SYDNEY TECHNICAL HIGH SCHOOL

2 Unit Mathematics

Year 11

Assessment Task 1

May 2009

Time Allowed: 70 minutes

Instructions:

- Write using black or blue pen
- Show all necessary working
- Approved calculators may be used
- Start each question on a new page
- Marks may be deducted for careless or badly arranged work

Name: _____ Teacher: _____

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total

QUESTION 1

Marks

a) Evaluate $\frac{1}{\sqrt{5.3^2 - 1.7}}$ correct to 2 decimal places **2**

b) Express 183479208 in scientific notation correct to 3 significant figures **1**

c) Simplify $\frac{5}{5y + 20}$ **1**

d) Given that the surface area of a cone is found using the formula **2**

$$A = \pi rs + \pi r^2$$

find the value of s correct to one decimal place when A = 150 and r = 5

e) Simplify $x^2 + 5x - (x + 2)^2$ **2**

QUESTION 2

a) Simplify $\sqrt{75} - \sqrt{12}$ **2**

b) Rationalise the denominator of $\frac{\sqrt{2}}{3\sqrt{5} + 2}$ **2**

c) Find a and b if $(4 - \sqrt{3})^2 = a - \sqrt{b}$ **2**

d) State the domain and range of $y = \sqrt{x - 1}$ **2**

e) Show without sketching that $f(x) = x^2 - x^4$ is an even function **1**

QUESTION 3

Marks

a) Factorise fully

i) $x^3 + 27$ **1**

ii) $3x^2 - 14x - 5$ **2**

iii) $ab^2 - a + 3b^2 - 3$ **3**

b) Simplify $\frac{x-1}{1-x^3}$ **2**

QUESTION 4

a) Solve the following

i) $2x^2 + 3x - 7 = 0$ using the general quadratic formula and leaving your answers in exact form. **2**

ii) $\frac{x}{2} - \frac{x+1}{5} = 1$ **2**

iii) $|3y + 2| \geq 5$ **2**

iv) $|x + 1| = 2x + 1$ **3**

QUESTION 5

Marks

a) Sketch the following functions on separate number planes. Use a ruler to draw the axes. Label any important points.

i) $y = \frac{-3}{x}$ **2**

ii) $3x - 2y - 6 = 0$ **2**

iii) $y = (x-2)^2$ **2**

b) Sketch $x^2 + y^2 = 9$. Is this a function? Why or why not? **2**

QUESTION 6

a) i) Solve simultaneously: **3**

$$2x - 3y - 12 = 0$$

$$5x + 2y - 11 = 0$$

b) i) Sketch $y = x + 1$ and $y = x - 3$ on the same set of axes **2**

ii) Shade the region $y \geq x + 1$ **1**

iii) Write down the inequality which represents the region between the two lines. **1**

c) Margaret Math needed to buy a new calculator as her old one broke. She paid \$26.50 for a new calculator This price was 7% more than the price of her old calculator. How much did she pay for the old one? **1**

QUESTION 7

Marks

a) The function $f(x)$ is defined as **2**

$$f(x) = \begin{cases} x^3 + 1 & \text{if } x > 2 \\ 2x & \text{if } -1 \leq x \leq 2 \\ 5 & \text{if } x < -1 \end{cases}$$

Find $f(-3) + f(0) - f(4) + f(2)$

b) If $g(x) = 2x - 1$, find x when $g(x) = 5$ **1**

c) Simplify fully $\sqrt{108} \times \sqrt{50}$ **2**

d) Simplify $\frac{1}{x} + \frac{2}{x+1}$ **2**

e) Evaluate $8.3 \times 10^{15} - 7.1 \times 10^{13}$ and express your answer in scientific notation correct to 2 significant figures. **1**

QUESTION 8

a) Solve $3^{2x+1} = \frac{1}{27}$ **2**

b) Simplify $\frac{3a+6}{4b^3} \div \frac{a^2+a-2}{6b^2-2b}$ **3**

c) i) Write down the domain and range of **2**

$$y = 2 - \frac{1}{x+1}$$

ii) Sketch the function showing all main features **2**

Teacher's Name: ____ Student's Name/N°: ____

2009 Year 11 2 Unit Ass Task 1 Solutions

Question 1

a) $\underline{0.19}$ (2)

(1) if not rounded off correctly

b) $\underline{1.83 \times 10^8}$ (1)

c) $\frac{5}{5(y+4)}$

$= \frac{1}{y+4}$ (1)

d) $A = \pi r s + \pi r^2$

$150 = \pi \times 5 \times s + \pi \times 5^2$

$\underline{s = 4.5}$ (2)

(1) if not rounded

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

$x^2 + 5x - x^2 - 4x - 4$ (1)

$\underline{x - 4}$ (2)

Question 2

a) $\sqrt{75} - \sqrt{12}$

$5\sqrt{3} - 2\sqrt{3}$ (1)

$= \underline{3\sqrt{3}}$ (2)

b) $\frac{\sqrt{2}}{3\sqrt{5}+2} \times \frac{3\sqrt{5}-2}{3\sqrt{5}-2}$

$= \frac{3\sqrt{10} - 2\sqrt{2}}{41}$ (2)

c) $(4 - \sqrt{3})^2 = a - \sqrt{b}$

$16 - 8\sqrt{3} + 3 = a - \sqrt{b}$

$19 - 8\sqrt{3} = a - \sqrt{b}$

$19 - \sqrt{192} = a - \sqrt{b}$

$\underline{a = 19, \quad b = 192}$ (2)

d) $y = \sqrt{x-1}$

Domain: $x \geq 1$ (1)

Range: $y \geq 0$ (1)

e) $f(x)$ even if

$f(x) = f(-x)$

$x^2 - x^4 = (-x)^2 - (-x)^4$

$= x^2 - x^4$ ✓ (1)

$\therefore$ Even

Question 3

a) (i) $x^3 + 27$

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

(ii) $3x^2 - 14x - 5$

+ : −14
× : −15
−15, 1

$\frac{(3x-15)(3x+1)}{3}$

$= \underline{(x-5)(3x+1)}$ (2)

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(iii) $ab^2 - a + 3b^2 - 3$

$a(b^2-1) + 3(b^2-1)$ (1)

$(a+3)(b^2-1)$ (2)

$(a+3)(b-1)(b+1)$ (3)

b) $\frac{x-1}{1-x^3}$

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

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

Question 4

a) $2x^2 + 3x - 7 = 0$

$x = \frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times -7}}{2 \times 2}$ (1)

$= \frac{-3 \pm \sqrt{65}}{4}$ (2)

b) $\frac{x}{2} - \frac{x+1}{5} = 1$

$5x - 2(x+1) = 10$ (1)

$3x - 2 = 12$

$3x = 12$

$x = 4$ (2)

(iii) $|3y + 2| \geq 5$

$3y + 2 \geq 5$ or $3y + 2 \leq -5$ (1)

$3y \geq 3$ or $3y \leq -7$

$y \geq 1$ or $y \leq -\frac{7}{3}$ (2)

(iv) $|x+1| = 2x + 1$

$x + 1 = 2x + 1$, $x + 1 = -(2x$

$x = 0$ or $x + 1 = -2x$

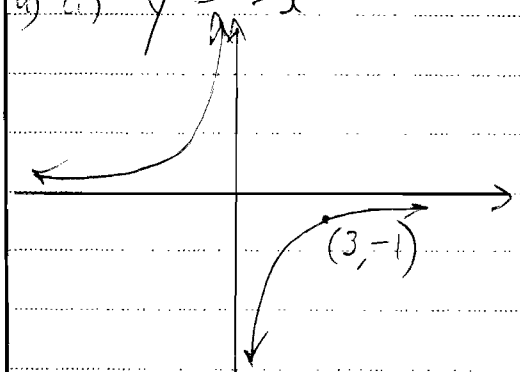
(2) → $3x = -2$

$x = \frac{-2}{3}$

(3) Check! Only $x = 0$

Question 5

a) (i) $y = \frac{-3}{x}$

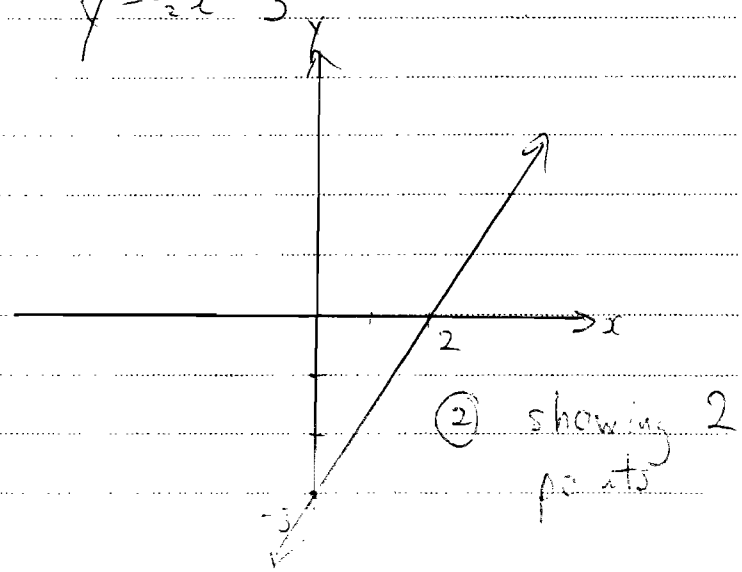


(2) showing a pt.

(ii) $3x - 2y - 6 = 0$

$2y = 3x - 6$

$y = \frac{3}{2}x - 3$



(2) showing 2 points

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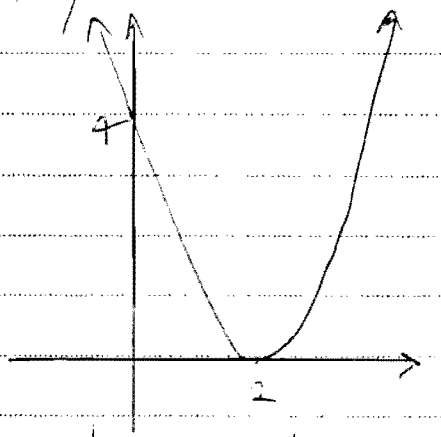
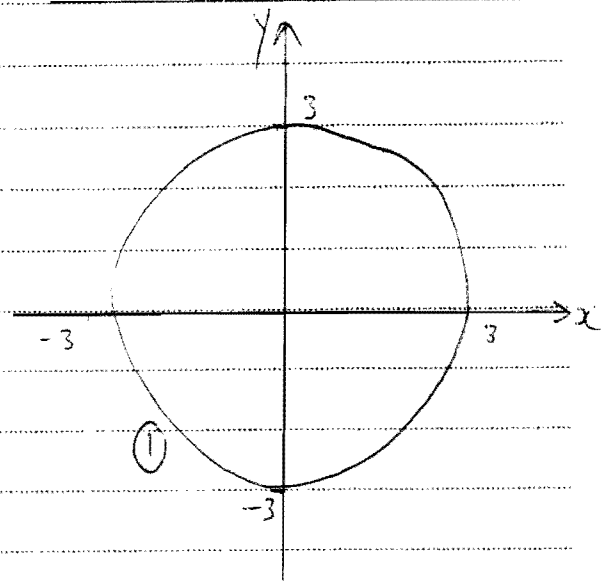
c(iii) $y = (x-2)^2$



(2) showing turning point and y intercept

b)



(1)

No. Fails vertical line test (or similar) (1)

Question 6

a) $2x - 3y - 12 = 0$ (1)

$5x + 2y - 11 = 0$ (2)

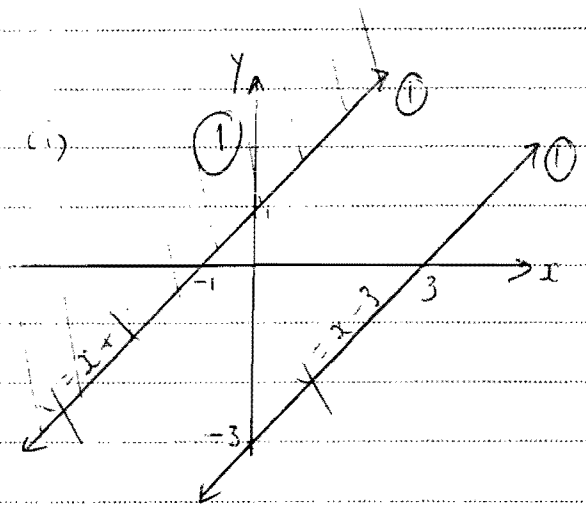
(1) × 2 + (2) × 3

$19x - 57 = 0$ (1) mark

$x = 3 \quad y = -2$

(1) (1)

b) (i)



(1) (1) (1)

(ii) $x - 3 \leq y \leq x + 1$ (1)

or $y \geq x - 3$ and $y \leq x + 1$ (1)

c) $\$26.50 \equiv 107\%$

Old price $= 100\%$

$\equiv \$24.77$ (1)

Question 7

a) $f(-3) + f(0) - f(4) + f(2)$

$5 + 0 - 65 + 4$ (1)

-56 (1)

b) $g(x) = 2x - 1$

$5 = 2x - 1$

$6 = 2x$

$x = 3$ (1)

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c) $\frac{\sqrt{108} \times \sqrt{50}}{6\sqrt{3} \times 5\sqrt{2}}$ ①

$= \underline{30\sqrt{6}}$ ①

d) $\frac{1}{x} + \frac{2}{x+1}$

$\frac{x+1+2x}{x(x+1)}$ ①

$\underline{\frac{3x+1}{x(x+1)}}$ ①

e) $\underline{8.2 \times 10^{15}}$ ①

Question 8

a) $3^{2x+1} = \frac{1}{27}$

$3^{2x+1} = 3^{-3}$ ①

$2x+1 = -3$

$2x = -4$

$\underline{x = -2}$ ①

b) $\frac{3a+6}{4b^3} \div \frac{a^2+a-2}{6b^2-2b}$

$\frac{3(a+2)}{4b^{\cancel{3}2}_{2}} \times \frac{2b(3b-1)}{(a+2)(a-1)}$ ②

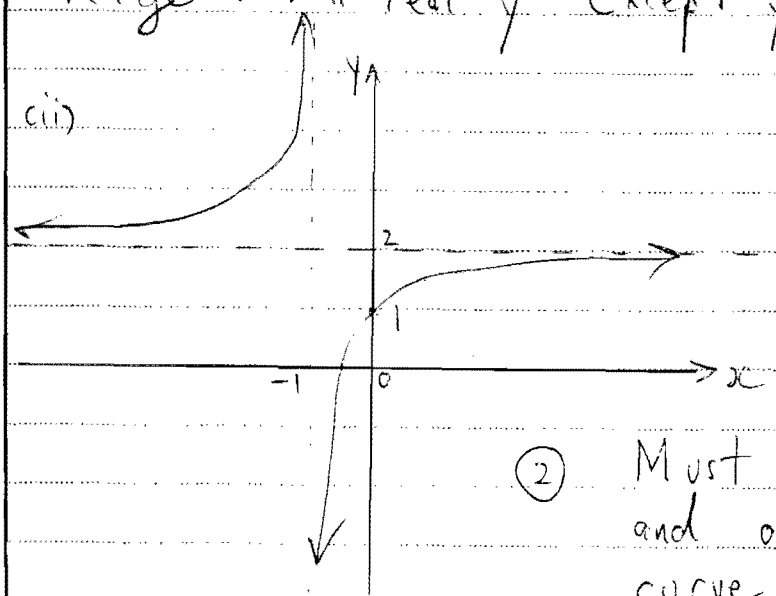
$= \underline{\frac{3(3b-1)}{2b^2(a-1)}}$ ①

c) (i) $y = 2 - \frac{1}{x+1}$

Domain: All real x except $x = -1$ ①

Range: All real y except $y = 2$ ①

(ii)



② Must have asymptotes and one point on curve labelled.