

INTERNATIONAL BACCALAUREATE
Mathematics: analysis and approaches

MAA

EXERCISES [MAA 2.13-2.15]
RATIONAL AND MODULUS FUNCTIONS – INEQUALITIES
Compiled by Christos Nikolaidis

O. Practice questions

1. [Maximum mark: 18] **[without GDC]**

For the following functions write down the roots, the y -intercept, the vertical and horizontal asymptotes (if there exist), the domain and the range.

	$f(x) = \frac{3x+8}{2x+7}$	$f(x) = \frac{8}{2x+7}$	$f(x) = \frac{3x+8}{7}$
Roots			
y-intercept			
V.A.			
H.A.			
Domain			
Range			

2. [Maximum mark: 15] **[without GDC]**

For the following functions write down the roots, the y -intercept, the vertical and horizontal asymptotes and the domain.

	$f(x) = \frac{(x-3)(x-4)}{(x+1)(x-2)}$	$f(x) = \frac{(2x-3)(x-4)}{(x+1)(x-2)}$	$f(x) = \frac{2x-3}{(x+1)(x-2)}$
Roots			
y-intercept			
V.A.			
H.A.			
Domain			

9. [Maximum mark: 8] **[without GDC]**

Solve the inequalities (notice that they all involve the same factors).

(i) $\frac{5(x-1)(x-2)^2}{(x-3)^3} \geq 0$ (ii) $\frac{(x-1)(x-3)^3}{5(x-2)^2} \geq 0$ (iii) $\frac{(x-2)^2(x-3)^3}{5(x-1)} \geq 0$

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10*. [Maximum mark: 6] **[with / without GDC]**

Solve the inequality $x + \frac{2}{x} \geq 3$

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11. [Maximum mark: 6] **[with / without GDC]**

(a) Solve the equation $|x-5|=3$ [3]

(b) Solve the inequality $|x-5|<3$ [3]

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12. [Maximum mark: 8] **[with / without GDC]**

(a) Solve the equation $|x-5|=|x-3|$ [4]

(b) Solve the inequality $|x-5|<|x-3|$ [4]

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13*. [Maximum mark: 10] **[with / without GDC]**

(a) Solve the equation $|x-5| = x-3$ [5]

(b) Solve the inequality $|x-5| < x-3$ [5]

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14*. [Maximum mark: 5] **[with / without GDC]**

Solve the inequality $x^2 - 3|x| > 2$

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A. Exam style questions (SHORT)

17. [Maximum mark: 5] **[without GDC]**

Find all the asymptotes (horizontal, vertical, or oblique) of $f(x) = \frac{3x^2 - x + 1}{2x^2 - 14x + 24}$

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18. [Maximum mark: 5] **[without GDC]**

Find all the asymptotes (horizontal, vertical, or oblique) of $f(x) = \frac{3x^2 - x + 1}{x^2 - x + 1}$

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19. [Maximum mark: 6] **[without GDC]**

Find all the asymptotes (horizontal, vertical, or oblique) of $f(x) = \frac{6x^2 + 5x + 1}{3x + 7}$

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20. [Maximum mark: 7] **[without GDC]**

Find all the asymptotes (horizontal, vertical, or oblique) of $f(x) = \frac{6x^3 + 1}{2x^2 - 14x + 24}$

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21. [Maximum mark: 7] **[without GDC]**

Express in partial fractions the function $f(x) = \frac{5}{2x^2 - 14x + 24}$

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22. [Maximum mark: 7] **[without GDC]**

Express in partial fractions the function $f(x) = \frac{5x+1}{2x^2 - 14x + 24}$

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28. [Maximum mark: 5] **[with / without GDC]**

Find the values of x for which $|5 - 3x| \leq |x + 1|$.

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29. [Maximum mark: 5] **[with / without GDC]**

Solve the inequality $|x - 2| \geq |2x + 1|$.

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30*. [Maximum mark: 6] **[with / without GDC]**

Solve the inequality $\left| \frac{x+9}{x-9} \right| \leq 2$.

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31. [Maximum mark: 6] **[with / without GDC]**

Find the largest set of values of x such that the function f given by $f(x) = \sqrt{\frac{8x-4}{x-3}}$ takes real values.

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