

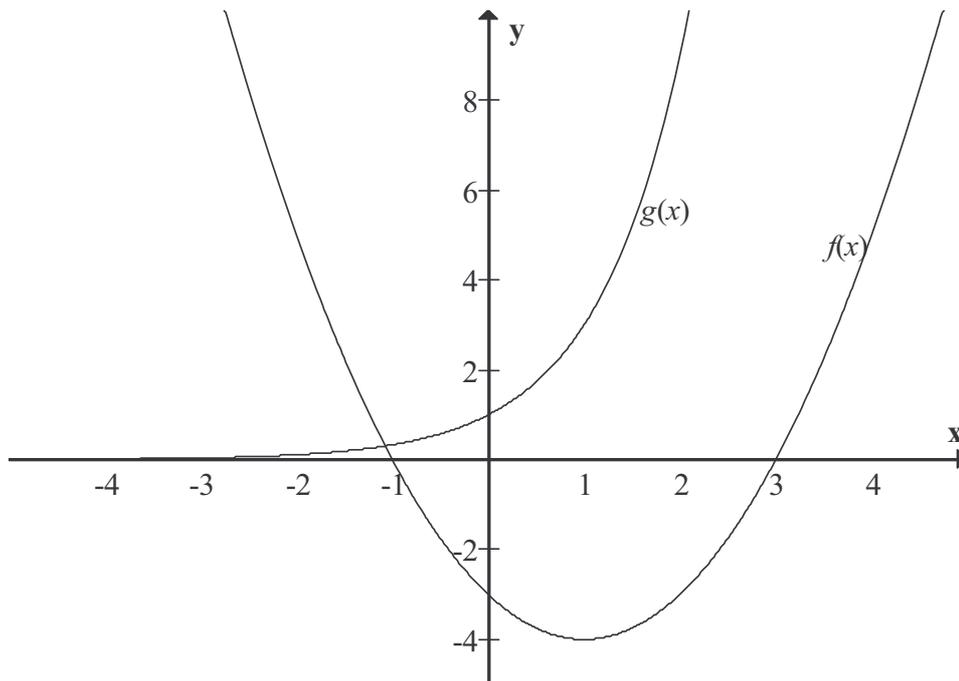
**Grade 11 Mathematics: Question Paper 1**

**MARKS: 150**

**TIME: 3 hours**

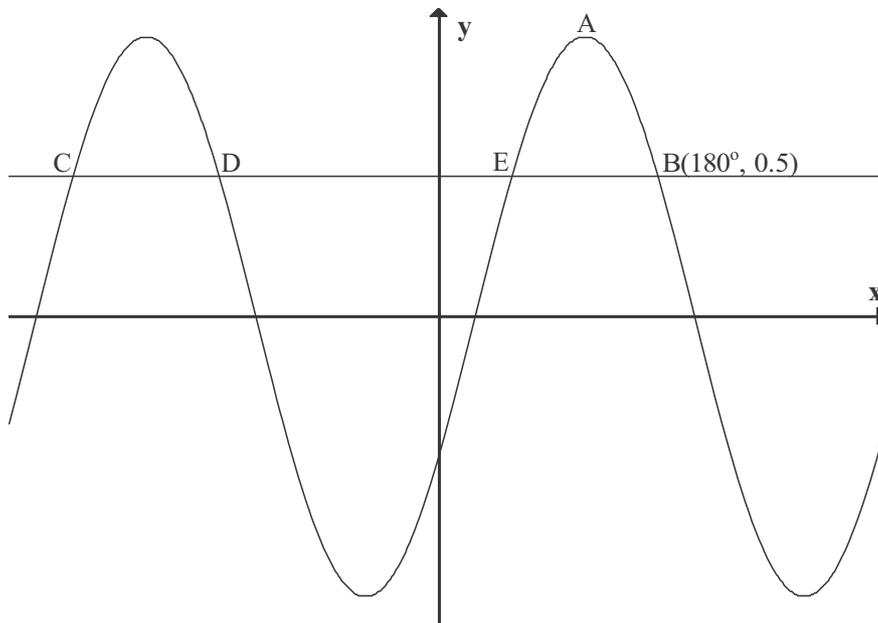
**QUESTION 1**

- 1.1 1.1.1 Which of the following numbers is non-real?  $\sqrt{3}$  or  $\sqrt{-9}$  (1)
- 1.1.2 Determine the value of  $a$ :  $(x^{\frac{1}{2}})^{\frac{2}{3}} x^3 = x^a$  (2)
- 1.1.3 Simplify:  $\sqrt{75} - \sqrt{48}$ . Leave answer in surd form. (2)
- 1.1.4 Will the product of two irrational numbers always be irrational? Support your answer with an example. (3)
  
- 1.2 Find the 6<sup>th</sup> term of each of the following sequences
  - 1.2.1 2; 5; 8; 11; ... (1)
  - 1.2.2 64; 32; 16; 8; ... (1)
  - 1.2.3 1; 4; 9; 16; ... (1)
  
- 1.3 Find:  $30000 \times (1,03)^{10}$  (1)
  
- 1.4 Answer the following questions relating to the graphs below



- 1.4.1 Which function,  $f(x)$  or  $g(x)$ , has the form  $y = 3^x$  ? (1)
- 1.4.2 What are the roots of  $f(x) = 0$ ? (2)
- 1.4.3 What is y-intercept of  $g(x)$ ? (1)
- 1.4.4 What is the range of  $g(x)$ ? (1)
- 1.4.5 Give the equation of the asymptote of  $g(x)$ . (2)
- 1.4.6 Give the equation of the axes of symmetry of  $f(x)$ . (1)

- 1.5 Answer the following questions relating to the graphs of:  
 $y = \sin(x - 30^\circ)$  and  $y = 0,5$ .



- 1.5.1 Determine the co-ordinates of A, a maximum of the graph. (2)
- 1.5.2 B, C, D and E are where the two graphs intersect. Given that B(180°; 0,5), find the coordinates of C, D and E. (6)
- 1.5.3 What is the  $y$ -intercept of the sine graph? (1)
- 1.5.4. What is the amplitude of the sine graph? (1)
- 1.6 Solve for  $x$ :
- 1.6.1  $\frac{x+2}{6} = \frac{1}{2}$  (2)
- 1.6.2  $\frac{x^2-4}{2x-4} = 7$  (4)
- 1.6.3  $x^2 - 2x - 15 = 0$  (4)
- 1.6.4  $x^2 > 4$  (3)

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**QUESTION 2**

2.1 Given the sequence:

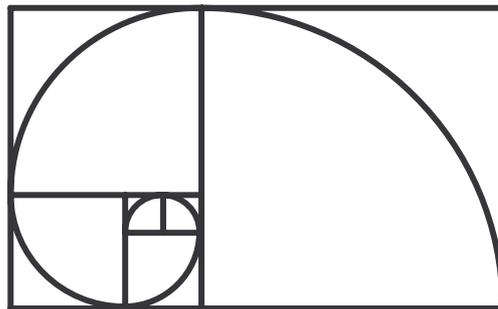
Sequence	3	6	11	18	27	$p$
1 <sup>st</sup> difference		3	5	$x$	$y$	$z$
2 <sup>nd</sup> difference		2				

- 2.1.1 Determine the values of  $x$  and  $y$ . (2)
- 2.1.2 Hence, or otherwise, predict the value of  $z$ . (1)
- 2.1.3 Determine the value of  $p$ . (2)
- 2.1.4 What do you notice about the 2<sup>nd</sup> differences? (2)
- 2.1.5 Determine the 10<sup>th</sup> term of the sequence (4)

2.2 The Fibonacci sequence has  $T_1 = 1$  and  $T_2 = 1$ .

$T_3 = T_1 + T_2$ ;  $T_4 = T_2 + T_3$ ; and  $T_5 = T_3 + T_4$  and so on

- 2.2.1 Find the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> terms (3)
- 2.2.2 In the picture below the two smallest squares each have sides of length 1 unit. What is the length of the side of the largest square? (2)



2.2.3 It is noted that:

$$T_1^2 + T_2^2 = T_3^2$$

$$T_1^2 + T_2^2 + T_3^2 = T_4^2$$

From this observation the conjecture is that:

$$T_1^2 + T_2^2 + T_3^2 + \dots + T_k^2 = T_{k+1}^2$$

Is this conjecture correct if  $k = 6$ ? You may use the diagram in 2.2.2 (5)

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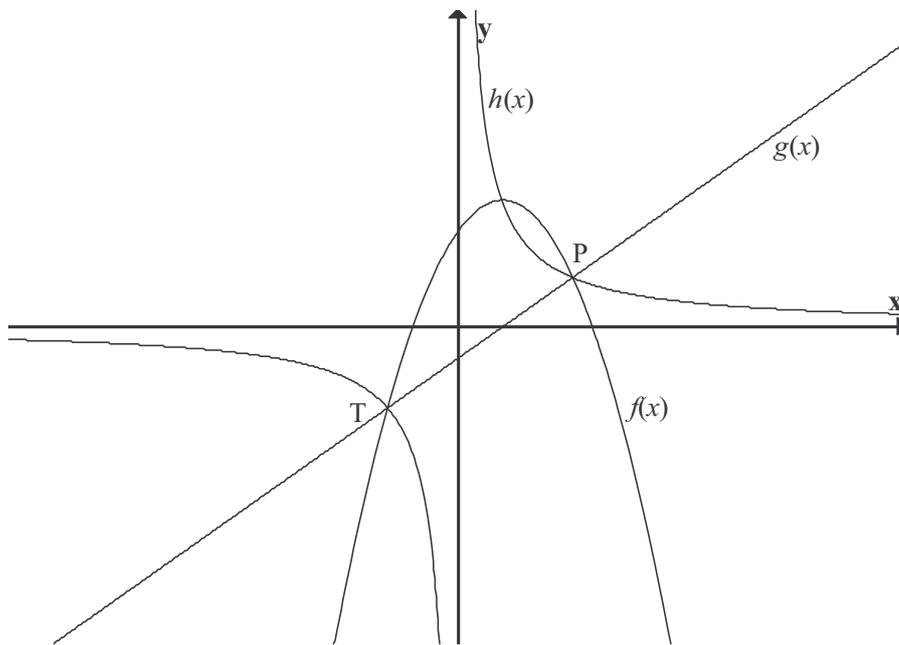
**QUESTION 3**

- 3.1 You purchase a car for R100 000 and the depreciation rate will be 13% per annum on a reducing balance. Inflation is expected to be 8% per annum for the next 5 years.
- 3.1.1 In which year will your car lose the greatest value? (1)
- 3.1.2 What will the value of your car be after 5 years? (3)
- 3.1.3 What would the cost of a new car be in 5 years time? (3)
- 3.1.4 If you used your old car as a trade in 5 years time, how much more will you need to buy a similar new car? (1)
- 3.2 A bank offers two account options
- A) 14,5 % per annum simple interest?
- B) 14 % per annum compounded monthly?
- 3.2.1 You have R10 000 to invest for one year. Which option would be the best for you? Show your working. (4)
- 3.2.2 Would your choice be different if you were investing for 6 months? Show your working. (5)

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**QUESTION 4**

The graphs of  $f(x)$ ;  $g(x)$  and  $h(x)$  are drawn below:

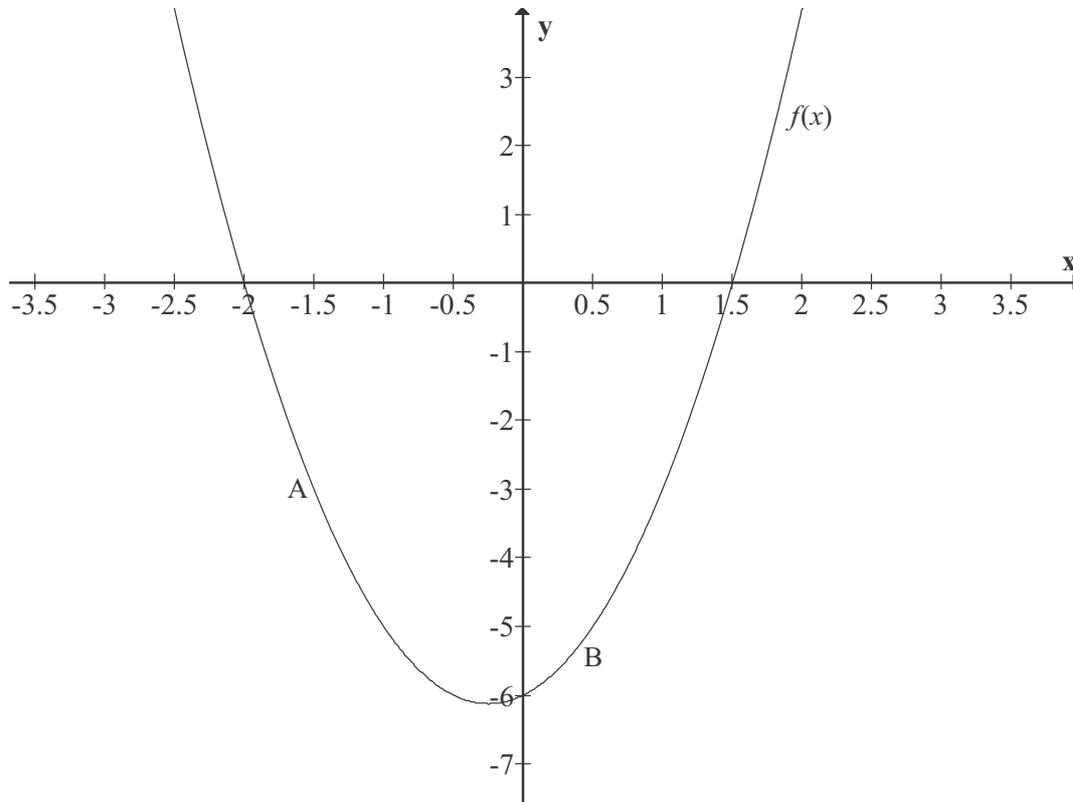


- 4.1 Given  $g(x) = x - 1$ . Find the  $x$ -value such that  $g(x) = 6$ . (1)
- 4.2  $f(x) = x^2 - 2x + 3$
- 4.2.1 Determine the roots of  $f(x) = 0$ . (3)
- 4.2.2 Find the equation of the axis of symmetry of  $f(x)$ . (2)
- 4.2.3 Find the co-ordinates of the turning point of  $f(x)$ . (2)
- 4.3  $h(x) = \frac{a}{x}$  and passes through the point  $(1; 4)$
- 4.3.1 Determine the value of  $a$ . (1)
- 4.3.2 For which values of  $x$  are  $h(x)$  decreasing as  $x$  is increasing? (2)
- 4.3.3 The graphs of  $h(x)$  and  $g(x)$  intersect at P. Determine the co-ordinates of P correct to 2 decimal places. (5)
- 4.3.4 Show that all three graphs are concurrent at P (2)
- 4.4 Determine the  $x$ -values for which  $h(x) - g(x) > 0$  (4)

**[22]**

**QUESTION 5**

The graph of the function  $f(x)$  is given below where  $f(x) = 2x^2 - x - 6$



- 5.1 The x-coordinates of A and B are  $x = -1,5$  and  $x = 0,5$  respectively. Determine the y-coordinates of A and B. (2)
- 5.2 Determine the average gradient between A and B. (2)
- 5.3 For what values of  $x$  is  $f(x)$  increasing? (3)
- 5.4 Use your graph to determine the coordinates of a point C, where the average gradient between A and C would be 0. (2)
- 5.5 Find the coordinates of a point D such that the average gradient between B and D is 5. (2)

**[11]**

**QUESTION 6**

A disease is killing off a population of fish in a dam at a rate of 10 % every 24 hours. The function  $p(x) = A(1 - i)^t$  where  $A$  is the initial population,  $i$  is the rate of decrease and  $t$  is the number of days that have passed.

The following data is collected by researchers:

Days after disease identified ( $t$ )	0	1	2	3
Fish Population	$A$	4500	4050	3645

- 6.1 Plot this information on a graph. (3)
- 6.2 Determine  $A$  the initial population of fish in the dam. (3)
- 6.3 After how many days will the population of fish be halved? Indicate your solution on your graph. (5)
- [11]

**QUESTION 7**

- 7.1 Solve for  $x$ :

$$\frac{3}{x+2} - \frac{x+5}{x^2-4} = 3 \quad (6)$$

- 7.2 Solve simultaneously for  $x$  and  $y$  in the following system of equations:

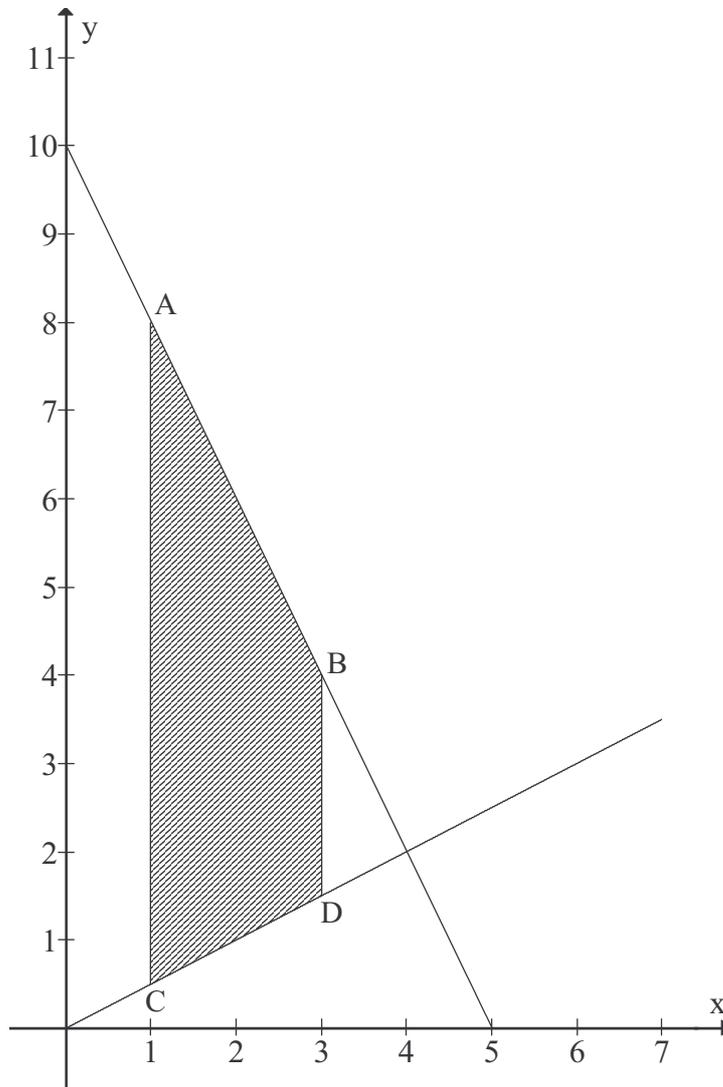
$$x - y - 7 = 0; \text{ and}$$

$$x^2 - y^2 = 25$$

(7)  
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**QUESTION 8**

Below is a feasible region for a linear programming problem.



- 8.1 Determine the system of inequalities that represent the above feasible region. (6)
  - 8.2 Determine the maximum value of  $P = x + y$  if  $P$  lies in the feasible region. (3)
  - 8.3 For what values of  $k$  would  $T = kx + y$  have a maximum at point B? (3)
- [12]**

– End of Paper –