



## MATHEMATICS

Time: 3 hours  
150 marks  
Examiner: Mrs Dwyer

Moderators: Mrs Thorne, Mrs Rixon

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### PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 10 pages.
2. Read the questions carefully. Answer all the questions.
3. Number your answers exactly as the questions are numbered.
4. You may use an approved, non-programmable, and non-graphical calculator, unless otherwise stated.
5. Round off your answers to **ONE DECIMAL PLACE**, unless otherwise indicated. All the necessary working details must be clearly shown.
6. It is in your own interest to write legibly and to present your work neatly.
7. Diagrams are not drawn to scale.

Name: \_\_\_\_\_ Teacher: \_\_\_\_\_

### **FORMULAE**

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 + i)^n$$

$$A = P(1 - i)^n$$

$$P(A) = \frac{n(A)}{n(B)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

## SECTION A

## Question 1

a) Solve for x in each of the following:

i)  $(2x - 1)(x + 3) = 12x + 1$  (5)

ii)  $2x^2 - x - 6 > 0$  (4)

iii)  $\sqrt{10 - 3x} = x - 2$  (5)

iv)  $2^{3x-6} = \sqrt{8}$  (3)

v)  $(3^x - 27)(3^x + 1) = 0$  (3)

b) Simplify:  $\frac{3 \cdot 2^m - 4 \cdot 2^{m+2}}{2^m - 2^{m+1}}$  (4)

## Question 2

41; 43; 47; 53; 61; 71; 83; ...

a) Determine an expression for the  $n^{\text{th}}$  term of the number pattern above. (5)

b) The first 40 terms of this number pattern are all prime numbers. Determine the 41<sup>st</sup> term and show that it is not a prime number. (3)

## Question 3

a) Patricia deposited a certain amount of money into a bank account which paid 8% per annum compounded half-yearly. After 4 years, the money has a value of R100 000.

i) Convert this nominal interest rate into the equivalent effective rate. (2)

ii) Using the nominal rate, calculate the amount of money originally deposited into the bank account by Patricia. (3)

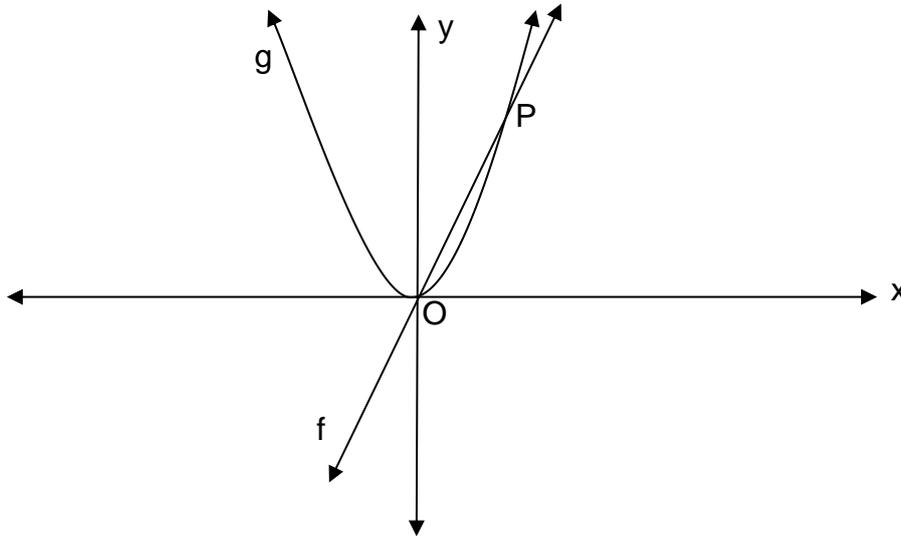
b) The following outrageous offer is made:

*Invest now and you will receive 10 times your money after only 1 year!*

If the interest is compounded monthly, what would the annual interest rate have to be to achieve this? (3)

**Question 4**

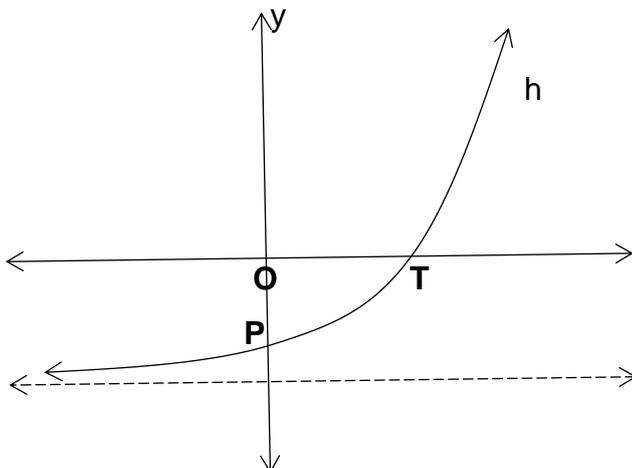
The accompanying diagram shows the graphs of two functions defined by  $f(x) = 2x$  and  $g(x) = x^2$ . The graphs intersect at O and P.



- a) Calculate the co-ordinates of P. (4)
- b) By using the graphs, answer the following questions:
- Write down the domain of  $g(x)$ . (1)
  - Determine the values of  $x$  for which  $x^2 > 2x$ . (2)
  - For which values of  $x$  is  $g(x) < 0$ ? (1)
- c) Determine the equation of  $h$  if  $h(x) = f(x) + 4$ . (2)

**Question 5**

Given  $h(x) = a \cdot 2^{x-1} + q$ . The line  $y = -6$  is an asymptote to the graph of  $h$ . T and P are the x and y - intercepts of  $h$  respectively.



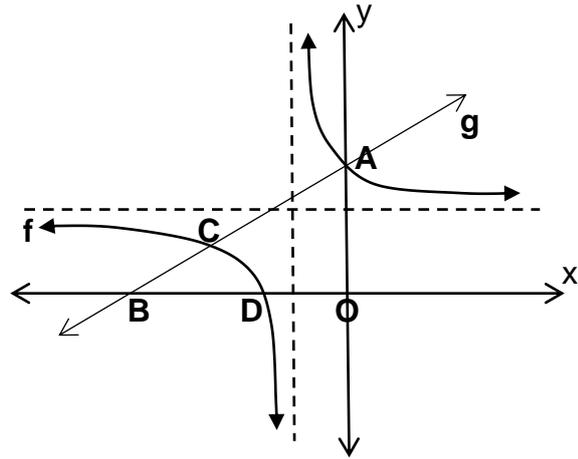
- a) Write down the value of  $q$ . (1)
- b) If the graph of  $h$  passes through the point  $\left(-1; -5\frac{1}{4}\right)$ , show that  $a = 3$ . (4)

### Question 6

$$f(x) = \frac{a}{x+2} + 3$$

$$g(x) = \frac{1}{2}x + 5$$

The graphs intersect at A on the y-axis and at C (-6; t).  
B and D are the x-intercepts.

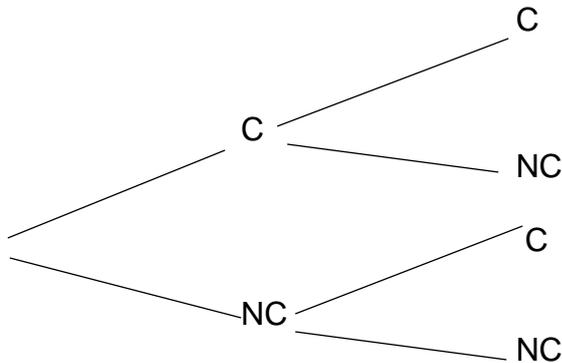


Determine:

- the equations of the asymptotes of  $f$  (2)
- the co-ordinates of A and B. (2)
- the value of  $t$  (2)
- the value of  $a$  (3)
- the values of  $x$  for which  $g(x)$  is decreasing. (1)

### Question 7

- During a survey, 25 out of 40 pupils indicated that they own a cell-phone. Two pupils were selected at random, the first one not returning to the group before the second one is selected.



- Copy and complete the tree diagram above, writing the probabilities on the relevant branches. (6)
- What is the probability that of the two pupils selected, one will own a cell-phone and one will not? (3)

- b) The Titanic sank in 1912 without enough lifeboats for the passengers and crew. The contingency table below provides data on the passengers who were on board during the disaster. Use the information to determine, with reasons, whether the events  $M = \{\text{a passenger was a male}\}$  and  $N = \{\text{a passenger did not survive}\}$  are dependent or independent.

Survived	Male	Female	Total
Yes	367	344	711
No	1364	126	1490
Total	1731	470	2201



(4)

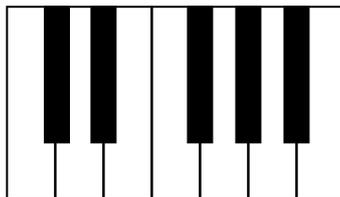
78 marks

## SECTION B

## Question 8

- a) Without a calculator, calculate the area (in terms of  $\pi$ ) of a pie if it has a radius of  $4 + \sqrt{5}$  cm. Leave your answer in simplified surd form. (3)

b)



C D E F G A B

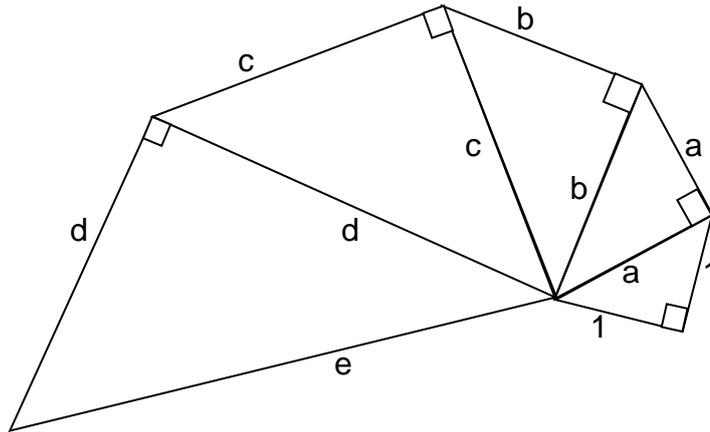
A section of a keyboard is shown. The frequency of C is 256 Hz.

The frequency of each note is  $2^{\frac{1}{12}}$  x the frequency of the previous note, including the black keys. Calculate the frequency of note A as a power of 2. (3)

## Question 9

- a) 3 consecutive terms of a linear sequence are  $2x - 3$ ,  $5x + 2$  and  $x - 7$ . Determine the value of  $x$  and the first 3 terms. (5)

b)

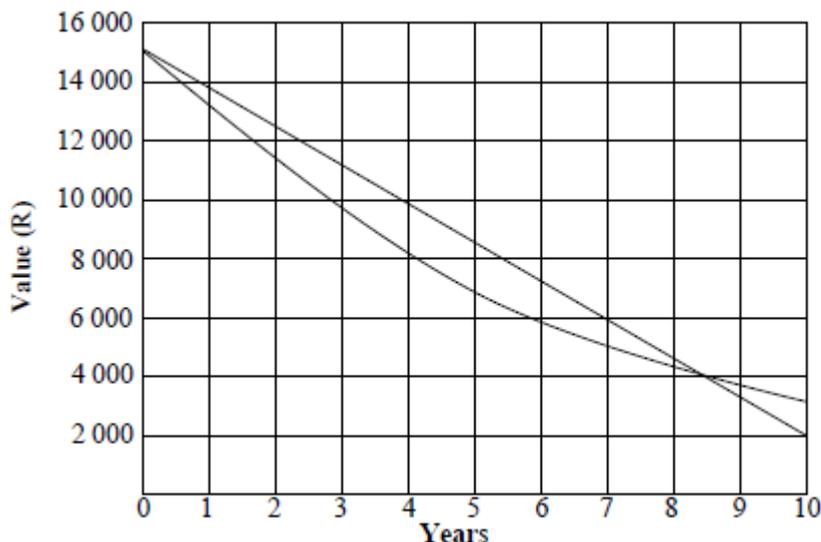


The drawing above shows a spiral composed of isosceles right-angled triangles. The first triangle has two sides each equal to 1 unit.

- Calculate the values of  $a$ ,  $b$ ,  $c$ ,  $d$  and  $e$ , leaving your answers in surd form, where necessary. (5)
- If these values form a sequence, explain how it is formed. (2)
- Use the pattern to predict the length of the hypotenuse of the next two triangles. (2)

### Question 10

The graph below shows the depreciated value of a laptop using the straight-line and reducing balance methods.



Use the graph to:

- Estimate the original value of the laptop. (1)
- Determine the depreciated value of the laptop when the two depreciated values are equal. (1)
- Calculate the interest rate for the straight-line depreciation. (4)

**Question 11**

Jamie invests a certain sum of money for 5 years. The investment earns interest at 12% p.a. compounded monthly, for the full term.

She withdraws R2000 from the account after 18 months.

After 5 years, the value of the investment is R23 564.

How much did Jamie originally invest?



(5)

**Question 12**

Of a group of 110 pupils at a high school, 67 play sport and 59 belong to a society. 22 neither play a sport nor belong to a society.

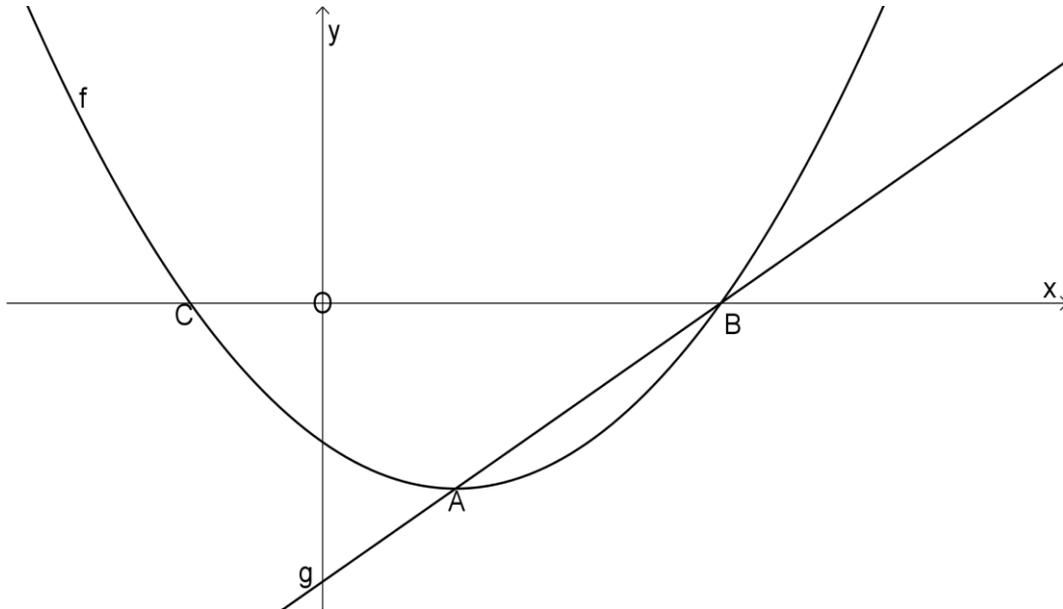
- a) Draw a Venn diagram to illustrate this information. (4)
- b) What is the probability that a pupil who does not belong to a society, plays sport? (1)
- c) Determine  $P(\text{Sport or Society})$  (1)
- d)  $P(\text{Society})$  (1)

**Question 13**

- a) Without sketching the graphs, state how you would transform  $m$  to produce  $n$ .
- i)  $m(x) = -2x + 3$   
 $n(x) = 2x - 3$  (2)
- ii)  $m(x) = 4^{x-2}$   
 $n(x) = 4^{x+1}$  (2)
- b) Sketch the appropriate graphs in each of the following cases:
- i)  $y = ax^2 + bx + c$ , with  $a < 0$ ,  $b > 0$ ,  $c < 0$ . (2)
- ii)  $y = a(x - p)^2 + q$ , with  $a > 0$ ,  $p > 0$  and  $q > 0$ . (2)

**Question 14**

The graphs of  $f(x)$  and  $g(x)$  are sketched below. A and B are the points of intersection. A is also the turning point of  $f$ . The graph of  $f$  intersects the  $x$  – axis at B and C. The axis of symmetry is  $x = 1$ .



- a)  $f(x)$  is a quadratic function of the form  $ax^2 + bx + c$ . If  $t - 3$  and  $t + 1$  are the roots of  $f(x) = 0$ , show that  $t = 2$ . (3)
- b) If  $f(0) = -3$ , show that the equation of  $f$  is  $f(x) = x^2 - 2x - 3$  (5)
- c) Determine the co-ordinates of A. (2)
- d) For what values of  $x$  will:
- i)  $f(x) \geq 0$  (2)
- ii)  $\frac{f(x)}{g(x)} > 0$  (2)
- e) For what values of  $k$  will  $y = x^2 - 2x + k$  have non-real roots? (2)

## Question 15



Diagram 1

<http://www.realwowz.net>

L'Umbracle is a garden in Valencia, Spain, consisting of a series of parabolic arches. It extends a length of 320 m and houses plants indigenous to Valencia.

The shape of the arches can be approximated by the equation (measured in metres)

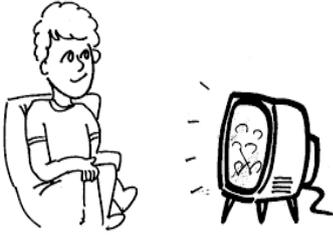
$$y = -\frac{1}{50}(x-30)^2 + 18.$$



Diagram 2

<http://www.skyscrapercity.com/>

- a) What is the maximum height of the arches? (1)
- b) The central pathway is 2m wide, and each garden alongside is 0,5m wide. If the palms are planted next to this garden (see Diagram 1), what is the maximum height of the palm trees that may be planted? (3)
- Give your answer correct to 3 decimal places.

**Question 16**

The effectiveness ( $E$ ) of a TV advertisement is dependent on the number of times ( $n$ ) it is seen by a viewer. These variables are related by the equation

$$E = \frac{2}{3}n - \frac{n^2}{90}$$

- a) How many times should a viewer watch the advertisement for it to be most effective? (3)
- b) After how many viewings would the advertisement be ineffective? (3)

**72 marks**

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