



Number of Pages Used _____

NORTH SYDNEY BOYS HIGH SCHOOL

Mathematics

Extension 1

2009 YEAR 11
Assessment Task 1

General Instructions

- Working time – **50 minutes**
- Write on one side of the paper
- Write using blue or black pen
- Board approved calculators may be used
- All necessary working should be shown in every question
- Each new question is to be started on a **new page**.

Total Marks 60

- Attempt all questions

Class Teacher:

(Please tick or highlight)

- ☐ Mr Barrett
- ☐ Mr Fletcher
- ☐ Mr Ireland
- ☐ Mr Lowe
- ☐ Mr Rezcallah
- ☐ Mr Trenwith
- ☐ Mr Weiss

Student Name: _____

Section	Q1	Q2	Q3	Q4	Total
Mark	/8	/19	/23	/10	/60

Question 1 (8 marks)**marks**

- a) i) Evaluate $12 \cdot 8^3 + \sqrt{\frac{24 \cdot 7 - 2 \cdot 5}{5}}$.
Express your answer in scientific notation with 3 significant figures. 2
- b) Express $0 \cdot 5\dot{8}$ in simplest fraction form. 2
- c) Simplify $9\sqrt{8} + 3\sqrt{12} - \sqrt{27}$ 2
- d) Rationalise the denominator of $\frac{\sqrt{5}}{\sqrt{7} + 3}$ 2

Question 2 (19 marks)

- a) i) State the domain and range of $y = x^2 - 2x$.
ii) Sketch the function showing all the important features. 4
- b) Sketch the following relations on separate number planes, showing all the important features and intercepts. **NO** domain or range need be stated for the following.
- i) $(x - 3)^2 + (y - 4)^2 = 5$ 3
- ii) $y = \frac{-3}{x - 6}$ 3
- iii) $y = \sqrt{8 - x}$ 2
- iv) $y = |4x - 6|$ 2
- c) Consider the function $y = 2 - 4^x$ 5
- i) State the domain and range of this function.
- ii) Write down the equation of the asymptote.
- iii) Sketch the curve showing all its important features.

Question 3 (23 marks)

- a) Fully factorise the following 10
- i) $ax^2 + axy + ax + ay$
 - ii) $10m^2 - 46m + 24$
 - iii) $8x^3 + 1$
 - iv) $p^5 - q^5$
 - v) $x^4 + x^2 - 20$
- b) Express with a single denominator in simplest form. 4
- i) $\frac{5}{x-8} - \frac{1}{x+3}$
 - ii) $\frac{1}{x^2 + 2x + 1} + \frac{1}{x^2 - 1}$
- c) Simplify fully $\frac{3x^2 - 48}{x^2 - 3x - 4} \div \frac{x^2 + 4x}{x^3 - x}$ 2
- d) Write, using fractional indices (ie, no radical sign) 2
- i) $5\sqrt[3]{x^2}$
 - iii) the fourth root of $16\sqrt{n}$
- e) If $a = \sqrt{2} - 1$, find the value of $a + \frac{1}{a}$ and hence show that $a^2 + \frac{1}{a^2} = 6$ 3
- f) Simplify fully by expressing the following without any negative indices 2
- $(m^{-2} + n^{-2})^{-1}$

Question 4 (10 marks)

- a) Is the function $y = \frac{x^3 - x}{x^2}$ odd, even or neither? 2
 Include a proof in your answer.

- b) The function $f(x)$ is defined as:
$$f(x) = \begin{cases} \sqrt{64 - x^2} & -8 \leq x \leq 8 \\ 2x - 16 & x > 8 \end{cases}$$

- i) Evaluate 1) $f(0)$ 2
2) $f(12)$
 ii) What is the range of $f(x)$? 1
 iii) Sketch the function $f(x)$ 2
- c) Sketch the graph of $y = \frac{1}{x} + x^2$. 3

Identify any asymptotes and points of intersection with the axes.

END OF EXAMINATION

EXN 1 2009 TEST1 (Suggested Solutions)

Q1 a) $2099.2 = 2.10 \times 10^3$

b) $x = 0.5888 \dots$

$10x = 5.888 \dots$ (1)

$100x = 58.888 \dots$ (2)

(2) - (1)

$\Rightarrow 90x = 53$ $\frac{53 \times 3}{990}$
 $x = \frac{53}{90}$

c) $9 \times 2\sqrt{2} + 3 \times 2\sqrt{3} - 3\sqrt{3}$

$= 18\sqrt{2} + 6\sqrt{3} - 3\sqrt{3}$

$= 18\sqrt{2} + 3\sqrt{3}$

d) $\frac{\sqrt{5}}{\sqrt{7}+3} \times \frac{\sqrt{7}-3}{\sqrt{7}-3} = \frac{\sqrt{35}-3\sqrt{5}}{7-9}$
 $= \frac{\sqrt{35}-3\sqrt{5}}{-2}$
 $= \frac{3\sqrt{5}-\sqrt{35}}{2}$

Q2 $y = x^2 - 2x$

i) $y = x(x-2)$

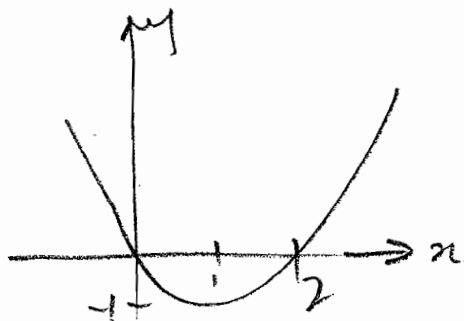
$y=0 \Rightarrow x=0 \text{ or } 2$

Min at $x=1 \therefore y=1-2=-1$

$\therefore D: x \in \mathbb{R}$

$R: y \geq -1$

ii)



— 1 correct answer
 (2) 1 rounding + S.Net

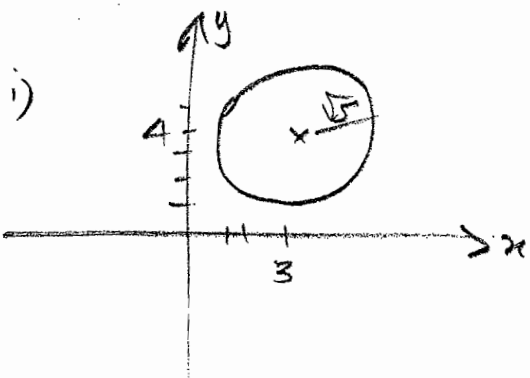
— 1 Method.
 (2) 1 answer

(2) — 1
 — 1

— 1
 — 1 (2)

— 1
 — 1

— 2
 (4)



1 - centre/Radius

1 - circle

1 - correct position

it should NOT cross the axes

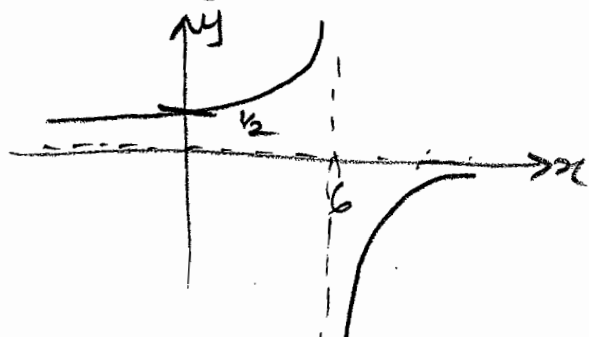
③

ii) $y = \frac{-3}{x-6}$

$(x-6)y = -3$

$x \neq 6, y \neq 0$

$x=0 \Rightarrow y = \frac{1}{2}$



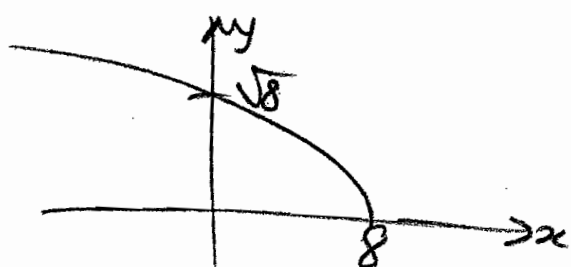
1 - asymptotes

1 - intercept

1 - shape

③

iii) $y = \sqrt{8-x}$

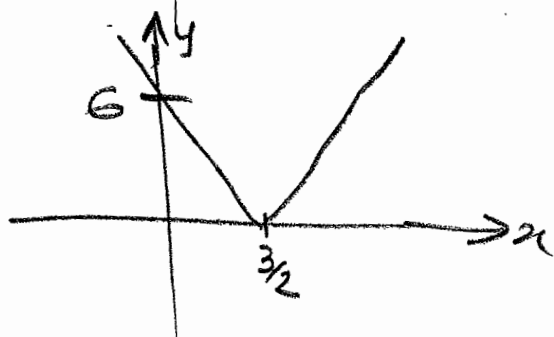


1 - shape/position

1 - intercepts

②

iv)



1 - shape/position

1 - intercepts

②

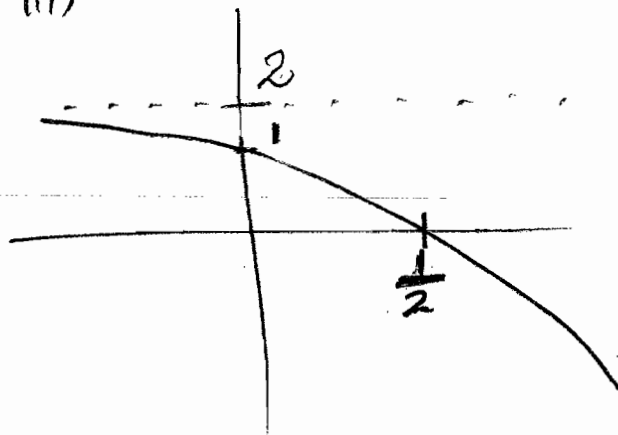
Q2 c)

i) $D: x \in \mathbb{R}$

R: $y < 2$ (no marks $y \leq 2$)

ii) $y = 2$

iii)



— |

— |

— |

— | shape / position

— | at least 1 of the intercepts

5

Q3

a) i) $ax(x+y) + a(x+y)$
 $= (x+y)(ax+a)$
 $= a(x+y)(x+1)$

— |

2

ii) $2(5m^2 - 23m + 12)$

$2(5m - 3)(m - 4)$

— 2

2

iii) $(2x+1)(4x^2 + 2x + 1)$ for + marks

— 2

2

iv) $(p-q)(p^4 + p^3q + p^2q^2 + pq^3 + q^4)$

— 2

2

v) $(x^2+5)(x^2-4)$

— |

$(x^2+5)(x-2)(x+2)$

— |

2

b)

$$i) \frac{5}{x-8} - \frac{1}{x+3}$$

$$\frac{5(x+3) - (x-8)}{(x-8)(x+3)}$$

$$= \frac{4x + 23}{(x-8)(x+3)}$$

— |

— |

2

$$ii) \frac{1}{(x+1)^2} + \frac{1}{(x+1)(x-1)}$$

$$= \frac{(x-1) + (x+1)}{(x+1)^2(x-1)}$$

— |

$$= \frac{2x}{(x+1)^2(x-1)}$$

— |

2

$$c) \frac{3(x-4)(x+4)}{(x-4)(x+4)} \times \frac{x(x-1)(x+1)}{x(x+4)}$$

— |

$$= 3(x-1)$$

— |

2

$$d) i) 5x^{2/3}$$

— |

1

$$ii) 2n^{1/8}$$

— |

1

$$e) a + \frac{1}{a} = \sqrt{2}-1 + \frac{1}{\sqrt{2}+1}$$

$$= \sqrt{2}-1 + \frac{\sqrt{2}+1}{(\sqrt{2}+1)(\sqrt{2}-1)}$$

$$= \sqrt{2}-1 + \frac{\sqrt{2}+1}{1}$$

$$= 2\sqrt{2}$$

$$\Rightarrow \left(a + \frac{1}{a}\right)^2 = 8$$

$$\left(a + \frac{1}{a}\right)^2 = a^2 + 2 + \frac{1}{a^2} = 8$$

$$a^2 + \frac{1}{a^2} = 6$$

3

$$f (m^{-2} + n^{-2})^{-1}$$

$$\frac{1}{\frac{1}{m^2} + \frac{1}{n^2}}$$

$$= \frac{1}{\frac{n^2 + m^2}{m^2 n^2}}$$

$$= \frac{m^2 n^2}{m^2 + n^2}$$

2

Q4

$$a) y = x \frac{x^3}{x^2}$$

$$f(a) = \frac{a^3 - a}{a^2}$$

$$f(-a) = \frac{(-a)^3 - (-a)}{(-a)^2}$$

$$= \frac{-a^3 + a}{a^2}$$

$$= -\left(\frac{a^3 - a}{a^2}\right)$$

$$= -f(a)$$

∴ Odd

2

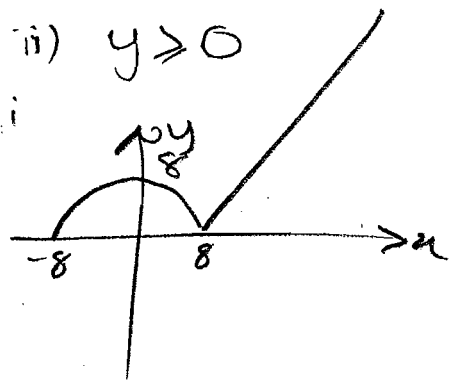
b)

i) 1. $f(0) = 8$

is 8 marks

ii) 2. $f(12) = 8$

iii) $y \geq 0$



— |

— |

— |

— |

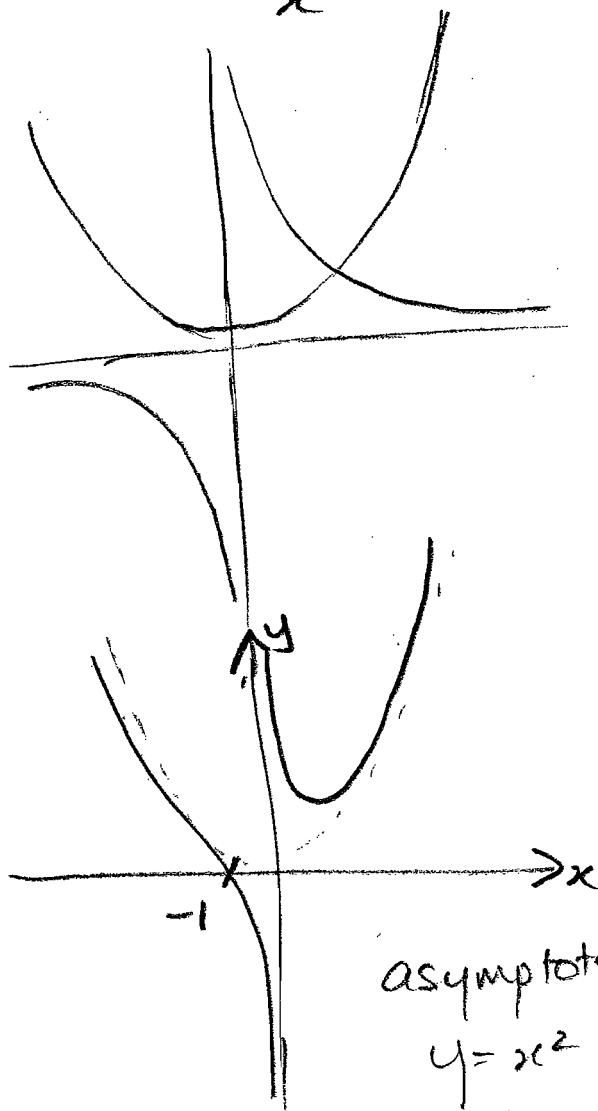
— |

Semicircle

line

5

c) $y = \frac{1}{x} + x^2$



asymptotes

$y = x^2$

and y axis

~~name~~

— |

asymptotes

— |

pt of intersection

— |

correct shape

3