GIRRAWEEN HIGH SCHOOL

YEAR 11 - TASK 1

2005

MATHEMATICS
2 UNIT

Time allowed – 90 minutes

DIRECTIONS TO CANDIDATES

- Attempt ALL questions.

- All necessary working should be shown in every question. Marks may be deducted for careless or badly arranged work.

- Board-approved calculators may be used.

- Start each question on a *new* sheet of paper.

Question 1 (16 marks)

(a)   Find $\dfrac{\sqrt{34 \div 5.9}}{21 - 4.7}$ correct to 3 decimal places.   **1**

(b)   Evaluate $\sqrt[3]{\dfrac{73.1}{0.2}}$ correct to 2 significant figures.   **1**

(c)   Write 0.01072 in scientific notation.   **1**

(d)   Fully simplify $\sqrt{245}$.   **2**

(e)   If $\sqrt{12} - \sqrt{3} = x\sqrt{3}$, find the value of x.   **2**

(f)   Which of the following $\pi, \sqrt{1}, -\sqrt{9}, \sqrt{3}, 2^{-1}, 5^{\frac{1}{2}}, 8^{-\frac{1}{3}}$
are rational numbers.   **3**

(g)   Express the following as a fraction in simplest form.
(i) $0.38\dot{4}$ **3**

(ii) $6.\dot{2}4\dot{7}$ **3**

Question 2 (24 marks)

(a)   Simplify.

(i) $\sqrt{50} - \sqrt{32}$ **2**

(ii) $2\sqrt{3} + \sqrt{27} - \sqrt{243}$ **2**

(iii) $\dfrac{5\sqrt{2} \times 6\sqrt{10}}{3\sqrt{5}}$ **3**

(b)   Expand and simplify.

(i) $4\sqrt{3}(3\sqrt{6} + 2\sqrt{12})$ **2**

(ii) $(5\sqrt{2} - 3)^2$ **3**

(c)   Express with a rational denominator.

(i) $\dfrac{2\sqrt{3}}{\sqrt{7}}$ **2**

(ii) $\dfrac{4}{2 - \sqrt{7}}$ **3**

(iii) $\dfrac{3\sqrt{2}}{\sqrt{3} + \sqrt{5}}$ **3**

(iv) $\dfrac{7\sqrt{5} - 1}{7\sqrt{5} + 1}$ **4**

Question 3 (22 marks)

(a)   Expand and simplify

   (i) $-3a^2\left(2a - \dfrac{b^2}{a}\right) - 5a\left(b^2 + 3a\right)$ 2

   (ii) $(3y^2 - 2)(3y^2 + 2)$ 2

   (iii) $(x + 2)(x^2 - 2x + 4)$ 2

   (iv) $(x + 2)(x - 4)^2$ 3

(b)   Factorise.

   (i) $4m^2 - 25$ 2

   (ii) $x^2 - 4xy - 60y^2$ 2

   (iii) $2y^2 + 11y - 21$ 3

   (iv) $r^3 - 27$ 3

   (v) $4 - 16a^4$ 3

Question 4 (19 marks)

(a)   Simplify

   (i) $\dfrac{c}{4} - \dfrac{c}{6}$ 2

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

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

(b)   Simplify

   (i) $\dfrac{1-x}{x^2 - 1}$ 3

   (ii) $\dfrac{x^3 + 4x^2 - 4x - 16}{x^2 + 6x + 8}$ 4

   (iii) $\dfrac{a^2 + b}{a + b} \div \dfrac{a^4 - b^4}{a^2 + 2ab + b^2}$ 4

Question 5 (20 marks)

(a) Solve

(i) $28 = 12x - 5x$ **2**

(ii) $(2x - 1)(x + 3) = 0$ **2**

(iii) $\dfrac{9}{2x} = 4 - \dfrac{3}{x}$ **3**

(iv) $4x^2 + 4x - 15 = 0$ **4**

(b) Complete the following

$x^2 + 16x + \ldots = \left(x + \ldots\right)^2$ **2**

(c) Solve by completing the square

$x^2 + 4x = 1$ **4**

(d) Solve by using the quadratic formula

$2x^2 + 4x - 7 = 0$ **3**

Question 6 (18 marks)

(a) Solve the following

(i) $-2x \leq 4$ **1**

(ii) $\dfrac{2x}{3} < x + 2$ **2**

(iii) $|4x + 3| = 15$ **2**

(iv) $\left|\dfrac{x + 1}{2}\right| \geq 6$ **3**

(b) Solve simultaneously

(i) $\begin{aligned} x + 2y &= 10 \\ x - y &= 1 \end{aligned}$ **3**

(ii) $\begin{aligned} 5x + 2y &= 11 \\ x - 5y &= 13 \end{aligned}$ **3**

(iii) $\begin{aligned} y &= x^2 + 3 \\ y &= 4x \end{aligned}$ **4**

Yr 11 - Mathematics   SOLUTIONS
Task 1 (2005)

Q1) a) 0.147   (3 dec. pls.)   ①

b) 7.1   (2 sign. fig.)   ①

c) 1.072×10^{-2} ①

d) $= \sqrt{49 \times 5}$
$= 7\sqrt{5}$ ②

e) $2\sqrt{3} - \sqrt{3} = x\sqrt{3}$
$1\sqrt{3} = x\sqrt{3}$
$\underline{x = 1}$ ②

f) $\sqrt{1}, -\sqrt{9}, 2^{-1}, 8^{\frac{1}{3}}$ ③

g) (i) $x = 0.38\dot{4}$
$100x = 38.44...$
$1000x = 384.44...$

$1000x - 100x = 384.44.. - 38.44..$
$900x = 346$
$x = \frac{346}{900} = \frac{173}{450}$ ③

(ii) $x = 6.\dot{2}4\dot{7}$
$1000x = 6247.247247.$
$1000x - x = 6247.247247.. - 6.247247..$
$999x = 6241$
$x = \frac{6241}{999} = 6\frac{247}{999}$ ③

Q2) a) (i) $5\sqrt{2} - 4\sqrt{2} = \sqrt{2}$ ②

(ii) $2\sqrt{3} + 3\sqrt{3} - 9\sqrt{3} = -4\sqrt{3}$ ②

(iii) $= \frac{30\sqrt{20}}{3\sqrt{5}} = \frac{10\sqrt{20}}{\sqrt{5}}$
$= \frac{20\sqrt{5}}{\sqrt{5}}$ ③
$= 20.$

b) (i) $= 12\sqrt{18} + 8\sqrt{36}$
$= 36\sqrt{2} + 48$ ②

(ii) $= 25\sqrt{4} - 2 \times 15\sqrt{2} + 9$
$= 50 - 30\sqrt{2} + 9$
$= 59 - 30\sqrt{2}$ ③

c) (i) $\frac{2\sqrt{3}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{2\sqrt{21}}{7}$ ②

(ii) $\frac{4}{2-\sqrt{7}} \times \frac{2+\sqrt{7}}{2+\sqrt{7}} = \frac{8+4\sqrt{7}}{4-7}$
$= \frac{8+4\sqrt{7}}{-3}$ ③

(iii) $\frac{3\sqrt{2}}{\sqrt{3}+\sqrt{5}} \times \frac{\sqrt{3}-\sqrt{5}}{\sqrt{3}-\sqrt{5}} = \frac{3\sqrt{6}-3\sqrt{10}}{3-5}$
$= \frac{3(\sqrt{6}-\sqrt{10})}{-2}$ ③

(iv) $\frac{7\sqrt{5}-1}{7\sqrt{5}+1} \times \frac{7\sqrt{5}-1}{7\sqrt{5}-1} = \frac{49\sqrt{25}-2\times7\sqrt{5}+1}{49\sqrt{25}-1}$
$= \frac{245 - 14\sqrt{5} + 1}{245 - 1}$
$= \frac{246 - 14\sqrt{5}}{244}$
$= \frac{2(123 - 7\sqrt{5})}{244}$
$= \frac{123 - 7\sqrt{5}}{122}$ ④

Q3 a) (i) $-6a^3 + 3ab^2 - 5ab^2 - 15a^2$

$\qquad = -6a^3 - 2ab^2 - 15a^2$ ②

(ii) $9y^4 - 4$ ②

(iii) $x^3 + 8$ ②

(iv) $(x+2)(x^2 - 8x + 16)$

$\qquad = x^3 - 8x^2 + 16x + 2x^2 - 16x + 32$

$\qquad = x^3 - 6x^2 + 32$ ③

b) (i) $(2m+5)(2m-5)$ ②

(ii) $(x - 10y)(x + 6y)$ ②

(iii) $2y^2 + 14y - 3y - 21$

$\qquad = 2y(y+7) - 3(y+7)$

$\qquad = (y+7)(2y-3)$ ③

or
$\begin{array}{cc|c} 2y & \times \quad -3 & -3y \\ y & \quad +7 & +14y \\ \hline & & 11y \end{array}$

(iv) $(r-3)(r^2 + 3r + 9)$ ③

(v) $4(1 - 4a^4)$

$\qquad = 4(1 - 2a^2)(1 + 2a^2)$ ③

Q4 a) (i) $\dfrac{6c}{24} - \dfrac{4c}{24} = \dfrac{2c}{24} = \dfrac{c}{12}$ ②

(ii) $\dfrac{x}{x(x-2)} - \dfrac{(x-2)}{x(x-2)}$

$\qquad = \dfrac{2}{x(x-2)}$ ③

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

$\qquad = \dfrac{2x - 4 + x^2 + 3x}{(x+3)(x-2)}$

$\qquad = \dfrac{x^2 + 5x - 4}{(x+3)(x-2)}$ ③

b) (i) $\dfrac{-(x-1)}{(x-1)(x+1)}$

$\qquad = \dfrac{-1}{x+1}$ ③

(ii) $\dfrac{x^2(x+4) - 4(x+4)}{(x+4)(x+2)}$

$\qquad = \dfrac{(x+4)(x^2-4)}{(x+4)(x+2)}$

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

$\qquad = x-2$ ④

(iii) $\dfrac{(a^2+b)}{(a+b)} \times \dfrac{(a+b)^2}{(a^2+b^2)(a^2-b^2)}$

$\qquad = \dfrac{(a^2+b)(a+b)}{(a^2+b^2)(a+b)(a-b)}$

$\qquad = \dfrac{a^2+b}{(a^2+b^2)(a-b)}$ ④

Q5 a) (i) $28 = 7x$

$\underline{x = 4}$ ②

(ii) $\underline{x = \frac{1}{2}, -3}$ ②

(iii) $9 = 8x - 6$

$15 = 8x$

$\underline{x = \frac{15}{8} = 1\frac{7}{8}}$ ③

(iv) $0 = 4x^2 - 6x + 10x - 15$

$0 = 2x(2x-3) + 5(2x-3)$

$0 = (2x-3)(2x+5)$

$\therefore \underline{x = \frac{3}{2}, -\frac{5}{2}}$

$or \left(x = 1\frac{1}{2}, -2\frac{1}{2}\right)$ ④

or $(2x \times +5) \Big| 10x$
$(2x \times -3) \Big| -6x$
$\overline{\quad 4x}$

b) $x^2 + 16x + \underline{64} = (x + \underline{8})^2$ ②

c) $x^2 + 4x + \underline{4} = 1 + \underline{4}$

$(x+2)^2 = 5$

$x + 2 = \pm\sqrt{5}$

$\underline{x = -2 \pm \sqrt{5}}$ ④

d) $x = \dfrac{-4 \pm \sqrt{4^2 - 4(2)(-7)}}{2(2)}$

$= \dfrac{-4 \pm \sqrt{16 + 56}}{4}$

$= \dfrac{-4 \pm 6\sqrt{2}}{4}$

$\underline{x = \dfrac{-2 \pm 3\sqrt{2}}{2}}$ ③

Q6 (a) (i) $\underline{x \geqslant -2}$ ①

(ii) $2x < 3x + 6$

$-6 < x$

$\underline{x > -6}$ ②

(iii) $4x + 3 = 15$ $\qquad$ $4x + 3 = -15$
$\quad 4x = 12$ $\qquad\qquad$ $4x = -18$
$\quad \underline{x = 3}$ $\qquad\qquad$ $\underline{x = -4\frac{1}{2}}$ ②

(iv) $\dfrac{x+1}{2} \geqslant 6$ $\qquad$ $\dfrac{x+1}{2} \leqslant -6$

$\underline{x \geqslant 11}$ ⓞⓡ $\underline{x \leqslant -13}$ ③

(b) (i) $x + 2y = 10$ ①
$\quad\;\; x - y = 1$ ②

① - ② $\quad 3y = 9$

$\underline{y = 3}$

sub $y = 3$ into ① $\quad x + 2(3) = 10$

$\underline{x = 4}$ $\qquad (4,3)$ ③

(ii) $5x + 2y = 11$ ①
$\quad\; x - 5y = 13$ ②

② × 5 $\quad 5x - 25y = 65$ ③

① - ③ $\quad 27y = -54$

$\underline{y = -2}$

sub $y = -2$ into ② $\quad x - 5(-2) = 13$

$x + 10 = 13$

$\underline{x = 3}$ $\qquad (3,-2)$ ③

(iii) $y = x^2 + 3$ ①
$\quad\; y = 4x$ ②

Sub ① into ② $\quad x^2 + 3 = 4x$

$x^2 - 4x + 3 = 0$

$(x-1)(x-3) = 0$

$\therefore \underline{x = 1, 3}$

sub $x = 1, 3$ into ② $\quad y = 4(1) \; \& \; y = 4(3)$

$\underline{y = 4, 12}$ $\therefore \underline{(1,4) \& (3,12)}$ ④