

Name and Surname: File

Mathematics teacher: \_\_\_\_\_

HUDSON PARK HIGH SCHOOL



GRADE 11

Mathematics Paper 1

DATE: May 2016

TOTAL: 100 MARKS

EXAMINER: Mrs. Selkirk

TIME: 2 HOURS

Instructions

1. Work clearly and neatly. Start each question at the top of a new side of a page..
2. Staple Diagram sheet A to your answers and hand the question paper in separately.
3. Show all working out. Answers alone may not be awarded full marks.
4. Non – programmable calculators may be used unless the question states that you may not use one.
5. Round all answers off to 2 decimal places, where necessary.

Question 1 (34 marks)

- 1.1 Solve for  $x$ :
- 1.1.1  $-2x(x - 7) = 24$  (3)
- 1.1.2  $x - 1 - \frac{1}{x} = 0$  (4)
- 1.1.3  $3 - 2\sqrt{x-3} = x$  (5)
- 1.1.4  $(3x^{\frac{1}{2}} - 4)(x^{\frac{1}{2}} + 3) = 0$  (3)
- 1.1.5  $x^2 = x$  (2)
- 1.1.6  $2^{2x} + 3 \cdot 2^x - 4 = 0$  (4)
- 1.1.7  $5^x(x - 5) < 0$  (2)

- 1.2 Solve for  $x$  and  $y$  simultaneously:  
 $y^2 + x = xy + y$  and  $3y + x = 2$  (6)

- 1.3 Consider the inequality:

$$\frac{x-1}{x+3} \leq 0$$

- 1.3.1 Why is the following not permissible:

$$\frac{x-1}{x+3} \times (x+3) \leq 0(x+3) \quad x \neq -3$$

$$x - 1 \leq 0$$

(2)

- 1.3.2 Why is the following permissible

$$\frac{x-1}{x+3} \times (x+3)^2 \leq 0 \times (x+3)^2 \quad x \neq -3$$

$$(x - 1)(x + 3) \leq 0$$

(1)

- 1.3.3 Now complete the solution begun in 1.3.2 starting with:

$$(x - 1)(x + 3) \leq 0 \quad x \neq -3$$

(2)

(34)

Question 2 (13 marks)

YOU MAY NOT USE A CALCULATOR IN THIS QUESTION

Simplify, leaving your answers in simplest surd form:

2.1  $\frac{\sqrt{75} - \sqrt{3}}{\sqrt{27}}$  (4)

2.2  $\frac{(3 - \sqrt{3})^2}{\sqrt{3}\sqrt{6}}$  (Leave this answer with a rational denominator) (6)

2.3 Simplify:  $\frac{2^{2013} - 6 \cdot 2^{2011}}{4^{1010}}$  (3) [13]

Question 3 (10 marks)

3.1 Given the equation  $y = \frac{\sqrt{7x-1}}{2-x}$

- 3.1.1 Determine the value(s) of  $x$  for which  $y$  is undefined. (1)

- 3.1.2 For which value(s) of  $x$  is  $y$  real? (2)

3.2 For the equation  $8x^2 - 2x + 1 = 0$

- 3.2.1 Find the value of the discriminant. (2)

3.2.2 Hence, discuss the nature of the roots of the above equation. (1)

3.3 Prove that the equation

$$rx^2 + 4x = r - 1 - x^2$$

Has real roots for all real values of  $r$ . (4) [10]

**Question 4** (13 marks)

4.1 The first term of a linear number pattern is 56 and the common difference is -2.

4.1.1 Write down the values of the second and third term of the number pattern. (1)

4.1.2 Write down an expression for the  $n$ th term. (2)

4.1.3 Determine the value of  $T_{48}$ . (2)

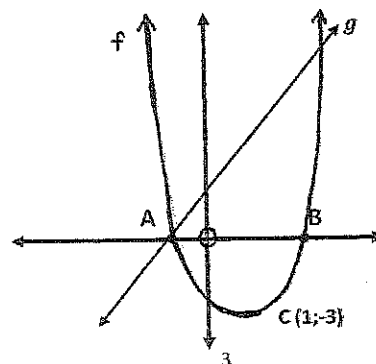
4.1.4 If  $T_p + T_q = 2$ , determine the value of  $(p + q)$ . (2)

4.2 Write down the next two terms in the sequence -2; -7; -16; -29; ... (2)

4.3 Consider the following quadratic number pattern:  $x$ ; 1; -6;  $y$ ; -14  
Calculate the values of  $x$  and  $y$ . (4) [13]

**Question 5** (17 marks)

Below the following two functions are sketched:  $f(x) = ax^2 + bx + c$  and  $g(x) = x + \frac{1}{2}$ . C(1;-3) is a point on the graph of  $f$ . The axis of symmetry for  $f$  is  $x = \frac{3}{4}$ . A and B are the  $x$ -intercepts of  $f(x)$ .  $f(x)$  and  $g(x)$  intersect at A.



5.1 Work out the coordinates of

5.1.1 A (2)

5.1.2 B (2)

5.2 Determine the equation of  $f(x)$  in the form  $f(x) = ax^2 + bx + c$ , showing that it is  $f(x) = 2x^2 - 3x - 2$  (3)

5.3 Rewrite the equation for  $f(x)$  in the form  $f(x) = a(x - p)^2 + q$  by completing the square. (4)

5.4 Determine the coordinates of the turning point of  $f$ . (2)

5.5 Write down the equation of  $h$  if  $h(x)$  results from shifting  $f(x)$   $\frac{3}{4}$  units to the left. (2)

5.6 Find the average gradient of  $f$  between points B and C (2) [17]

**Question 6** (10 marks)

Use the set of axes provided on diagram sheet A to answer question 6.

Consider  $f(x) = \frac{-4}{x+2} + 4$

6.1 Calculate  $x$  if  $f(x) = 0$ . (2)

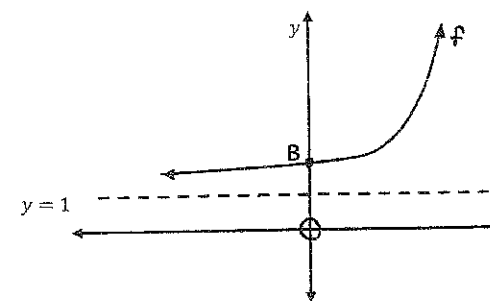
6.2 Find  $f(0)$ . (2)

6.3 Sketch the graph of  $f(x)$ , showing all intercepts with axes and labelling any asymptotes that may exist. (5)

6.4 What is the equation of the axis of symmetry of  $f(x)$  if  $x < -2$  (1) [10]

**Question 7** (3 marks)

The function  $f(x) = 2^{x-p} - q$  is sketched below. B is the point (0; 1,5). Calculate the values of  $p$  and  $q$ .



[3]

[100 marks]

Diagram Sheet A

Question 6

6.1

\_\_\_\_\_ (2)

6.2

\_\_\_\_\_ (2)

6.3

(7)

6.4

\_\_\_\_\_ (1)

\_\_\_\_\_

\_\_\_\_\_

[10]