



GIRRAWEEN HIGH SCHOOL

YEAR 11 - TASK 1

2006

MATHEMATICS

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 $\frac{\sqrt{2.8+7.6}}{4.7-2.9}$ correct to 3 decimal places. 2
- (b) Evaluate $\sqrt{\frac{4.91 \times 10^5}{7.46 \times 10^9}}$ correct to 3 significant figures. 1
- (c) Write 6 340 000 000 in scientific notation. 1
- (d) Evaluate $\frac{|10-12|}{|5| \times |-7|}$ 2
- (e) If $S = \frac{a}{1-r}$ find the value of a when $S = 30$ and $r = \frac{3}{4}$ 2
- (f) After GST of 10% the new price of an item is \$16.50
What was the price of the item before GST? 2
- (g) Express the following as a fraction in simplest form. 6
- (i) $0.1\dot{4}$
- (ii) $0.\dot{3}2\dot{4}$

Question 2 (22 marks)

(a) Simplify.

(i) $4\sqrt{5} \times 3\sqrt{7}$

1

(ii) $\sqrt{8} + \sqrt{32} - \sqrt{2}$

2

(iii) $\frac{5\sqrt{3} \times 6\sqrt{15}}{2\sqrt{5}}$

3

(b) Expand and simplify :

(i) $\sqrt{2}(\sqrt{6} - 1)$

2

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

3

(c) Express with a rational denominator :

(i) $\frac{4}{3\sqrt{2}}$

2

(ii) $\frac{2}{2 - \sqrt{3}}$

3

(iii) $\frac{2\sqrt{3}}{\sqrt{2} + \sqrt{3}}$

3

(d) Show that $\frac{1}{5 - \sqrt{7}} + \frac{1}{5 + \sqrt{7}}$ is a rational number.

3

Question 3 (21 marks)

(a) Expand and simplify :

(i) $4(a - 2b) - 4(b - 4a)$ 2

(ii) $(2x^2 - 1)(2x^2 + 1)$ 2

(iii) $(x - y)(x^2 + xy + y^2)$ 2

(iv) $(x + 1)(x - 3)^2$ 3

(b) Factorise :

(i) $a^2 + 6a + 9$ 2

(ii) $3x^3 - 27$ 2

(iii) $2x^2 - 7x - 15$ 3

(iv) $ax + by - bx - by$ 2

(v) $8x^3 - 125$ 3

Question 4 (17 marks)

(a) Simplify :

(i) $\frac{x}{3} - \frac{x}{7}$ 2

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

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

(b) Simplify :

(i) $\frac{1-t^2}{t-1}$ 3

(ii) $\frac{m^2 + 2m - 8}{m^2 - 4}$ 3

(iii) $\frac{x^3 + 8}{x^2 - 2x + 4}$ 3

Question 5 (20 marks)

(a) Solve the following equations :

(i) $4(x + 1) - 3(x - 1) = 6$ 3

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

(iii) $\frac{2 - x}{2x} = -5$ 2

(iv) $4x^2 + 7x - 2 = 0$ 3

(b) Use the method of completing the square to solve the equation $x^2 + 6x + 7 = 0$.
[Give answer in surd form] 3

(c) Use the quadratic formula to solve the equation $3x^2 - 3x - 1 = 0$.
[Give answer in exact form] 3

(d) A rectangle has a perimeter of 30 cm and a length of x cm. 4

(i) Show that its area, A , is given by $A = 15x - x^2$.

(ii) Find the length of the rectangle when the area is 56 cm^2

Question 6 (¹⁷~~19~~ marks)

(a) Solve :

(i) $-3x \geq 6$ 1

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

(b) Solve $|2x - 3| < 5$ and graph the solution on the number line. 4

(c) Solve the following simultaneous equations :

(i) $x - 5y = -11$ 3
 $x + 2y = -4$

(ii) $3x - 7y = 1$ 3
 $4x - 5y = -3$

(iii) $y = x^2 - 3x + 3$ 4
 $2x - y - 3 = 0$

End of Assessment Task 1

Mathematics Yr 11 Task 1, 2006 (Solutions)

QUESTION 1

$$(a) \frac{\sqrt{10.4}}{1.8} = 1.792 \# \quad (2)$$

$$(b) 8.11 \times 10^{-3} \# \quad (1)$$

$$(c) 6.34 \times 10^9 \# \quad (1)$$

$$(d) \frac{110-121}{151 \times 1.71} = \frac{2}{5 \times 7} = \frac{2}{35} \# \quad (2)$$

$$(e) 30 = \frac{a}{1-3/4}$$
$$30 = \frac{a}{1/4} \quad (2)$$
$$a = 7\frac{1}{2} \#$$

$$(f) 110\% \equiv \$16.50$$
$$1\% \equiv \frac{\$16.50}{110}$$
$$100\% = \frac{\$16.50}{110} \times 100 = \$15 \# \quad (2)$$

$$(g) (i) \text{ Let } x = 0.14444\dots \quad (1)$$

$$\therefore 10x = 1.44444\dots \quad (2)$$

$$(2) - (1) \Rightarrow 9x = 1.3$$
$$\therefore x = \frac{13}{90} \# \quad (3)$$

$$(ii) \text{ Let } x = 0.324324324\dots \quad (1)$$

$$\therefore 1000x = 324.324324\dots \quad (2)$$

$$(2) - (1) \Rightarrow 999x = 324$$

$$x = \frac{324}{999}$$

$$x = \frac{12}{37} \# \quad (3)$$

QUESTION 2

$$(a) \quad (i) \quad 4\sqrt{5} \times 3\sqrt{7} = 12\sqrt{35} \quad (1)$$

$$(ii) \quad \begin{aligned} & \sqrt{8} + \sqrt{32} - \sqrt{2} \\ &= 2\sqrt{2} + 4\sqrt{2} - \sqrt{2} \\ &= 5\sqrt{2}. \end{aligned} \quad (2)$$

$$(iii) \quad \frac{5\sqrt{3} \times 6\sqrt{15}}{2\sqrt{5}} = \frac{5\sqrt{3} \times 6\sqrt{5} \cdot \sqrt{3}}{2\sqrt{5}} = 45 \quad (3)$$

$$(b) \quad (i) \quad \begin{aligned} \sqrt{2}(\sqrt{6}-1) &= \sqrt{12} - \sqrt{2} \\ &= 2\sqrt{3} - \sqrt{2}. \end{aligned} \quad (2)$$

$$(ii) \quad \begin{aligned} & (5\sqrt{3}-2)^2 \\ &= (5\sqrt{3})^2 + 2 \times 5\sqrt{3} \times -2 + (-2)^2 \\ &= 75 - 20\sqrt{3} + 4 \\ &= 79 - 20\sqrt{3} \end{aligned} \quad (3)$$

$$(c) \quad (i) \quad \frac{4}{3\sqrt{2}} = \frac{4}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{4\sqrt{2}}{6} = \frac{2\sqrt{2}}{3} \quad (2)$$

$$(ii) \quad \begin{aligned} \frac{2}{2-\sqrt{3}} &= \frac{2}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} \\ &= \frac{2(2+\sqrt{3})}{4-3} \\ &= 4+2\sqrt{3} \quad \# \end{aligned} \quad (3)$$

$$(iii) \quad \begin{aligned} \frac{2\sqrt{3}}{\sqrt{2}+\sqrt{3}} &= \frac{2\sqrt{3}}{\sqrt{2}+\sqrt{3}} \times \frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}-\sqrt{3}} \\ &= \frac{2\sqrt{6}-6}{2-3} \\ &= 6-2\sqrt{6} \quad \# \end{aligned} \quad (3)$$

$$(d) \frac{1}{5-\sqrt{7}} + \frac{1}{5+\sqrt{7}}$$

$$= \frac{5+\sqrt{7} + 5-\sqrt{7}}{(5-\sqrt{7})(5+\sqrt{7})}$$

$$= \frac{10}{25-7} = \frac{10}{18} = \frac{5}{9} \text{ which is } \textcircled{3} \text{ rational. \#}$$

QUESTION 3

$$(a) \text{ (i) } 4(a-2b) - 4(b-4a)$$

$$= 4a - 8b - 4b + 16a$$

$$= 20a - 12b \text{ \# } \textcircled{2}$$

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

$$= 4x^4 - 1 \text{ \# } \textcircled{2}$$

$$\text{(iii) } (x-y)(x^2+xy+y^2)$$

$$= x^3 + x^2y + xy^2 - x^2y - xy^2 - y^3$$

$$= x^3 - y^3 \text{ \# } \textcircled{2}$$

(iv)

$$(x+1)(x-3)^2$$

$$= (x+1)(x^2-6x+9)$$

$$= x^3 - 6x^2 + 9x + x^2 - 6x + 9$$

$$= x^3 - 5x^2 + 3x + 9 \text{ \# } \textcircled{3}$$

(b)

$$\text{(i) } a^2 + 6a + 9 = (a+3)^2 \text{ \# } \textcircled{2}$$

$$\text{(ii) } 3x^3 - 27$$

$$= 3(x^3 - 9) \text{ \# } \textcircled{2}$$

(iii)

$$2x^2 - 7x - 15$$

$$= 2x^2 - 10x + 3x - 15$$

$$= 2x(x-5) + 3(x-5) = (2x+3)(x-5) \text{ \# } \textcircled{3}$$

$$\begin{aligned}
 \text{(iv)} \quad & ax + by - bx - by \\
 &= ax - bx \\
 &= x(a - b) \quad \# \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 \text{(v)} \quad & 8x^3 - 125 \\
 &= (2x)^3 - 5^3 \\
 &= (2x - 5)(4x^2 + 10x + 25) \quad \# \quad (3)
 \end{aligned}$$

QUESTION 4

$$\text{(a) (i)} \quad \frac{x}{3} - \frac{x}{7} = \frac{7x - 3x}{21} = \frac{4x}{21} \quad \# \quad (2)$$

$$\begin{aligned}
 \text{(ii)} \quad & \frac{1}{x+1} - \frac{1}{x-1} \\
 &= \frac{x-1 - (x+1)}{(x+1)(x-1)} = \frac{-2}{x^2-1} \quad \# \quad (3)
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & \frac{3}{x+2} + \frac{2}{x-3} \\
 &= \frac{3(x-3) + 2(x+2)}{(x+2)(x-3)} = \frac{3x-9+2x+4}{(x+2)(x-3)} \\
 &= \frac{5x-5}{(x+2)(x-3)} \quad \# \quad (3)
 \end{aligned}$$

$$\text{(b) (i)} \quad \frac{1-t^2}{t-1} = \frac{(1-t)(1+t)}{-(1-t)} = -1-t \quad \# \quad (3)$$

$$\text{(ii)} \quad \frac{m^2+2m-8}{m^2-4} = \frac{(m+4)(m-2)}{(m+2)(m-2)} = \frac{m+4}{m+2} \quad \# \quad (3)$$

$$\text{(iii)} \quad \frac{x^3+8}{x^2-2x+4} = \frac{(x+2)(x^2-2x+4)}{(x^2-2x+4)} = x+2 \quad \# \quad (3)$$

QUESTION 5

(a) (i) $4(x+1) - 3(x-1) = 6$

$$4x + 4 - 3x + 3 = 6$$

$$x = 6 - 7$$

$$\therefore x = -1 \quad \# \quad \textcircled{3}$$

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

$$\therefore 3x-1=0 \text{ or } x-2=0$$

$$\therefore x = \frac{1}{3} \text{ or } x = 2 \quad \textcircled{2}$$

(iii) $\frac{2-x}{2x} = -5$

$$2-x = -10x$$

$$10x - x = -2$$

$$9x = -2$$

$$x = -\frac{2}{9} \quad \# \quad \textcircled{2}$$

(iv) $4x^2 + 7x - 2 = 0$

$$(4x-1)(x+2) = 0$$

$$\therefore 4x-1=0 \text{ or } x+2=0 \quad \textcircled{3}$$

$$x = \frac{1}{4} \text{ or } x = -2 \quad \#$$

(b) $x^2 + 6x = -7$

$$x^2 + 6x + 3^2 = -7 + 3^2$$

$$(x+3)^2 = 2$$

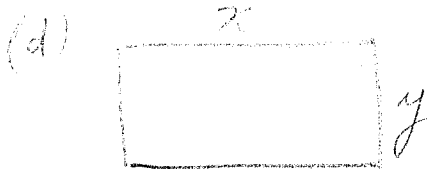
$$\therefore x+3 = \pm\sqrt{2}$$

$$\therefore x = -3 \pm\sqrt{2} \quad \# \quad \textcircled{3}$$

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

$$= \frac{3 \pm \sqrt{9+12}}{6}$$

$$= \frac{3 \pm \sqrt{21}}{6} \quad \# \quad \textcircled{3}$$



$$(i) \quad 2(x+y) = 30$$

$$\therefore x+y = 15 \quad (1)$$

$$A = xy$$

$$= x(15-x) \text{ using (1)}$$

$$\therefore A = 15x - x^2$$

$$(ii) \quad 15x - x^2 = 56$$

$$\therefore x^2 - 15x + 56 = 0$$

$$(x-8)(x-7) = 0$$

$$\therefore x = 8 \text{ or } x = 7.$$

\therefore length is 8 cm ($x > y$).

(4)

QUESTION 6

$$(a) (i) \quad -3x > 6, \therefore \frac{-3x}{-3} \leq \frac{6}{-3}, \therefore x \leq -2 \quad (1)$$

$$(ii) \quad \frac{3x}{2} < x + 3$$

$$3x < 2x + 6$$

$$3x - 2x < 6$$

$$x < 6 \quad \# \quad (2)$$

$$(b) \quad |2x-3| < 5$$

$$\therefore 2x-3 < 5 \text{ or } -2x+3 < 5$$

$$2x < 8$$

$$x < 4$$

$$-2x < 2$$

$$x > -1$$



(4)

$$(c) (i) \quad x - 5y = -11 \dots (1)$$

$$x + 2y = -4 \dots (2)$$

$$(2) - (1) \Rightarrow 7y = 7$$

$$\therefore y = 1$$

$$\text{From (1), } x = -11 + 5$$

$$\therefore x = -6$$

$$\therefore x = -6, y = 1 \quad \#$$

(3)

-Page 6-

$$\therefore x = -6, y = 1 \quad \#$$

(3)

-Page 6-

$$(c) \quad (ii) \quad 3x - 7y = 1 \quad \dots \quad (1)$$

$$4x - 5y = -3 \quad \dots \quad (2)$$

$$4 \times (1) \Rightarrow 12x - 28y = 4 \quad \dots \quad (3)$$

$$3 \times (2) \Rightarrow 12x - 15y = -9 \quad \dots \quad (4)$$

$$(3) - (4) \Rightarrow -13y = 13$$

$$\therefore y = -1$$

$$\text{From (1)} \quad 3x + 7 = 1$$

$$3x = -6$$

$$x = -2$$

$$\therefore x = -2, y = -1 \quad \# \quad (3)$$

$$(iii) \quad y = x^2 - 3x + 3 \quad \dots \quad (1)$$

$$2x - y - 3 = 0 \quad \dots \quad (2)$$

Sub (1) into (2),

$$\therefore 2x - (x^2 - 3x + 3) - 3 = 0$$

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

$$-x^2 + 5x - 6 = 0$$

$$x^2 - 5x + 6 = 0$$

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

$$\therefore x = 3 \text{ or } x = 2$$

$$\text{When } x = 3, \quad y = 3^2 - 3 \times 3 + 3 = 3$$

$$\text{When } x = 2, \quad y = 2^2 - 3 \times 2 + 3 = 1$$

$$\therefore x = 3, y = 3$$

$$x = 2, y = 1 \quad \# \quad (4)$$