



# CORNWALL HILL COLLEGE

## Mathematics Department

### EXAMINATIONS – 9 November 2015

#### Paper 1

Grade: 11

Time: 3 hours

Marks: 150

Examiner: Mr P van Schalkwyk

Moderators: Mrs S Hickling, Mrs M van Niekerk and Mrs T Knoetze

#### **INSTRUCTIONS**

1. The question paper consists of 13 Questions and 8 pages. A diagram sheet for Question 8 is also included. Please check that your paper is complete.
2. Answer all the questions.
3. Read the questions carefully.
4. It is in your own interest to write legibly and to present your work neatly.
5. All the necessary working details must be clearly shown.
6. Answers to be rounded off to TWO DECIMAL DIGITS unless it is specified differently.
7. Answers that are coincidentally right will not earn any marks.
8. GOOD LUCK!

**SECTION A [78 MARKS]****QUESTION 1 [28 MARKS]**Solve for  $x$ :

(a)  $3x(x - 3) = 2(x - 3)(x + 3)$  (4)

(b) (1)  $x(x + 2) < 24$  (3)

(2) Hence determine the sum of all the integers satisfying this inequality. (2)

(c)  $x^2 - 2x - 3 - \frac{8}{x^2 - 2x} = 4$  (6)

(d)  $2x(x - 2) = 5$ . Leave your answer in simplest surd form. (4)

(e)  $3^{2x} - 24 \times 3^x = 81$  (4)

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

**QUESTION 2 [22 MARKS]**

(a) Simplify and leave with positive exponents:  $\frac{4^{x+2} \times 36^{-x-1}}{45^{-x+1} \times 5^{x-1} \times 81^{-1}}$  (4)

(b) Simplify fully:  $\sqrt{\frac{11^{3008} + 23 \times 11^{3006}}{9}}$  (4)

(c) The roots of a quadratic equation are:  $x = \frac{7 \pm \sqrt{6 - 3k}}{8}$  where  $k \in \mathbb{Q}$ .

Determine the value(s) of  $k$  such that:

(1) The roots of the equation are equal. (2)

(2) The roots of the equation are non-real. (2)

(d) Given:  $f(x) = 5^x - 5$ .

Determine the value of  $\frac{f(x+1)}{f(x) + 4}$  (4)

(e) Solve the given equations simultaneously for  $x$  and  $y$ :

$2^y = 128^{x-1}$  and  $y = 2x^2 - 4x - 2$  (6)

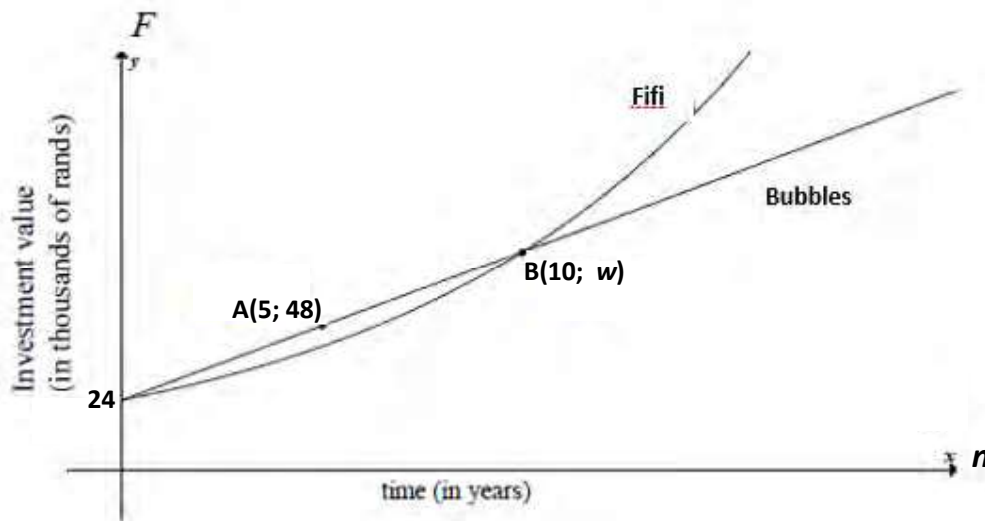
**QUESTION 3 [4 MARKS]**

Consider the linear number pattern:  $-2; 3; 8; 13 \dots$

- (a) Determine the rule that will give the general term for this number pattern. (2)
- (b) Hence determine which term in the row will be equal to 283. (2)

**QUESTION 4 [8 MARKS]**

We know that if an investment is made at simple interest it will grow by the same amount every year and if interest is compounded the investment will grow exponentially.



The given graphs represent the growth of two investments, one belonging to Bubbles and one to Fifi. Both investments earn interest annually only.

- (a) What is the initial value of both investments? (1)
- (b) What type of interest is paid on Bubbles's investment? (1)
- (c) Determine the interest rate on Bubbles's investment. (2)
- (d) (1) Write down the value of  $w$ . (1)
- (2) Hence determine the interest rate on Fifi's investment. (2)
- Calculate your answer as a percentage correct to TWO decimal digits. (3)

**QUESTION 5 [6 MARKS]**

Consider the following quadratic number pattern:

5 9 15 23 33 45 59 75 5 9 15 23 33 45 59 75 ...

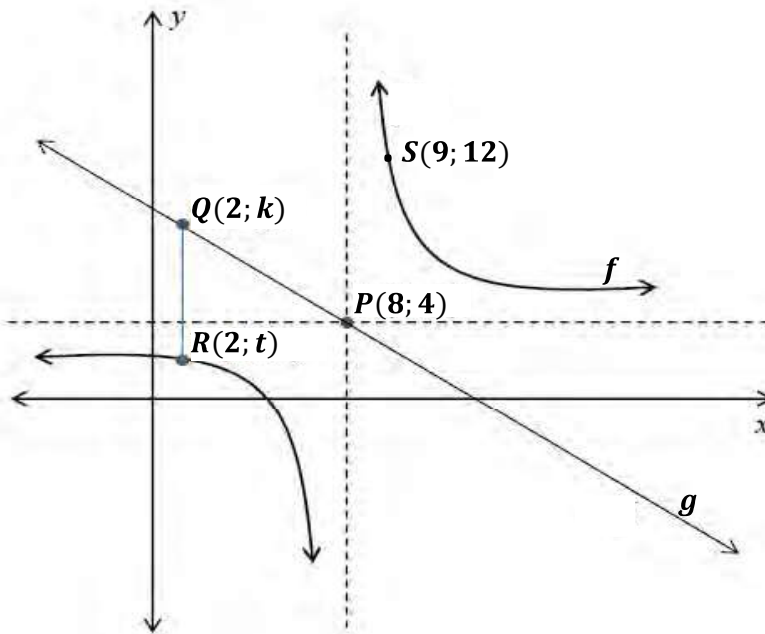
Determine:

- (a) The general rule ( $T_n$ ) for the first EIGHT terms of this pattern. (4)
- (b) The value of the 47 783<sup>rd</sup> term. (2)

**QUESTION 6 [10 MARKS]**

In the graph below  $P(8; 4)$  and  $Q(2; k)$  lie on  $y = g(x)$ , one of the axes of symmetry for the graph of  $y = f(x)$ . The dotted lines that go through  $P$  represent the asymptotes for  $f(x)$ .

Points  $R(2; t)$  and  $S(9; 12)$  lie on the graph of  $f$ . The equation of  $f$  is given by  $f(x) = \frac{a}{x-p} + q$ .



- (a) Write down the equations of the asymptotes of  $f$ . (2)
- (b) Determine the equation for the graph of  $f$ . (3)
- (c) Determine the equation of  $g$ . (1)
- (d) Calculate the length of  $RQ$ . (2)
- (e) Calculate the coordinates of the  $x$  – intercept of the graph of  $f$  and hence determine how many units the graphs needs to shift horizontally so that the graph of  $f$  passes through the origin. (2)

**SECTION B [72 MARKS]****QUESTION 7 [9 MARKS]**

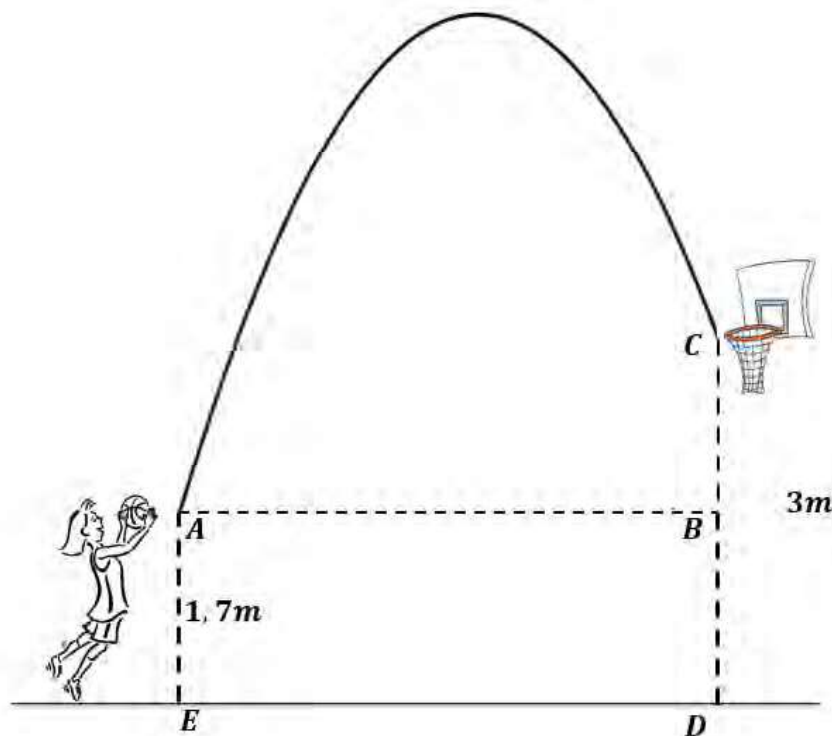
- (a) The nominal rate of interest that a Financial Institution offers is 10,95% per annum compounded daily. Determine the effective rate of interest. (3)
- (b) Jessica wants to go to university in 2019. In order to pay for her first year studies on 1 January 2019, her parents follow the following savings plan with the bank, which pays interest at 13,56% per annum, compounded monthly:
- 1 July 2015: Deposit R7 500
  - 1 April 2016: Deposit R10 400
  - 1 October 2017: Deposit R15 800
  - 1 July 2018: Withdraw R6 200
- Will there be enough money in the account on 1 January 2019 to pay for Jessica's first year at University which is expected to cost R40 000? (6)
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**QUESTION 8 [16 MARKS]**

- (a) Given:  $f(x) = -x^2 + 2x + 8$  and  $g(x) = 2^x - 4$
- (1) Sketch the graphs of  $f$  and  $g$  on the same set of axes on the given diagram sheet. (7)
  - (2) For which values of  $x$  is  $f(x) \cdot g(x) \geq 0$ ? (3)
  - (3) Write down the equation of  $h$  if  $h$  is the reflection of  $g$  in the  $y - axis$ . (1)
  - (4) For which values of  $k$  will  $-x^2 + 2x + k = 0$  have real roots. (1)
- (b) Consider the quadratic function  $y = ax^2 + bx + c$ .  
The graph has the following properties:
- The range is  $y \in (-\infty; 5]$
  - The graph has one positive and one negative zero
  - $b > 0$
- Draw a neat sketch graph that will reflect all of the given properties. (4)
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**QUESTION 9 [10 MARKS]**

Refer to the diagram below. The diagram is not drawn to scale. Lourie, an enthusiastic netball player is practicing her shooting. Each throw follows the path of a parabola. She throws from point A, which is 1,7m above the floor. On one of her throws, the ball reaches its maximum height of 3,1625m when it has covered a horizontal distance of 3m. Unfortunately, this throw does not go into the basket, but hits the rim of the basket which is 3m above the floor. The floor is along the  $x$  – axis and AE is perpendicular to the floor and is along the  $y$  – axis. CD is also perpendicular to the ground.



- (a) Write down the coordinates of the turning point of the given parabola. (2)
- (b) Hence determine the equation of the parabola in the form  $y = a(x - p)^2 + q$ . (5)
- (c) Determine AB, the horizontal distance, between Lourie's hand and the front of the rim of the basket. (3)
-

**QUESTION 10 [11 MARKS]**

The first four terms of a quadratic number pattern are:  $2$ ;  $x$ ;  $2x + 1$  and  $4x$ .

- (a) Calculate the value of  $x$ . (4)
- (b) If  $x = 5$ , determine an expression for the  $n^{\text{th}}$  term of this number pattern. (3)
- (c) Determine which term in this number pattern will have a value of  $572$ . (4)
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**QUESTION 11 [8 MARKS]**

A bag contains **9** identical in shape and size, red balls and **6** green balls.

Puleng draws a ball and then **PUTS IT BACK INTO** the bag. She then draws another ball.

- (a) Draw a Tree Diagram to represent the possible outcomes, clearly indicating the probabilities and outcomes on each branch. (4)
- (b) Calculate the probability of drawing two balls of the same colour. (4)
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**QUESTION 12 [9 MARKS]**

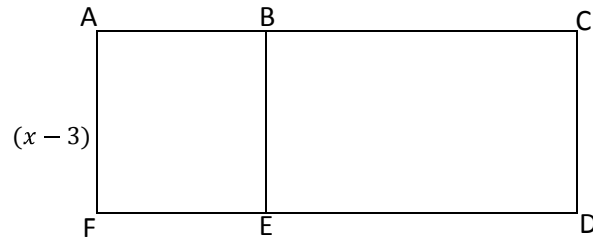
Each of the 600 employees of a company wrote a competency test. The results are given in the given table.

	<b>PASS</b>	<b>FAIL</b>	<b>TOTAL</b>
<b>MALE</b>	<b>p</b>	<b>96</b>	<b>234</b>
<b>FEMALE</b>	<b>216</b>	<b>q</b>	<b>r</b>
<b>TOTAL</b>	<b>354</b>	<b>s</b>	<b>600</b>

- (a) Write down the values of **p**, **q**, **r** and **s**. (2)
- (b) State, giving a reason, whether the events **PASS** and **FAIL** are mutually exclusive or not. (2)
- (c) Are the events **PASS** and **FEMALE** independent. Calculate the relevant probabilities to **TWO** decimal places. (5)
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**QUESTION 13 [9 MARKS]**

- (a) ABCDEF is a rectangle with an area  $(x^2 + 3x - 18)cm^2$ . B is a point on AC and E is a point on FD such that ABEF is a square with sides of length  $(x - 3)cm$  each.



Calculate the length of ED. (5)

- (b) Given:  $(2x - k)^2 = 20$ . Determine the value of  $16x^2 - 16kx + 4k^2 + 16$ . (4)

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**THE END**