NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2008

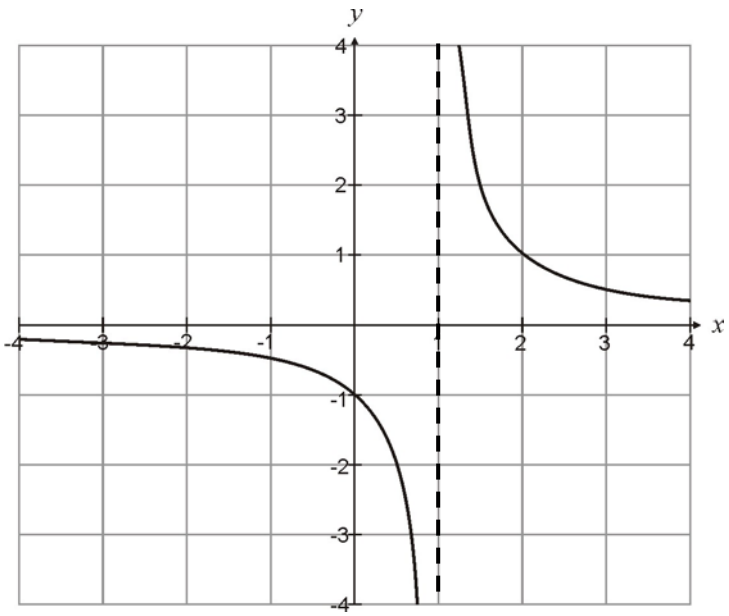
MATHEMATICS: PAPER I

EXAMINATION NUMBER

ANSWER BOOKLET – MARKING GUIDELINES

QUESTION 5

(a) Part of the graph of the function with equation $y = f(x)$ is shown below.

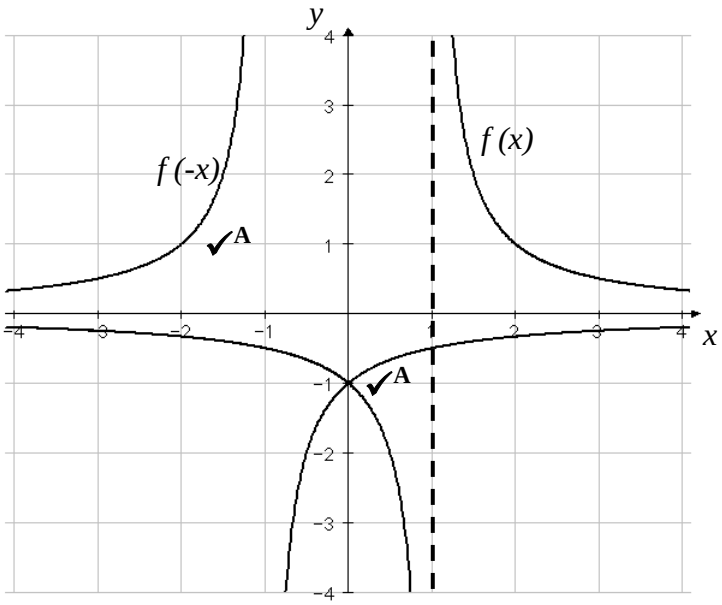


(1) Give the equation of each asymptote. (2)

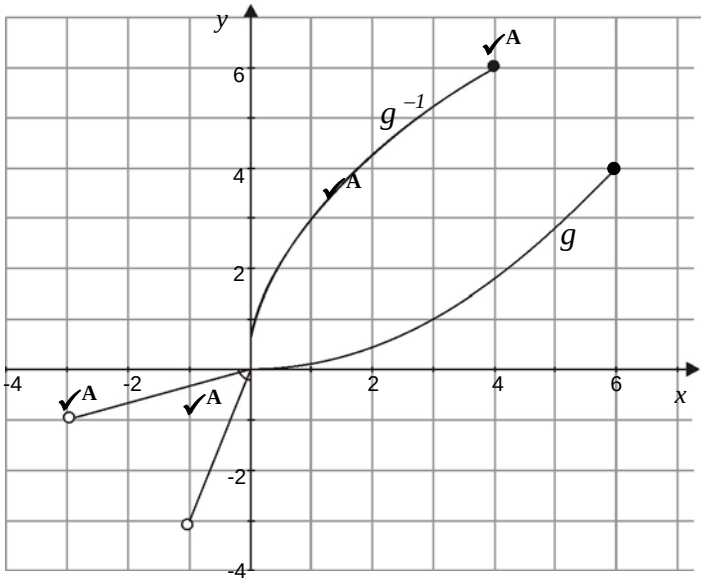
$x = 1$ ✓A

$y = 0$ ✓A

(2) On this set of axes, draw the graph of $y = f(-x)$ (2)



(b) The graph of the function g is shown below.



(1) Give the domain and range of the function. (2)

$x \in (-1; 6]$ ✓A

$y \in (-3; 4]$ ✓A

(2) On this set of axes, draw the graph of the inverse function of g. (4)

(3) Explain why this inverse is a function. (1)

The original function is a 1 – 1 mapping, ✓A

so its inverse is a function.

11 marks

QUESTION 6

Nutritionists have established that vitamins A, B_1 and B_2 are the most popular vitamins that people take to supplement their diets.
Research has shown that a person's daily requirement is at least 16 units of vitamin A, 5 units of B_1 and 20 units of B_2.
Two brands of vitamins are available : brand P and brand Q.
The table below summarises the units of each vitamin per tablet for each brand, and the cost per tablet.

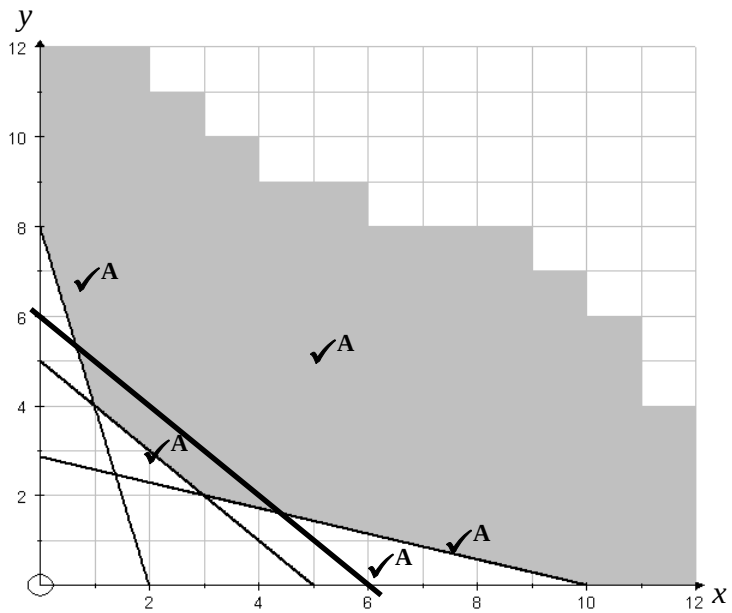
	Vit. A	Vit. B_1	Vit. B_2	Cost per tablet
Brand P	8 units	1 unit	2 units	40c
Brand Q	2 units	1 unit	7 units	80c

Let x represent the number of tablets of brand P taken each day and y represent the number of tablets of brand Q taken each day.

The inequalities below summarise the information about a person's daily requirements of each vitamin mentioned above.

Vit. A: $8x + 2y \geq 16$
Vit. B_1: $x + y \geq 5$
Vit. B_2: $2x + 7y \geq 20$
Implicit constraints: $x \geq 0, \quad y \geq 0$

(a) On the axes provided, draw the constraints and shade the feasible region. (4)



New Vit. B_1

(b) State the objective function that represents the cost of the daily requirement of vitamins. (1)

$C = 40x + 80y$ ✓A

(c) Determine the values of x and y within the feasible region that will minimise the daily cost and calculate this minimum. (4)

$y = -\frac{x}{2} + \frac{C}{80}$

Minimum when $-x + 5 = -\frac{2x}{7} + \frac{20}{7}$

$-7x + 35 = -2x + 20$

$-5x = -15$

$x = 3$ ✓A $y = 2$ ✓A

Min. cost $= 40 \times 3 + 80 \times 2$ ✓M

$= R2,80$ ✓A

(d) Suppose brand Q decreased in price to 40c per tablet. Determine how this would effect the optimal solution and calculate the new minimum. (3)

New cost $= 40x + 40y$

$y = -x + \frac{\text{new cost}}{40}$

New objective function has same gradient as constraint $y \geq -x + 5$ ✓M

Optimal solutions: ✓A

x	1	2	3
y	4	3	2

Min. cost $= 40 + 40 \times 4$

$= R2,00$ ✓A

(e) Further research has shown that the daily requirement of vitamin B_1 is 6 units instead of 5 units as previously stated.

(1) Rewrite the constraint that is effected by this change. (1)

$x + y \geq 6$ ✓A

(2) Draw this constraint on the graph used in (a) and label it 'new vitamin $B_{1'}$'. (1)

(3) Determine the new optimal solution, using the objective function in (b). (2)

New min. when $-x + 6 = -\frac{2x}{7} + \frac{20}{7}$

$x = \frac{22}{5}$ ✓A

$x = 4, \quad y = 2 : C = 320$ ✓A

16 marks