GIRRAWEEN HIGH SCHOOL

MATHEMATICS

YEAR 11   **MARCH 2003**

TIME: 80 minutes   **TEST 1**

Instructions:

- Attempt all questions.
- Start each question on a separate page.
- All necessary working must be shown.
- Marks will be deducted for careless or badly arranged work.

Question 1 (12 marks)

(a)   Calculate $\dfrac{\sqrt{6.1}+18.7}{12.4}$ correct to 1 decimal place.   2

(b)   Find $\sqrt[5]{102}$ correct to 1 decimal place.   2

(c)   Write in scientific notation:

     (i)   2 100 000 000   2

     (ii)   0.00104   2

(d)   Find $[4.3\times10^{19}]\times[7.1\times10^{28}]$. Write your answer in scientific notation.   2

(e)   Express each of these recurring decimals as a fraction in its simplest form:

     (i) $0.\overset{\bullet\bullet}{58}$ 2

     (ii) $0.72\overset{\bullet}{6}$ 2

1

Question 2 (16 marks)

(a) Simplify $4(a-2)-3(a-5)$.

2

(b) Expand and simplify:

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

2

     (ii) $2m^2(3m^3+2m+6)-5m(3m^2-4m)$

2

(c) Expand and simplify:

     (i) $(p^2-q^2)(p+q)$

2

     (ii) $(3x-4)(x^2-2x+5)$

2

(d) Expand and simplify $(3x-4)(x-2)(x-2)$.

2

(e) If $V=3x^2y$, find V if $x=0.2$ and $y=75$.

2

(f) If $K=(a+b)^3$, find K if $a=\dfrac{1}{5}$ and $b=4\dfrac{1}{2}$.

2

2

Question 3 (23 marks)

(a) Write these surds in their simplest form:

      (i) $\sqrt{250}$ 2

      (ii) $\sqrt{\dfrac{9}{4}}$ 2

(b) Simplify:

      (i) $\sqrt{8} + \sqrt{32}$ 2

      (ii) $\sqrt{180} + \sqrt{128} - 2\sqrt{5}$ 2

(c) Find the value of a if $\sqrt{90} - \sqrt{40} = a\sqrt{10}$.

                                                  2

(d) Expand and simplify:

      (i) $(\sqrt{3} + 2\sqrt{5})(\sqrt{3} - 2\sqrt{5})$ 2

      (ii) $(\sqrt{3} + 2\sqrt{2})^2$ 2

(e) Rationalise the denominator and simplify:

      (i) $\dfrac{2\sqrt{3}}{3\sqrt{2}}.$ 2

      (ii) $\dfrac{4}{\sqrt{3} + 1}$ 2

      (iii) $\dfrac{\sqrt{2} + 1}{\sqrt{2} - 1}$ 2

(f) Show $\dfrac{1}{5 - \sqrt{7}} + \dfrac{1}{5 + \sqrt{7}}$ is a rational number.

                                                  3

Question 4 (23 marks)

(a)   Factorise:

        (i) $3x + 3y + x^2 + xy$ 2

        (ii) $(a + b)^2 + x(a + b)$ 2

(b)   Factorise:

        (i) $p^2 - 100$ 2

        (ii) $12 - 3x^2$ 2

(c)   Factorise:

        (i) $x^2 - x - 12$ 2

        (ii) $3x^2 - 10x + 8$ 2

        (iii) $2 + x - 10x^2$ 2

(d)   Simplify:

        (i) $\dfrac{3x^2 y}{6xy^2}$.   2

        (ii) $\dfrac{x^2 - 9}{x - 3}$ 2

(e)   Expand and simplify $(3a^2 + a)(a^3 - 3a^2 + 6a - 3)$.   3

(f)   If $7.2x^3 = 50$, find x to 1 decimal place.   2

Question 5 (10 marks)

(a)   Simplify:

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

     (ii) $\dfrac{1}{x}+\dfrac{1}{x+y}$ 2

     (iii) $\dfrac{2}{(x+1)(x+3)}+\dfrac{1}{x+3}$ 2

(b)   Factorise $8x^3-125$.   2

               a+

(c)   If $T = a+(n-1)d$, find n if $T = 45$, $a = 5$ and $d = 2$.   2

Question 6 (12 marks)

(a)   Simplify:

     (i) $\dfrac{m^2+2m-8}{m^2-4}$ 2

     (ii) $\dfrac{1-t^2}{t-1}$ 2

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

(b)   Simplify:

     (i) $\dfrac{3b-3c}{bc}\times\dfrac{b^2}{b^2-bc}$ 3

     (ii) $\dfrac{x+1}{x+3}\div\dfrac{x^2-16}{x^2-x-12}$ 3

Year 11   2003 Task 1 Solutions

Question 1

a) 0.4 (to 1 d.p.)   ②

b) $\sqrt[5]{102} = 2.5$ ②

c) i) 2.1×10^9 ①
    ii) 1.04×10^{-3} ①

d) 3.053×10^{48} ②

e) i) $0.\dot{5}\dot{8}$

Let $x = 0.5858$

$100x = 58.5858$

$99x = 58$

$\therefore 0.\dot{5}\dot{8} = \dfrac{58}{99}$ ②

ii) $0.72\dot{6}$

Let $x = 0.72666$

$10x = 7.26666$

$9x = 6.54$

$x = \dfrac{6.54}{9} = \dfrac{654}{900}$

$\therefore 0.72\dot{6} = \dfrac{109}{150}$ ②

Question 2

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

$= 4a - 8 - 3a + 15$

$= a + 7$ ②

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

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

$= 2x^2 - 3x$ ②

ii) $2m^2(3m^3 + 2m + 6) - 5m(3m^2 - 4m)$

$= 6m^5 + 4m^3 + 12m^2 - 15m^3 + 20m^2$

$= 6m^5 - 11m^3 + 32m^2$ ②

c) i) $(p^2 - q^2)(p + q)$

$= p^3 + p^2q - pq^2 - q^3$ ②

ii) $(3x - 4)(x^2 - 2x + 5)$

$= 3x^3 - 6x^2 + 15x - 4x^2 + 8x - 20$

$= 3x^3 - 10x^2 + 23x - 20$ ②

d) $(3x - 4)(x - 2)(x - 2)$

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

$= 3x^3 - 12x^2 + 12x - 4x^2 + 16x - 16$

$= 3x^3 - 16x^2 + 28x - 16$ ②

e) $V = 3x^2 y$

$V = 3 \times (0.2)^2 \times 75$

$V = 9$ ②

f) $k = (a + b)^3$

$= \left(\dfrac{1}{5} + \dfrac{9}{2}\right)^3$

$= 103.823$ ②

Question 3

a) i) $\sqrt{250} = \sqrt{25 \times 10}$

$= 5\sqrt{10}$　　②

ii) $\sqrt{\frac{9}{4}} = \frac{3}{2}$　　②

b) i) $\sqrt{8} + \sqrt{32}$

$= 2\sqrt{2} + 4\sqrt{2}$

$= 6\sqrt{2}$　　②

ii) $\sqrt{180} + \sqrt{128} - 2\sqrt{5}$

$\sqrt{36 \times 5} + \sqrt{64 \times 2} - 2\sqrt{5}$

$= 6\sqrt{5} + 8\sqrt{2} - 2\sqrt{5}$

$= 4\sqrt{5} + 8\sqrt{2}$　　②

c) $\sqrt{90} - \sqrt{40} = a\sqrt{10}$

$3\sqrt{10} - 2\sqrt{10} = 1\sqrt{10}$

$\therefore a = 1$　　②

d) $(\sqrt{3} + 2\sqrt{5})(\sqrt{3} - 2\sqrt{5})$

$= 3 - 20$

$= -17$　　②

ii) $(\sqrt{3} + 2\sqrt{2})^2$

$= 3 + 4\sqrt{6} + 8$

$= 11 + 4\sqrt{6}$　　②

e) i) $\frac{2\sqrt{3}}{3\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

$= \frac{2\sqrt{6}}{6}$

$= \frac{\sqrt{6}}{3}$　　②

ii) $\frac{4}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$

$= \frac{4\sqrt{3} - 4}{3 - 1}$

$= 2\sqrt{3} - 2$　　②

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

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

$= 3 + 2\sqrt{2}$　　②

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

$= \frac{5+\sqrt{7} + 5 - \sqrt{7}}{25 - 7}$

$= \frac{10}{18}$　　③

$= \frac{5}{9}$　a rational number

Question 4

a) i) $3x + 3y + x^2 + xy$

$= 3(x+y) + x(x+y)$

$= (3+x)(x+y)$　　②

ii) $(a+b)^2 + x(a+b)$

$= (a+b)(a+b+x)$　　②

b) i) $p^2 - 100 = (p+10)(p-10)$ ②

ii) $12 - 3x^2 = 3(4 - x^2)$
$= 3(2 - x)(2 + x)$ ②

c) i) $x^2 - x - 12 = (x - 4)(x + 3)$ ②

ii) $3x^2 - 10x + 8 = (3x - 4)(x - 2)$ ②

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

d) i) $\dfrac{3x^2 y}{6x y^2} = \dfrac{x}{2y}$ ②

ii) $\dfrac{x^2 - 9}{x - 3} \quad \dfrac{(x+3)(x-3)}{(x-3)}$
$= x + 3$ ②

e) $(3a^2 + a)(a^3 - 3a^2 + 6a - 3)$
$= 3a^5 - 9a^4 + 18a^3 - 9a^2 + a^4 - 3a^3 + 6a^2 - 3a$
$= 3a^5 - 8a^4 + 15a^3 - 3a^2 - 3a$ ③

f) $7.2\,x^3 = 50$
$x^3 = \dfrac{50}{7.2}$
$x = 2.6$ ②

Question 5

a) i) $\dfrac{x+1}{2} + \dfrac{x}{3}$
$= \dfrac{3x + 3 + 2x}{6}$
$= \dfrac{5x + 3}{6}$ ②

ii) $\dfrac{1}{x} + \dfrac{1}{x+y}$
$= \dfrac{x + y + x}{x(x+y)}$
$= \dfrac{2x + y}{x(x+y)}$ ②

iii) $\dfrac{2}{(x+1)(x+3)} + \dfrac{1}{x+3}$
$= \dfrac{2 + 1(x+1)}{(x+1)(x+3)}$
$= \dfrac{3 + x}{(x+1)(x+3)}$ ②

b) $8x^3 - 125 = (2x)^3 - 5^3$
$= (2x - 5)(4x^2 + 10x + 25)$ ②

c) $T = a + (n-1)d$
$45 = 5 + (n-1)2$
$40 = 2n - 2$
$42 = 2n$
$n = 21$ ②

Question 6

a) i) $\dfrac{m^2 + 2m - 8}{m^2 - 4}$

$= \dfrac{(m-2)(m+4)}{(m-2)(m+2)}$

$= \dfrac{m+4}{m+2}$ ②

ii) $\dfrac{1 - t^2}{t - 1}$

$= \dfrac{(1+t)(1-t)}{-(1-t)}$

$= -(1+t)$ ②

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

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

$= x + 2$ ③

b) i) $\dfrac{3b - 3c}{bc} \times \dfrac{b^2}{b^2 - bc}$

$= \dfrac{3(b-c)}{bc} \times \dfrac{b^2}{b(b-c)}$

$= \dfrac{3}{c}$ ②

ii) $\dfrac{x+1}{x+3} \div \dfrac{x^2 - 16}{x^2 - x - 12}$

$= \dfrac{x+1}{x+3} \div \dfrac{(x+4)(x-4)}{(x+3)(x-4)}$

$= \dfrac{x+1}{(x+3)} \times \dfrac{(x+3)(x-4)}{(x+4)(x-4)}$

$= \dfrac{x+1}{x+4}$ ③