,211,25$	CA✓ subtraction	
	$= R671\,659,85$	CA✓ answer	(2)
7.2.4 a).	4 deposits	A✓ answer	(1)

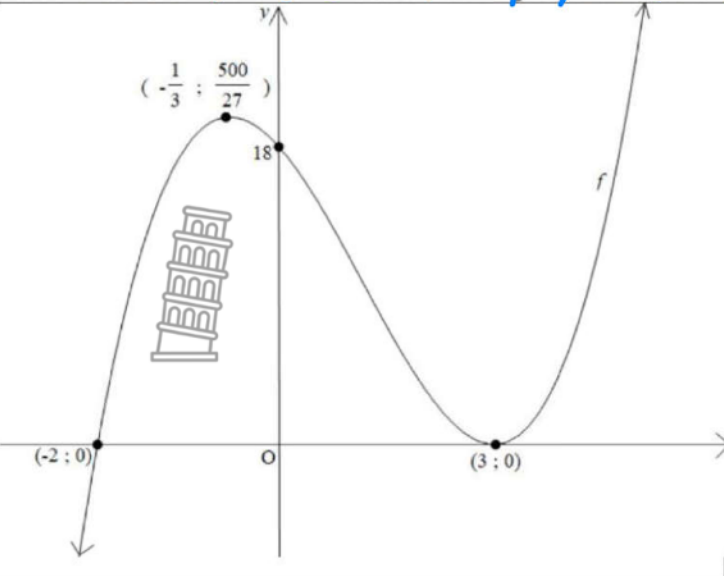| 7.2.4 b).		
	$671\ 659,85 = x\left(1+\dfrac{9,6}{1200}\right)^{36} + x\left(1+\dfrac{9,6}{1200}\right)^{24} +$ $x\left(1+\dfrac{9,6}{1200}\right)^{12} + x$ $671659,85 = x\left[\left(1+\dfrac{9,6}{1200}\right)^{36} + \left(1+\dfrac{9,6}{1200}\right)^{24} + \left(1+\dfrac{9,6}{1200}\right)^{12} + 1\right]$ $x = \text{R}144\ 650,97$	A✔ $x\left(1+\dfrac{9,6}{1200}\right)^{36}$ A✔ $x\left(1+\dfrac{9,6}{1200}\right)^{24}$ A✔ $x\left(1+\dfrac{9,6}{1200}\right)^{12} +$ x CA✔ setting up the equation CA✔ answer (5)
		[15]

QUESTION 8			
8.1.1	$f(x) = 3x^2 + 2x$ $f(x+h) = 3(x+h)^2 2(x+h) = 3x^2 + 6xh + 3h^2 + 2x + 2h$ $f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ $f'(x) = \lim\limits_{h \to 0} \dfrac{3x^2 + 6xh + 3h^2 + 2x + 2h - 3x^2 - 2x}{h}$ $f'(x) = \lim\limits_{h \to 0} \dfrac{6xh + 3h^2 + 2h}{h}$ $f'(x) = \lim\limits_{h \to 0} \dfrac{h(6x + 3h + 2)}{h}$ $f'(x) = \lim\limits_{h \to 0}(6x + 3h + 2)$ $f'(x) = 6x + 2$	A✓calculating $f(x+h)$ CA✓substitution into the formula CA✓simplification CA✓factorising CA✓answer	(5)
8.1.2	Average gradient $= 6x + 3h + 2$ $x = -1$ $h = 2 - (-1) = 3$ Ave grad $= 6(-1) + 3(3) + 2 = 5$ **OR** At $x = -1$ $y = 3(-1)^2 + 2(-1) = 1$ At $x = 2$ $y = 3(2)^2 + 2(2) = 16$ Ave grad $= \dfrac{y_2 - y_1}{x_2 - x_1}$ Ave grad $= \dfrac{16-1}{2-(-1)} = \dfrac{15}{3} = 5$	CA✓formula for average gradient A✓ value for h CA✓ answer **OR** A✓y values CA✓substituting in gradient formula CA✓answer	(3)

8.2.1	$g(x) = -7x^2 + 22x - 3$	A✓	
	$g'(x) = -14x + 22$	CA✓answer	(2)
8.2.2	$y = 5x + \dfrac{1}{2} - \dfrac{6}{\sqrt{x}}$	A✓	
	$y = 5x + \dfrac{1}{2} - 6x^{-\frac{1}{2}}$	CA✓ $2x^{-\frac{1}{2}}$	
	$\dfrac{dy}{dx} = 5 + 3x^{-\frac{3}{2}}$	CA✓ CA✓(two terms)	(4)
			[14]

QUESTION 9

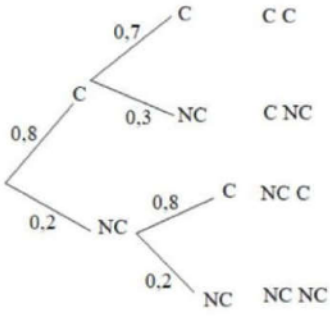| 9.1	$y = 18$	A✓	(1)
9.2	$0 = (x-3)(x-3)(x+2)$ $x = 3$ or -2	A✓ equating to zero A✓ A✓	(3)
9.3	Turning points: $f'(x) = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x+1)(x-3)$ $x = 3$ or $-\dfrac{1}{3}$ $y = (3-3)(3-3)(3+2) = 0 \qquad (3;0)$ $y = \left(-\dfrac{1}{3}-3\right)\left(-\dfrac{1}{3}-3\right)\left(-\dfrac{1}{3}+2\right) = \dfrac{500}{27} = 18,52 \qquad \left(-\dfrac{1}{3}; \dfrac{500}{27}\right)$ **OR** Turning points: $f'(x) = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x+1)(x-3)$ $x = 3$ or $-\dfrac{1}{3}$ $y = (3)^3 - 4(3)^2 - 3(3) + 18 = 0 \qquad (3;0)$ $y = \left(-\dfrac{1}{3}\right)^3 - 4\left(-\dfrac{1}{3}\right)^2 - 3\left(-\dfrac{1}{3}\right) + 18 = \dfrac{500}{27} \qquad \left(-\dfrac{1}{3}; \dfrac{500}{27}\right)$	A✓ derivative CA✓ equating to zero CA✓ x values CA✓ y values **OR** A✓ derivative CA✓ equating to zero CA✓ x values CA✓ y values	(4)

9.4		A✓ shape CA✓ turning points labelled CA✓ intercepts labelled	(3)

On the graph: $(-\frac{1}{3}; \frac{500}{27})$, 18, $(-2; 0)$, O, $(3; 0)$, f

9.5	$f'(x) = 3x^2 - 8x - 3$ $-3 = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x$ $0 = x(3x - 8)$ $x = 0 \text{ or } \dfrac{8}{3}$ $\therefore \quad x = 0$ At $x = 0 \quad y = 18$ and $m = -3$ $y = -3x + 18$	CA✓ equating $f'(x)$ to -3 CA✓ factors CA✓ $x = 0$ CA✓ answer	(4)
			[15]

QUESTION 10

10.1	No people were infected	A✓	(1)
10.2	$N'(t) = -\frac{3}{2}t^2 + 6t$ $N'(2) = -\frac{3}{2}(2)^2 + 6(2)$ $= 6000$ people/month	A✓ substitution into the derivative CA✓ answer	(2)
10.3	$N'(t) = -\frac{3}{2}t^2 + 6t$ $0 = -\frac{3}{2}t^2 + 6t$ $0 = t^2 - 12t$ $0 = t(t-4)$ $t = 0$ or 4 $\therefore$ 4 months	CA✓ equating to zero CA✓ factors CA✓ both values of t CA✓ answer	(4)
10.4	Virus reached the peak after 4 months $N(4) = -\frac{1}{2}(4)^3 + 3(4)^2$ $\therefore 16\ 000$ people	CA✓ substitution CA✓ answer	(2)
			[9]

QUESTION 11 (DO NOT MARK 11.1.1)			
11.1.1	For mutually exclusive events P(A and B) = 0	A✓No A✓explanation	(2)
11.1.2	$P(\text{Grade 11 and Samsung}) = \dfrac{d}{150}$ $P(\text{Grade 11}) \times P(\text{Samsung}) = \dfrac{50}{150} \times \dfrac{90}{150}$ $P(\text{Grade 11 and Samsung}) = P(\text{Grade 11}) \times P(\text{Samsung})$ $\therefore \dfrac{d}{150} = \dfrac{50}{150} \times \dfrac{90}{150}$ $d = \dfrac{50}{150} \times \dfrac{90}{150} \times 150 = 30$	A✓ A✓ A✓ CA✓answer	(4)
11.2.1	8	A✓	(1)
11.2.2	 $P(\text{CC or NCC}) = 0,8 \times 0,7 + 0,2 \times 0,8$ $= 0,72$	A✓ $0,8 \times 0,7$ A✓ $0,2 \times 0,8$ A✓ addition CA✓ answer	(4)
			[11]
		TOTAL MARKS: 150	

MARK THE PAPER OUT OF 137 THEN CONVERT TO 150