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

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

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

c)   Simplify $\dfrac{5}{5y + 20}$ 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 $\dfrac{\sqrt{2}}{3\sqrt{5} + 2}$ 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

a)   Factorise fully

  i) $x^3 + 27$ 1

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

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

b)   Simplify $\dfrac{x-1}{1-x^3}$ 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) $\dfrac{x}{2} - \dfrac{x+1}{5} = 1$ 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) $\quad y = \dfrac{-3}{x}$ **2**

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

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

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 $\dfrac{1}{x} + \dfrac{2}{x+1}$ 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 $3^{2x+1} = \dfrac{1}{27}$ 2

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

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

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

          ii)   Sketch the function showing all main features   2

2009 Year 11 2 Unit Ass Task 1 Solutions

Question 1

a) 0.19 ②

① if not rounded off correctly

b) 1.83×10^8 ①

c) $\dfrac{\cancel{5}(y+4)}{\cancel{5}}$

$= \dfrac{1}{y+4}$ 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) $\dfrac{\sqrt{2}}{3\sqrt{5}+2} \times \dfrac{3\sqrt{5}-2}{3\sqrt{5}-2}$

$= \dfrac{3\sqrt{10} - 2\sqrt{2}}{41}$ 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

∴ Even

Question 3

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

$\underline{(x+3)(x^2 - 3x + 9)}$ ①

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

$\begin{array}{r|l} + & -14 \\ \times & -15 \\ \hline & -15, 1 \end{array}$

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

$= (x - 5)(3x + 1)$ ②

(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) $\dfrac{x - 1}{1 - x^3}$

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

$= \dfrac{-1}{x^2 + x + 1}$ ②

Question 4

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

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

$= \dfrac{-3 \mp \sqrt{65}}{4}$ ②

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

$5x - 2(x + 1) = 10$ 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 $y \leq \dfrac{-7}{3}$ ②

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

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

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

② $3x = -2$

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

③ Check! Only $x = 0$

Question 5

a) (i) $y = \dfrac{-3}{x}$
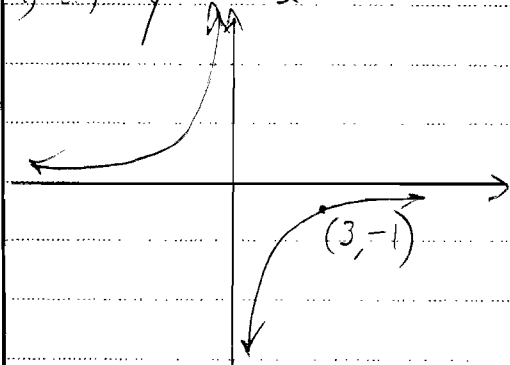
$(3, -1)$

② showing a pt.

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

$2y = 3x - 6$

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

② showing 2 points
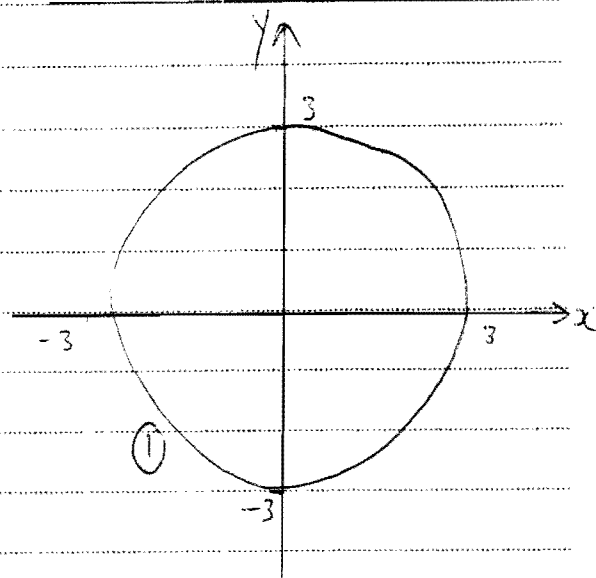
(iii) $y = (x-2)^2$

b)
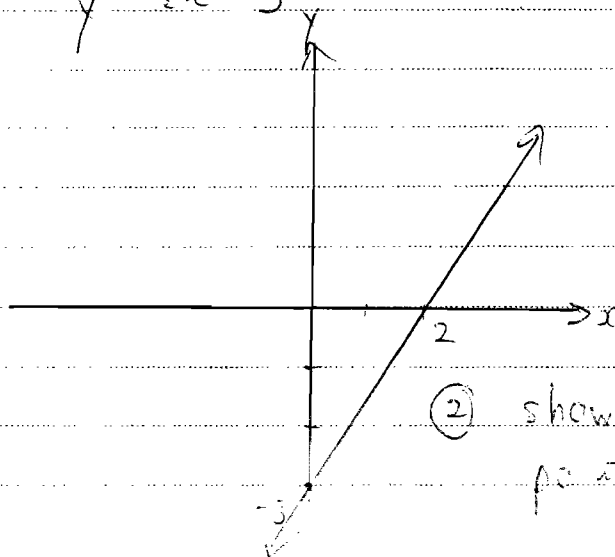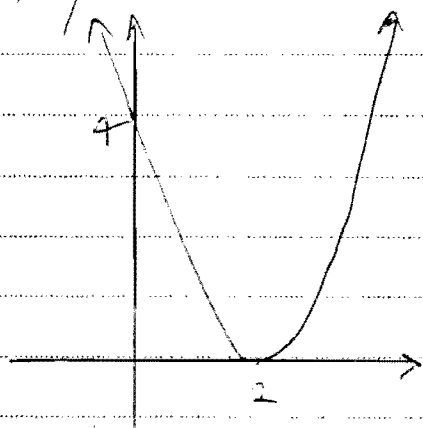
② showing turning point and y intercept

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

Question 6
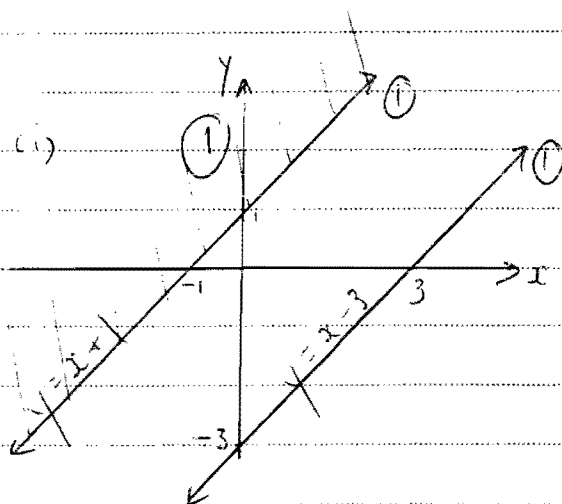
a) $2x - 3y - 12 = 0$ ①   b) (i)
$5x + 2y - 11 = 0$ ②

① $\times 2$ + ② $\times 3$

$19x - 57 = 0$ ① mark

$\underline{x = 3 \quad y = -2}$
   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 $= 100\%$
$= \$24.77$ ①

Question 7

a) $f(-3) + f(0) - f(4) + f(2)$
$5 + 0 - 65 + 4$ ①
$\underline{-56}$ ①

b) $g(x) = 2x - 1$
$5 = 2x - 1$
$6 = 2x$
$\underline{x = 3}$ ①

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

$= \dfrac{30\sqrt{6}}{}$ ①

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

$\dfrac{x+1 + 2x}{x(x+1)}$ ①

$\dfrac{3x+1}{x(x+1)}$ ①

e) 8.2×10^{15} ①

Question 8

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

$3^{2x+1} = 3^{-3}$ ①

$2x+1 = -3$

$2x = -4$

$\underline{x = -2}$ ①

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

$\dfrac{3(a+2)}{4b^3\,^2} \times \dfrac{2b(3b-1)}{(a+2)(a-1)}$ ②

$= \dfrac{3(3b-1)}{2b^2(a-1)}$ ①

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

Domain: All real x except $x = -1$ ①

Range : All real y except $y = 2$ ①

(ii)
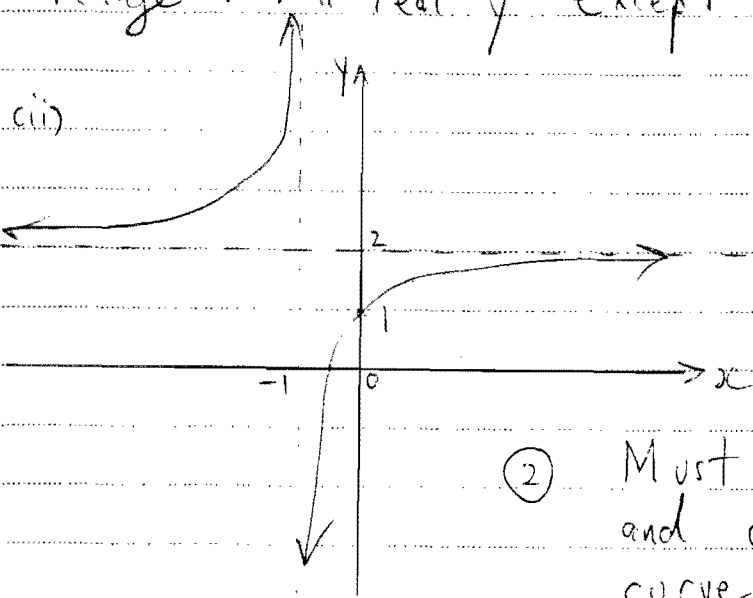
② Must have asymptotes and one point on curve labelled.