Founded 1982

THE HILLS GRAMMAR SCHOOL

TERM ONE ASSESSMENT TASK 2016

YEAR 11 MATHEMATICS

Time Allowed: 55 minutes

Weighting: 15%

Outcomes: P1, P2, P3, P4

Class Teachers: Mr O'Neill, Mr Parrish, Mrs Singh, Mr Tobin

Instructions:
- Approved calculators may be used
- Attempt all questions
- Start all questions on a new sheet of paper
- The marks for each question are indicated on the examination
- Show all necessary working

Topic Outcome	Multiple Choice	Question 1	Question 2	Question 3	Question 4	TOTAL
Marks	3	19	14	9	10	55

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Section 1 – Multiple Choice **(3 marks)**

Questions 1 to 3 are multiple choice. Place your answers in the answer grid below.

1) Fully simplify $\dfrac{2(x-4)}{x+2}$

A. $\dfrac{2(x-4)}{x+2}$

B. $\dfrac{2(x-4)}{x}$

C. $2x+4$

D. $2x-4$

2) Fully simplify $\sqrt{18}-\sqrt{50}$

A. $\sqrt{2}$

B. $3\sqrt{50}$

C. $4\sqrt{3}-3\sqrt{2}$

D. $-2\sqrt{2}$

3) What is the value of $\sqrt{4.01^2-0.8^2}$ correct to four significant figures?

(A) 1. 618

(B) 1.691

(C) 1.619

(D) 1.62

MULTIPLE CHOICE ANSWER GRID

1	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Section 2 – Extended Response (52 marks)

Answer questions 1 – 4 on the lined paper provided.

Question 1 **(19 Marks)** **Marks**

a) Simplify the following:

    i $-2x^2 + 3x - 4x^2 - 5x$ **2**

    ii $(-3x^2)^3$ **2**

b) Expand and simplify the following:

    i $8 - 4(2y + 1) + y$ **2**

    ii $(x - \dfrac{1}{x})(x + \dfrac{1}{x})$ **2**

c) Fully factorise the following:

    i $2y^2 - 11y - 6$ **2**

    ii $27a^3 - 64$ **3**

d) Simplify the following algebraic fractions:

    i $\dfrac{x^3 + 3x^2 - 9x - 27}{x^2 + 6x + 9}$ **3**

    ii $\dfrac{2}{x^2 - 4} - \dfrac{3}{x + 2}$ **3**

Question 2   (14 Marks)   **Marks**
start this question on a new page

a)   Solve the following equations:

 i $\dfrac{x+6}{4} = \dfrac{2x-3}{3}$ **3**

 ii $x^2 - 15x = 16$ **2**

b)   Solve using the **quadratic formula**: $3x^2 - 5x + 1 = 0$.   **3**

       Leave your answer in simplified surd form.

c)   Solving by **completing the square**: $x^2 - 2x = 1$.   **3**

       Leave your answer in simplified surd form.

d)   Solve the following pair of simultaneous equations.   **3**
       $xy = 6$
       $x + y = 5$

Question 3   (9 Marks)   **Marks**
start this question on a new page

   a) Simplify the following:

   i. $\dfrac{2\sqrt{3}}{7\sqrt{6} - \sqrt{54}}$ **3**

   ii. $\left(\sqrt{3} + 2\sqrt{3}\right)\left(\sqrt{3} - 2\sqrt{3}\right)$ **2**

   b) Find the exact value of a and b if. $\dfrac{\sqrt{3} - 4}{2 + \sqrt{3}} = a + b\sqrt{3}$ **3**

Question 4   (10 Marks)   **Marks**

start this question on a new page

a) Find the natural domain and range of each of the following functions.

   i. $h(x) = x^3$ **2**

   ii. $y = \dfrac{3}{x-2}$ **2**

b) Given $f(x) = \begin{cases} x^2 - 3x & \text{if } x > 2 \\ x & \text{if } x \leq 2 \end{cases}$

   find

   i) $f(6) - f(-2)$ **2**

   ii)   Sketch the graph of $f(x)$ **3**

   iii)   Is $f(x)$ a function or a non-function?

             Give a reason.   **1**

END OF ASSESSMENT TASK

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
1. $\dfrac{2\cancel{(x-2)}\cancel{(x+2)}}{\cancel{(x+2)}} = 2x-4$ (D)	Generally very well answered.
2. $\sqrt{18} - \sqrt{50}$ $= 3\sqrt{2} - 5\sqrt{2}$ (D) $= -2\sqrt{2}$	
3. 1.619 (C)	

Section 2

Question 1

a) (i) $\boxed{-2x^2} \boxed{+3x} \boxed{-4x^2} \boxed{-5x}$
 $= -6x^2 - 2x$ ① ① | Some students factorised but this was not necessary. |

(ii) $(-3x^2)^3 = -27x^6$ ① ① | common error was -9 instead of -27 |

b) (i) $8 - 4(2y+1) - y$
 $= 8 - 8y - 4 - y$ ①
 $= 4 - 7y$ ① | Generally well answered |

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments

(ii) $\left(x - \dfrac{1}{x}\right)\left(x + \dfrac{1}{x}\right)$

$= x^2 - \dfrac{1}{x^2}$ ①

← well answered

c) (i) $2y^2 - 11y - 6$

-12

$= 2y^2 - 12y + 1y - 6$

$= 2y(y-6) + 1(y-6)$ ①

$= (2y+1)(y-6)$ ①

← well answered

(ii) $27a^3 - 64$

$= (3a)^3 - 4^3$ ①

$= (3a - 4)(9a^2 + 12a + 16)$

①   ①

← Some substitute substituted $27a$ instead of $3a$. Also $+$ and $-$ signs in wrong place

d) (i) $\dfrac{x^3 + 3x^2 - 9x - 27}{x^2 + 6x + 9}$

$= \dfrac{x^2(x+3) - 9(x+3)}{(x+3)^2}$ ①

$= \dfrac{(x^2 - 9)(x+3)}{(x+3)(x+3)}$ ①

$= \dfrac{(x-3)(x+3)(x+3)}{(x+3)(x+3)} = x - 3$ ①

Most common error was students did not factorise $x^2 - 9$ therefore did not fully simplify. ✓

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments

(ii) $\dfrac{2}{(x-2)(x+2)} - \dfrac{3}{x+2}$ ①

$$= \frac{2 - 3(x-2)}{(x-2)(x+2)}$$ ①

$$= \frac{2 - 3x + 6}{(x-2)(x+2)}$$

$$= \frac{8 - 3x}{(x-2)(x+2)}$$ ①

Generally well answered.

Some had this as "−1" and therefore had $-4 - 3x$.

Question 2

a) (i) $\dfrac{x+6}{4} = \dfrac{2x-3}{3}$

$$3(x+6) = 4(2x-3)$$ ①

$$3x + 18 = 8x - 12$$ ①

$$-5x = -30$$ ①
$$x = 6$$

Generally well answered. Cross multiplying was the best utilised technique.
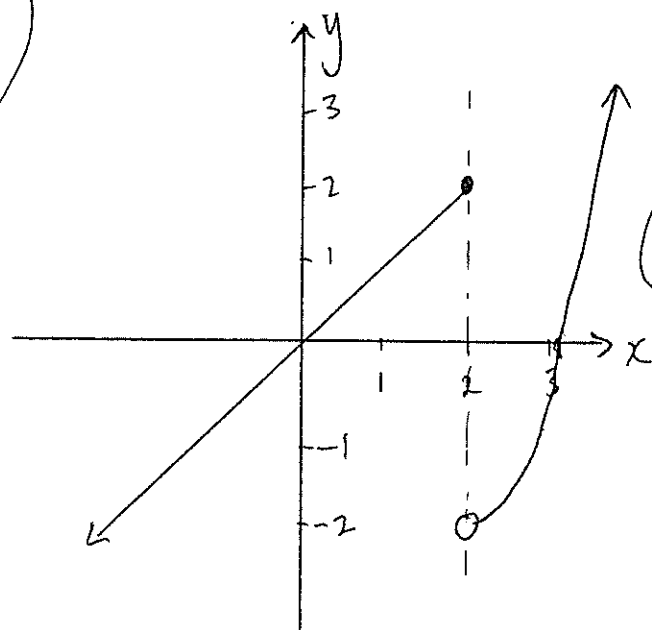
Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments

(ii) $x^2 - 15x = 16$

$\left. \begin{array}{l} x^2 - 15x - 16 = 0 \\ (x - 16)(x + 1) = 0 \end{array} \right\}$ ①

$x = 16, -1$ ①

Well answered

b) $3x^2 - 5x + 1 = 0$

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

$= \dfrac{5 \pm \sqrt{25 - 4 \times 3 \times 1}}{2 \times 3}$ ①

$= \dfrac{5 \pm \sqrt{13}}{6}$ ②

Some students failed to use the '±' sign in front of the $\sqrt{}$ (-1 mark).

c) $x^2 - 2x = 1$

$x^2 - 2x + (-1)^2 = 1 + (-1)^2$ ①

$(x - 1)^2 = 2$ ①

$x - 1 = \pm\sqrt{2}$ ①

$x = \pm\sqrt{2} + 1$ ①

Most students successfully used the completing the square method to solve this.

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments

d)

$$xy = 6 \quad ①$$
$$x + y = 5 \quad ②$$
$$y = 5 - x \quad ③$$

$$5x - x^2 = 6 \quad ①$$
$$x^2 - 5x + 6 = 0$$
$$(x-3)(x-2) = 0$$
$$x = 3, 2 \quad ①$$
$$y = 2, 3 \quad ①$$
$$\therefore (2,3) \ (3,2)$$

Question 3

a)(i)

$$\frac{2\sqrt{3}}{7\sqrt{6} - \sqrt{54}} = \frac{2\sqrt{3}}{7\sqrt{6} - 3\sqrt{6}} = \frac{2\sqrt{3}}{4\sqrt{6}} \quad ①$$

$$① \qquad = \frac{1}{2\sqrt{2}} = \boxed{\frac{\sqrt{2}}{4}} \quad ①$$

(ii)

$$\left(\sqrt{3} + 2\sqrt{3}\right)\left(\sqrt{3} - 2\sqrt{3}\right)$$
$$= 3 - 12 = -9 \quad ① \quad ①$$

Comments:

The main problem in this question was students not stating which x values corresponded to the y values.

Two correct ways:

① (2,3) and (3,2)

② when x=2, y=3
   when x=3, y=2 .

Q3

• question generally poorly ans by 2u cohort.

→ must rationalise denom to get 3rd mark.

• ans well.

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
b) $\dfrac{\sqrt{3}-4}{2+\sqrt{3}} \times \dfrac{2-\sqrt{3}}{2-\sqrt{3}} = \dfrac{2\sqrt{3}-8-3+4\sqrt{3}}{4-3}$ $= 6\sqrt{3} - 11$ ① $\therefore a = -11, b = 6$ ①	• generally poorly answered. Most did not know what to do with a and b Must state $a = \quad b = $

Question 4

a) (i) domain: all real x or $x \in R$ ①
     Range: all real y or $y \in R$ ①

   (ii) domain : $x \neq 2$ ①
     range : $y \neq 0$ ①

b) (i) $f(6) - f(-2) = 36 - 8 - (-2)$ ①
      $= 20$ ①

   (ii)

①-shape
① circle
① values

(iii) Yes, satisfies vertical line test

Comments:

Students made a large number of mistakes in this question. Statements need to be made eg domain $x \in R$

Students did not realise that this was a composite function

Sketch should be ½ page

students did not refer to vertical line test