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# HERSCHEL GIRLS SCHOOL

## Mathematics: Paper 1 Grade 11

November Examination 2016

Time: 3 hours

Marks: 150

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs etc that you have used in determining your answers. All working should be shown in its proper place.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Diagrams are not necessarily drawn to scale.
6. Number your answers according to the numbering system used in this question paper.
7. An answer sheet has been provided. This should be stapled to the *front* of your answer script and handed in.
8. It is in your own interest to write legibly and to present your work neatly.

## Question 1

1.1 Solve for  $x$ :

1.1.1  $2x^2 - 7x + 3 = 0$  (3)

1.1.2  $7x^2 + x = 15$  (correct to 2 decimal places) (4)

1.1.3  $5 - \sqrt{4x + 1} = x$  (5)

1.1.4  $2(x + 1)^{\frac{3}{2}} = 250$  (without using a calculator) (4)

1.1.5  $x^2 - 7x \leq 0$  (3)

1.2 Solve simultaneously for  $x$  and  $y$  if  $4^{x+y} = 2^{y+4}$  and  $2x^2 + 4 = 3xy$ . (8)

1.3 Without solving, discuss the nature of the roots of  $2x^2 + x + 3 = 0$ . (3)

1.4 Calculate the value(s) of  $k$  for which the equation  $x^2 - 3 = 2kx + 4k$  will have equal roots. (4)

1.5 Solve for  $x$ :

$$\frac{x \cdot \sqrt{x \cdot \sqrt{x \cdot \sqrt{x}}}}{\sqrt[8]{x^7}} = 2 \quad (3)$$

[37]

## Question 2

2.1 Determine the value of  $(0,04)^{\frac{1}{2}}$  without using a calculator. (3)

2.2 Prove without using a calculator that  $\sqrt{12} + \sqrt{27} = \sqrt{75}$ . (3)

2.3 Simplify and leave answers with positive exponents:

2.3.1  $\frac{27^x \times 9^{x+1}}{3^{5x+3}}$  (3)

2.3.2  $(x - 2)^{-1} - (x - 1)^{-1}$  (3)

2.4 Choose the letter which corresponds with the correct answer to the following question. Only write the letter down next to the question number.

If  $y > 4$ , which of the following is the smallest?

A	B	C	D	E	
$\frac{y+1}{4}$	$\frac{y}{4}$	$\frac{4}{y-1}$	$\frac{4}{y+1}$	$\frac{4}{y}$	(2)

[14]

### Question 3

3.1 The following pattern of numbers is given: 1 ; 5 ; 12 ; 22 ; 35 ...

3.1.1 Give the sixth term of the pattern. (1)

3.1.2 Determine  $T_n$  for the above pattern. (4)

3.1.3 Is 176 a term that would fit into this pattern? (4)

3.1.4 Which two consecutive terms in this pattern have a difference of 46?

Show all your working. (6)

3.2 Given a sequence with a constant second difference:

$k ; 18 ; 28 ; 40 ; m ; 70 ; 88 ; n$

Determine the values of  $k, m$  and  $n$ . (4)

3.3 Determine  $T_n$ , the general term, for the following pattern: 5 ; 10 ; 20 ; 40 ... (2)

[21]

#### Question 4

- 4.1 Susan plans to remodel her kitchen in 3 years time. She has done some research and estimates that she will need R65 000.
- 4.1.1 How much does she need to invest now at 11,5% compounded quarterly to make sure she has the required R65 000 in 3 years time? (4)
- 4.1.2 Convert the nominal interest rate of 11,5%, compounded quarterly, to the equivalent effective annual interest rate, correct to 2 decimal places. (3)
- 4.2 Matthew buys a new motorbike for R49 000. If the value of the bike depreciates on the reducing balance method at 17,4% p.a, how much will the bike be worth in 5 years time? (2)
- 4.3 Lethu applies to borrow a certain amount of money from the bank, with an agreement that she will make a lump sum payment of R100 000 at the end of 5 years to repay her loan. The interest rate was 9,45% p.a. compounded monthly for the first 2 years and changed to 11,37% p.a. compounded semi-annually for the remainder of the time of the loan. What was the size of Lethu's loan? (6)

[15]

### Question 5

5.1 Draw a rough sketch of the following graph;  $g(x) = a(x - p)^2 + q$  ;

if  $a < 0$ ,  $p < 0$  and  $q > 0$ . (3)

5.2 Describe what has been done to  $h$  , in each case to obtain  $f$ :

5.2.1  $f(x) = h(x) - 1$  (1)

5.2.2  $f(x) = h(x - 2)$  (1)

5.2.3  $f(x) = h(-x)$  (1)

5.3 The graph of  $p(x) = a \cdot b^x - 4$  , where  $b > 0$  passes through the point  $(2; -22)$  and cuts the  $y$ -axis at  $-6$ . Determine  $a$  and  $b$ . (4)

[10]

Question 6

Given:  $g(x) = -\frac{2}{x+1} - 3$

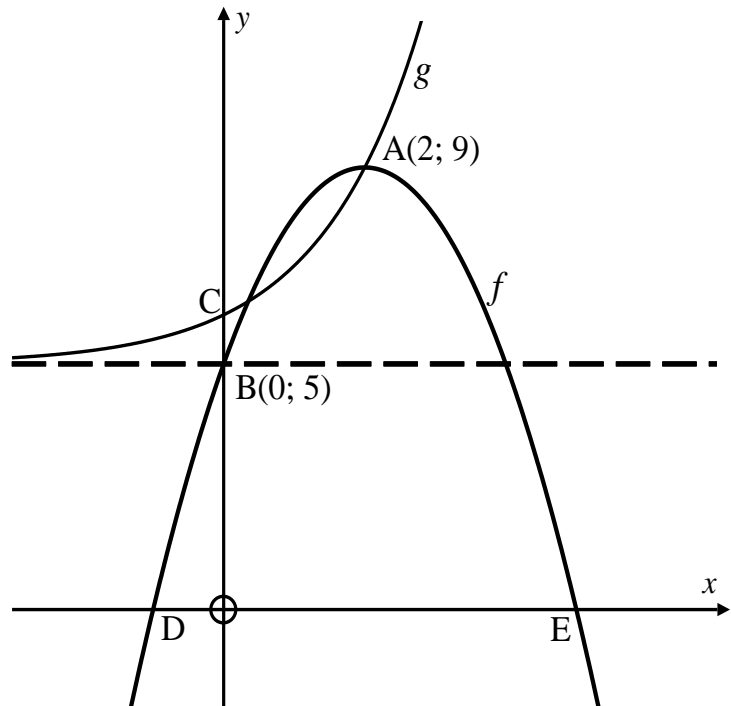
- 6.1 Give the domain of  $g$ . (1)
- 6.2 Give the equations of the asymptotes of  $g$ . (2)
- 6.3 For what value(s) of  $x$  is  $g(x) = 0$ ? (2)
- 6.4 Give the co-ordinates of the  $y$  – intercept of  $g$ . (2)
- 6.5 Draw a neat sketch of the graph of  $g$  on the **DIAGRAM SHEET** provided, labelling the asymptotes and intercepts with the axes. (4)
- 6.6 If  $y = x + b$  is an axis of symmetry of  $g$  find the value of  $b$ . (2)
- 6.7 Give the equation of  $h$ , which is the graph of  $g$  after it was shifted 4 units up and 1 to the left. Write your equation in the form  $h(x) = \dots$  (2)

[15]

### Question 7

The sketch below shows a graph of  $f(x) = ax^2 + bx + c$ , with turning point A(2;9) and y-intercept B(0;5).

$g(x) = t^x + 5$  is also drawn and it also passes through the point A.



- 7.1 Show that the value of  $t$  is 2. (2)
- 7.2 Give the equation of the axis of symmetry of  $f$ . (1)
- 7.3 Given that the equation of  $f$  is  $f(x) = ax^2 + bx + c$ , show that:  
 $a = -1$  ;  $b = 4$  and  $c = 5$ . (4)
- 7.4 Determine the coordinates of C, the y-intercept of  $g$ . (1)
- 7.5 Determine the length of DE. (4)
- 7.6 Give the equation of  $h$ , which is a graph of  $g$  after a reflection in the  $x$ -axis. (2)
- 7.7 For which value(s) of  $x$  is  $f(x) \cdot g(x) < 0$ ? (2)
- 7.8 Determine the equation of  $k$  in terms of  $x$  if  $k(x) = f(x - 1) + 1$ .  
 Give the equation of  $k$  in the form of  $k(x) = ax^2 + bx + c$ . (2)

[18]



## Question 8

8.1 Calculate  $P(B)$  if:

8.1.1 A and B are mutually exclusive events;  $P(A \text{ or } B) = 0,7$  and  $P(A) = 0,2$ . (1)

8.1.2 A and B are complementary events and  $P(A) = 0,4$ . (1)

8.2 A survey answered by 250 girls at Herschel indicated the popularity of 3 TV series', Madam Secretary, Game of Thrones and Big Bang Theory.

- 40 liked Madam Secretary and Game of Thrones
- 154 liked Big Bang Theory
- 61 liked Madam Secretary and Big Bang Theory
- 91 liked Madam Secretary
- 120 liked Game of Thrones
- 30 liked Madam Secretary, Game of Thrones and Big Bang Theory
- 56 liked Game of Thrones and Big Bang Theory

8.2.1 Summarise the given information by using a Venn diagram. (4)

8.2.2 Use the Venn diagram to determine the probability that if a girl is chosen at random, she will like watching:

- a) at least two of these series. (2)
- b) Madam Secretary and Game of Thrones, but not Big Bang Theory. (2)
- c) neither Madam Secretary or Game of Thrones. (2)

8.3 The table below summarises the results from all driving tests taken at a Test Centre in Cape Town during the first week of November.

	Male	Female	TOTAL
Pass	32	43	75
Fail	8	15	23
TOTAL	40	58	98

8.3.1 A person is chosen at random from those who were tested during the first week of November. What is the probability that the person was a female who passed? (2)

8.3.2 Given that a randomly chosen person is male, what is the probability that he failed? (2)

8.3.3 Determine, showing all working, whether passing your driver's test is dependent on gender. (4)

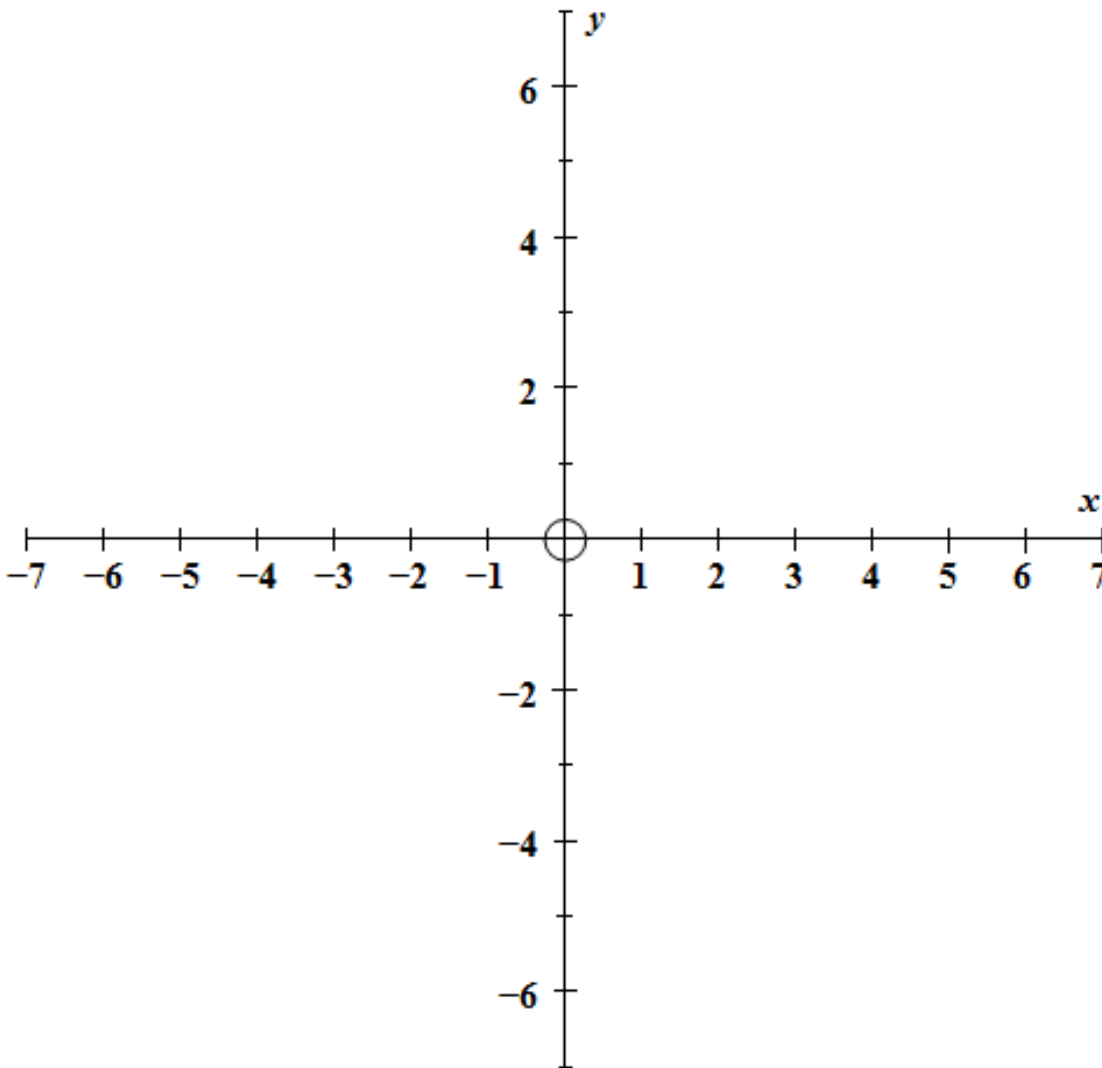
[20]

TOTAL: 150

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

Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	TOTAL
Algebra & Equations	Algebra & Equations	Patterns & Sequences	Finance	Functions	Functions	Functions	Probability	
37	14	21	15	10	15	18	20	150

Question 6.5



(4)