YEAR 11 MATHEMATICS

Preliminary Assessment Task 2

Half-Yearly Examination

May 2008

Arithmetic, Algebra, Functions and Relations, Linear Functions

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
                                                  6.1, 6.2, 6.3, 6.4, 6.5, 6.7, 6.8
Syllabus Outcomes to be addressed in this task: P2, P3, P4, P5

- **Time allowed: 1.5 hours plus 5 minutes reading time**
- There are five questions, each worth 12 marks
- The mark value of each part is indicated in [**…**] next to that part
- Start each question on a new page

Question 1   **Start a new page**   **[12 Marks]**

(a)   Find the value of a to four significant figures if:

$$a = \sqrt{\frac{12345 - 1.07}{1.96^2 + 3.22}}$$ **[2]**

(b)   Simplify fully: $3\sqrt{32} + 2\sqrt{50} - 8\sqrt{18}$.   **[2]**

(c)   Find, without a calculator, $0.1\overset{\bullet}{7}\overset{\bullet}{4}$ as a simplified fraction.   **[2]**

(d)   Explain, in your own words, what a rational number is.   **[1]**

(e)   Factorise fully:

(i) $b^2 + 13b - 48$ **[1]**

(ii) $x^3 y - 4xy - x^2 + 4$ **[2]**

(iii) $p - p^4$ **[2]**

Question 2   **Start a new page**   **[12 Marks]**

(a)   Find the values of a and b if $\dfrac{5}{\sqrt{3}+1} = a + b\sqrt{3}$.   **[2]**

(b)   Solve the inequation below: **[2]**

$$x^2 - 4x - 12 < 0$$

(c)   State whether the function $f(x) = x^5 - 3x$ is odd, even or neither.   **[2]**
Justify your answer with necessary working.

(d)   Consider the function

$$f(x) = \begin{cases} x+2 & \text{if } x > 2 \\ x^2 & \text{if } -2 < x \le 2 \\ -x+1 & \text{if } x \le -2 \end{cases}$$

(i)   Evaluate $f(-2)$.   **[1]**

(ii)   Sketch the above function showing **all** relevant features.   **[3]**

(e)   What is the domain of the function given by $f(x) = -\sqrt{9 - x^2}$?   **[1]**

(f)   Find the equation of the axis of symmetry of the parabola $y = (x+3)^2$.   **[1]**

Question 3   **Start a new page**   **[12 Marks]**

In the diagram below, the line l_1 has equation $3x - 2y + 6 = 0$ and has an angle of inclination α with the x-axis as shown. The line l_2 passes through points $B(5, 0)$ and $D(0, 10)$ as shown. Lines l_1 and l_2 intersect at point C.
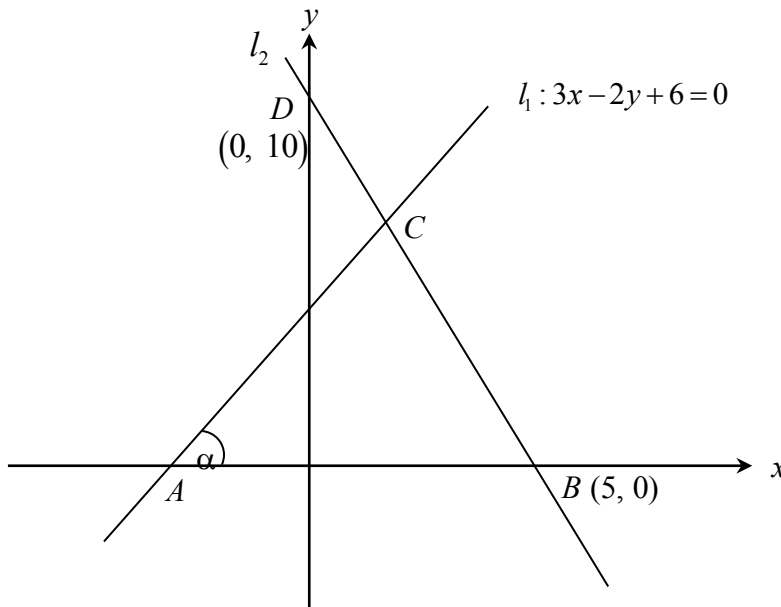
(a)   Copy this diagram onto your answer sheet.

(b)   Find the co-ordinates of A, the point where l_1 cuts the x-axis.   **[1]**

(c)   Calculate the size of angle α to the nearest degree.   **[2]**

(d)   Show that the gradient of line l_2 is -2.   **[1]**

(e)   Find the equation of line l_2.   **[2]**

(f)   Find the co-ordinates of point C, the intersection of l_1 and l_2.   **[2]**

(g)   Hence, or otherwise, find the area of $\triangle ABC$.   **[2]**

(h)   By choosing suitable inequations, define the region **inside** $\triangle ABC$ **[2]**
       in algebraic terms. Include the lines AB, BC and AC as part of the region.

Question 4   **Start a new page**   **[12 Marks]**

(a)   Find the value(s) of x for which: **[2]**

$$|2x + 6| = 3$$

(b)   The end-points of the diameter of a circle are the points $P(3, -3)$ and $Q(-1, -9)$.

   (i)   Find the co-ordinates of point C, the centre of the circle.   **[2]**

   (ii)   Hence, or otherwise, find the equation of the circle.   **[3]**

(c)   (i)   Draw a neat sketch of $y = \dfrac{1}{x} - 3$, showing all relevant features.   **[2]**

   (ii)   What is the range of the above graph?   **[1]**

(d)   Find, in exact form, the solution(s) to the equation: **[2]**

$$x^2 - 10x - 1 = 0$$

Question 5   **Start a new page**   **[12 Marks]**

(a)   Express the following as a single fraction in simplest form: **[3]**

$$\frac{4a-1}{4a+1} - \frac{4a+1}{4a-1}$$

(b)   Find the shortest (i.e. perpendicular) distance between the lines   **[3]**
$l_1 : 2x - 3y - 15 = 0$ and $l_2 : y = \frac{2x}{3} + 4$. Express your answer in exact form.

(c)   (i)   Draw a neat sketch of $f(x) = |x| - x$ over the domain $-4 \le x \le 4$.   **[2]**

       (ii)   **Using your graph in (i) above**, determine the number of solutions   **[1]**
       to the equations

$$y = |x| - x \text{ and}$$
$$xy = 1$$

       Do **not** solve the equations.

(d)   The general form of the quadratic equation is given by $ax^2 + bx + c = 0$.   **[3]**
       Show that by completing the square on this equation, the quadratic formula
       is obtained.

End of Examination