Student Number:

Class Teacher (*circle*): KM   GP   CG

YEAR 11 MATHEMATICS

Preliminary Assessment Task 1

April 2009

Arithmetic, Algebra, Functions and Relations

Syllabus Topics to be covered in this task:	1.1, 1.2, 1.3, 1.4
	4.1, 4.2, 4.3 (not locus), 4.4
Syllabus Outcomes to be addressed in this task:	P2, P3, P4, P5

- Time allowed: 50 minutes
- There are three questions, each worth 13 marks.
- The mark value of each part is indicated in [...] next to that part.
- Show all necessary working.
- **Start each question on a new page.**

1

Question 1   **Start a new page**   **[13 marks]**

(a)   Evaluate and write $\sqrt{\dfrac{25.8^2 - 5.2 \times 3.6}{4.13}}$ correct to 4 significant figures.   **[2]**

(b)   Express $0.2\dot{5}$ as a fraction in simplest form.   **[2]**

(c)   Simplify $2\sqrt{45} - 5\sqrt{20} + \sqrt{180}$.   **[2]**

(d)   Express $\dfrac{\sqrt{2}}{1 - 2\sqrt{3}}$ with a rational denominator in its simplest form.   **[2]**

(e)   Factorise completely:

     (i) $9x^2 - y^2$ **[1]**

     (ii) $a^3 + 27b^3$ **[2]**

(f)   Solve $|2x + 1| = 7$.   **[2]**

2

Question 2   Start a new page   [13 marks]

(a)   Simplify $\dfrac{x}{x+3} - \dfrac{5x^2}{x^2-9}$.   [2]

(b)   Solve $\dfrac{3-2x}{4} > 5$.   [2]

(c)   Solve simultaneously: [3]

$$\left. \begin{array}{l} y = x^2 + 2x - 5 \\ y - x = 7 \end{array} \right\}$$

(d)   Consider the ~~function~~ curve $(x+1)^2 + (y-4)^2 = 9$.

    (i)   Sketch the ~~function~~ curve showing all features.   [2]

    (ii)   State the domain of the ~~function~~ curve.   [1]

(e)   The base of a triangle is 5cm longer than its perpendicular height and the area of   [3]
the triangle is 7cm^2. Write an equation to represent this information and hence
solve to find the length of the base.

Question 3   Start a new page   [13 marks]

(a)   For the parabola $y = x^2 + 4x - 12$:

    (i)   Find the x-intercept(s).   [2]

    (ii)   Find the y-intercept.   [1]

    (iii)   Find the axis of symmetry.   [1]

    (iv)   Find the co-ordinates of the vertex.   [1]

    (v)   Sketch the parabola, showing the above features.   [1]

(b)   Is the function $f(x) = 4x - x^2$ odd, even or neither? Justify your answer.   [2]

(c)   A function is defined by the following :

$$f(x) = \begin{cases} 2^{-x} & \text{for } x < 0 \\ 3 - x & \text{for } x \geq 0 \end{cases}$$

    (i)   Find $f(-3) + f(0)$.   [2]

    (ii)   Neatly sketch $y = f(x)$ showing all features.   [3]

End of Assessment Task

Qu1)

a. $\sqrt{\dfrac{646.92}{4.13}}$ = 12.5$\boxed{156}$ (4 sig figs.) working? $^0/_2$

$\sqrt{156.639\cdots}$

b. Let $0.2\dot{5}$ be x = 12.52 (4 sig figs)

$100x = 25.5555\cdots$ ✓

$10x = 2.5555\cdots$ $\;\;$ $2/2$

$\therefore 90x = 23$ ✓

$x = \dfrac{23}{90}$

c. $2\sqrt{45} - 5\sqrt{20} + \sqrt{180}$

$= 2\times 3\sqrt{5} - 5\times 2\sqrt{5} + 2\sqrt{45}$ ✓

$= 6\sqrt{5} - 10\sqrt{5} + 6\sqrt{5}$ $\;\;$ $2\frac{1}{2}$

$= 2\sqrt{5}$

d. $\dfrac{\sqrt{2}}{1-2\sqrt{3}} \times \dfrac{1+2\sqrt{3}}{1+2\sqrt{3}}$ ✓

$= \dfrac{\sqrt{2}(1+2\sqrt{3})}{(1-2\sqrt{3})(1+2\sqrt{3})}$ $\;\;$ $2\frac{1}{2}$

$= \dfrac{\sqrt{2}+2\sqrt{6}}{-11}$ ✓

e. (i) $9x^2 - y^2$

$= (3x)^2 - y^2$ ✓ $\;\;$ 1

$= (3x-y)(3x+y)$ ✓

(ii) $a^3 + 27b^3$

$= a^3 + (3b)^3$ $\;\;$ $\frac{1}{2}$

$= (a+3b)(a^2 \boxed{+} 3ab + 9b^2)$

$\times \longrightarrow$ NB) $a^3+b^3 = (a+b)(a^2-ab+b^2)$ $\;\;$ $2/2$

f. $|2x+1| = 7$

$2x+1 = 7$ $\qquad$ $-2x-1 = 7$

$2x = 6$ $\qquad$ $-2x = 8$ ✓

$x = 3$ ✓ $\qquad$ $x = -4$

Test: $|2(3)+1| = 7$ $\qquad$ test: $|2(-4)+1| = 7$ $\qquad$ $\therefore x = 3, -4$

$|7| = 7$ ✓ true. $\qquad$ $|-8+1| = 7$

$\qquad\qquad\qquad\qquad$ $|-7| = 7$ ✓ true

Qu2)

a. $\dfrac{x}{x+3} - \dfrac{5x^2}{x^2-9}$ $\longrightarrow$ $\dfrac{x(x-3)}{(x+3)(x-3)} - \dfrac{5x^2}{(x+3)(x-3)}$

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

$= \dfrac{x(1-5x)}{(x+3)(x-3)}$ $\qquad = \dfrac{x^2-3x-5x^2}{(x+3)(x-3)}$

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

b. $\dfrac{3-2x}{4} > 5$ $\;^{\times 4^2}$ $\;^{\times 4^2}$ $\qquad$ Don't need to multiply by $\boxed{4^2}$ $\longrightarrow$ only for 'unknowns' in denominator 4 will do!

$4(3-2x) > 5 \times 16$

$12-8x > 80$ ✓ $\qquad\qquad$ 2

$-8x > 68$

$x < -8\frac{1}{2}$ ✓

c. $y = x^2 + 2x - 5$ ①

$y - x = 7$ ②

$x = -(7-y)$

$= -7+y$ ③

sub ③ into ①:

$y = (-7+y)^2 + 2(-7+y) - 5$

$= (49-14y+y^2) - 14+2y-5$

$= 49-14y+y^2-14+2y-5$

$= y^2-12y+30$

[crossed out]

$y = 7-x$ ③ $\qquad\qquad$ sub ④ into ②:

sub ③ into ①: $\qquad\qquad$ $y-(-4) = 7$ $\qquad$ $y-(3) = 7$

$7-x = x^2+2x-5$ ✓ $\qquad$ $y+4 = 7$ $\qquad\qquad$ $y-3 = 7$

$x^2+2x-5-7+x = 0$ $\qquad$ $y = 3$ $\qquad\qquad$ $y = 10$ $\qquad$ 3

$x^2+x-12 = 0$

$(x+4)(x-3) = 0$ ✓ $\qquad$ $\therefore$ when $x=-4$, $y=3$ ✓

$x = -4, 3$ ④ $\qquad\qquad\qquad$ $x = 3$, $y = 10$

$\qquad\qquad\qquad\qquad\qquad\qquad$

d. (i) $(x+1)^2 + (y-4)^2 = 9$

$(x+1)^2 + (y-4)^2 = 9$

centre : $(-1, 4)$ ✓

radius : 3 units.

(-1,7)

7

(-4,4)   4   (2,4)

-4   -1   2

2

✓

1
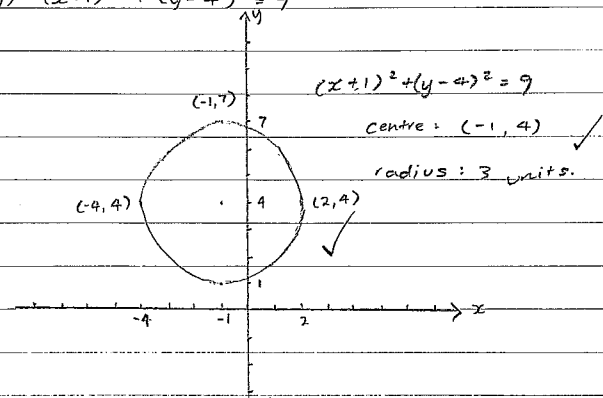
(ii) D : $-4 \leq x \leq 2$ ✓

e. Area of $\triangle = \frac{1}{2} bh$

Let the height be x.

base = $x + 5$

area = $7 cm^2$

$7 = \frac{1}{2} x(x+5)$ ✓

$= \frac{x(x+5)}{2}$

$14 = x(x+5)$

$= x^2 + 5x$

$x^2 + 5x - 14 = 0$

$(x+7)(x-2) = 0$ ✓

$\therefore x = -7$ or 2

base = $x + 5$

3

$\therefore$ base = $-7 + 5$ or   base = $2 + 5$

$= -2$ $= 7 cm.$

✗ not an answer as distances cannot be negative.

$\therefore$ length of base is 7cm. ✓

Qu3)

a. (i) $0 = x^2 + 4x - 12$

$(x+6)(x-2) = 0$ ✓   2

$x = -6, 2$ (x inter.)

(ii) $y = (0)^2 + 4(0) - 12$

$= 0 + 0 - 12$ ✓   1

$= -12$ (y inter.)

(iii) $\frac{-6+2}{2} = \frac{-4}{2}$

$= -2$ ✓   1

axis of sym. where $x = -2$.

(iv) $y = (-2)^2 + 4(-2) - 12$

$= 4 - 8 - 12$

$= -16$ ✓   1

vertex : $(-2, -16)$

(v)

axis of sym.

$y = x^2 + 4x - 12$

-6   -2   2

-12

-16

$(-2, -16)$

✓

1

PTO.
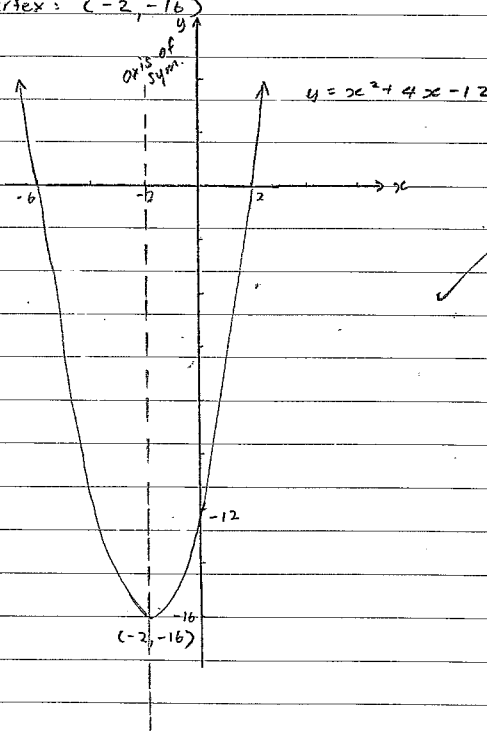
b. $f(x) = 4x - x^2$

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

$\qquad = -4x - x^2$ ✓

$\qquad \neq f(x) \quad \therefore \text{ not even.}$

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

$\qquad = -4x + x^2$ ✓

$\qquad \neq f(-x) \quad \therefore \text{ not odd.}$

The function $f(x) = 4x - x^2$ is hence, <u>neither</u> odd nor even.
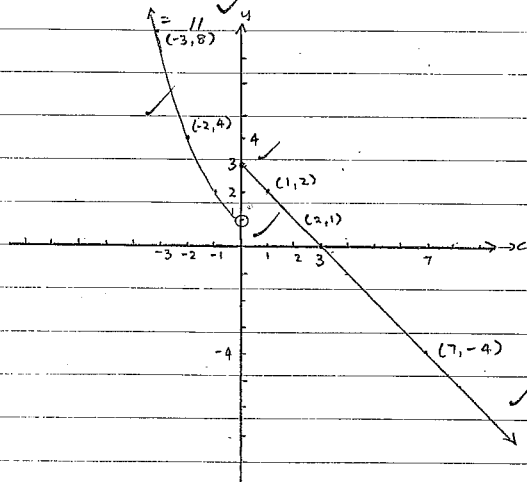
2.

C. (i) $f(-3) = 2^{-(-3)}$

$\qquad = 2^3$

$\qquad = 8$

$f(0) = 3 - 0$

$\qquad = 3$

$\therefore f(-3) + f(0) = 8 + 3$

$\qquad = 11$

2.

(ii)

3