

INTERNATIONAL BACCALAUREATE
Mathematics: applications and interpretation

MAI

EXERCISES [MAI 2.10]

ASYMPTOTES

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A. Paper 1 questions (SHORT)

1. [Maximum mark: 16]

Complete the following table by writing down the corresponding asymptotes

Function	Vertical asymptote	Horizontal asymptote
$y = \frac{2x+7}{x-5}$	$x = 5$	$y = 2$
$y = \frac{2x+7}{x-5} + 1$		
$y = \frac{2}{x-5}$		
$y = \frac{2}{x-5} + 1$		
$y = \frac{2}{x-5} - 1$		
$y = \frac{x+7}{2x-3}$		
$y = \frac{-4x+1}{2x-6}$		
$y = \frac{-4x+1}{2x-6} + 3.$		
$y = \frac{5-x}{5+x}$		

2. [Maximum mark: 15]

Complete the following table by writing down the corresponding asymptotes

Function	Vertical asymptote	Horizontal asymptote
$y = e^x$	---	$y = 0$
$y = e^{2x}$		
$y = 3e^{2x}$		
$y = 3e^{2x} + 5$		
$y = 3e^{2x} - 5$		
$y = 3e^{-2x}$		
$y = 3e^{-2x} - 1$		
$y = 3e^{-2x} + 2$		
$y = 2^x$		
$y = 2^x + 3$		
$y = 2^{-x} + 3$		
$y = \ln x$	$x = 0$	---
$y = 2 \ln x$		
$y = 2 \ln 3x$		
$y = \ln(x - 3)$		
$y = \log x$	$x = 0$	---
$y = \log(x - 3)$		
$y = \log(x - 3) + 2$		

3. [Maximum mark: 8]

Let $y = \frac{3x - 6}{x + 2}$

- (a) Write down the equations of the asymptotes. [2]
- (b) Find the x - and y -intercepts. [2]
- (c) Find the coordinates of the point of intersection with the line $y = 1$. [1]
- (d) Sketch the graph of the function. Indicate the information found in (a), (b), (c). [3]

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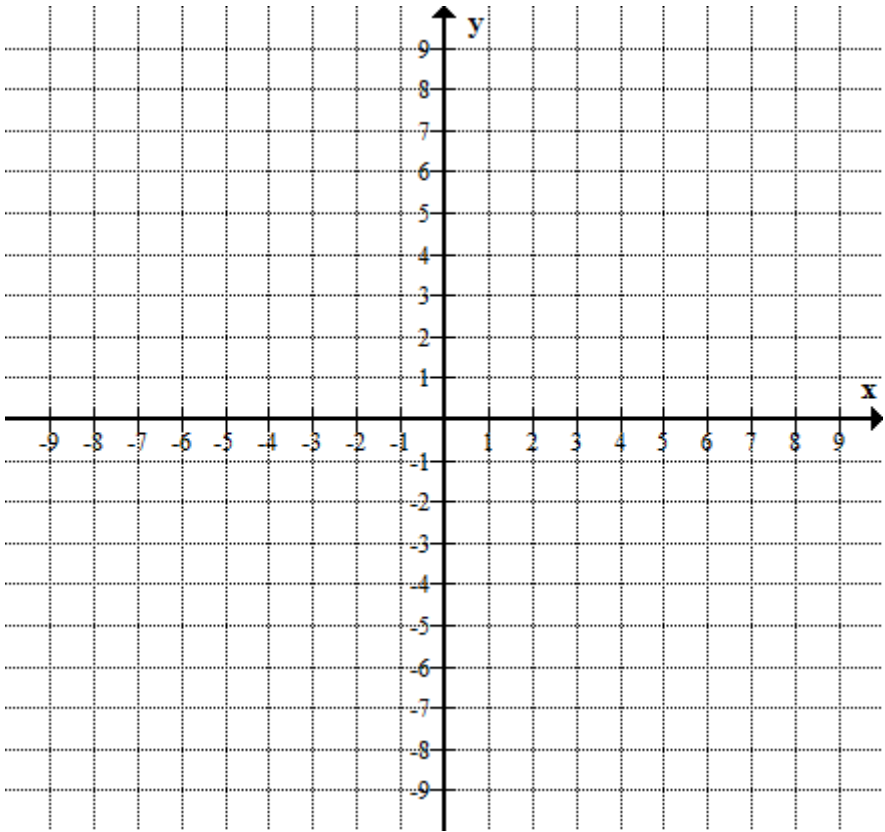
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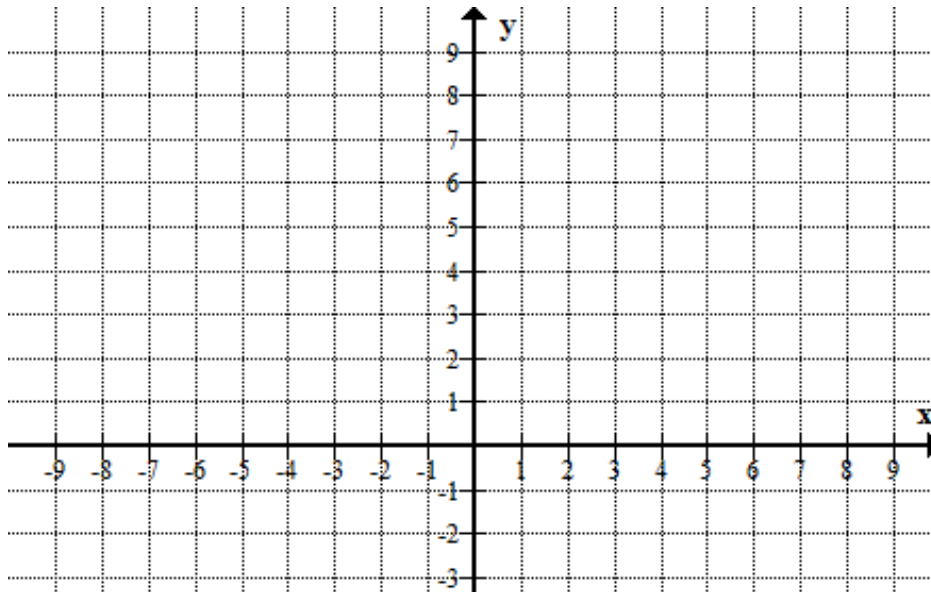
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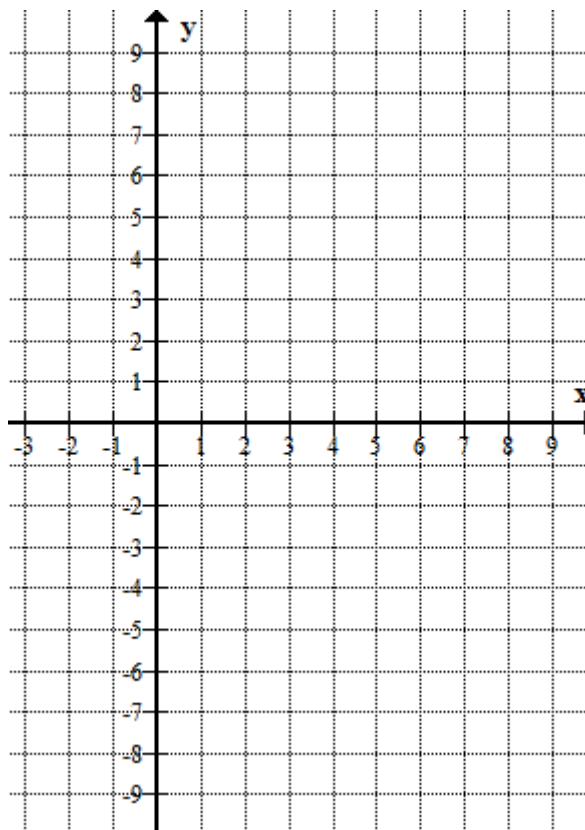
5. [Maximum mark: 5]

Sketch the graph of the function $y = 2e^x + 3$. Indicate on the graph the horizontal asymptote and the y -intercept



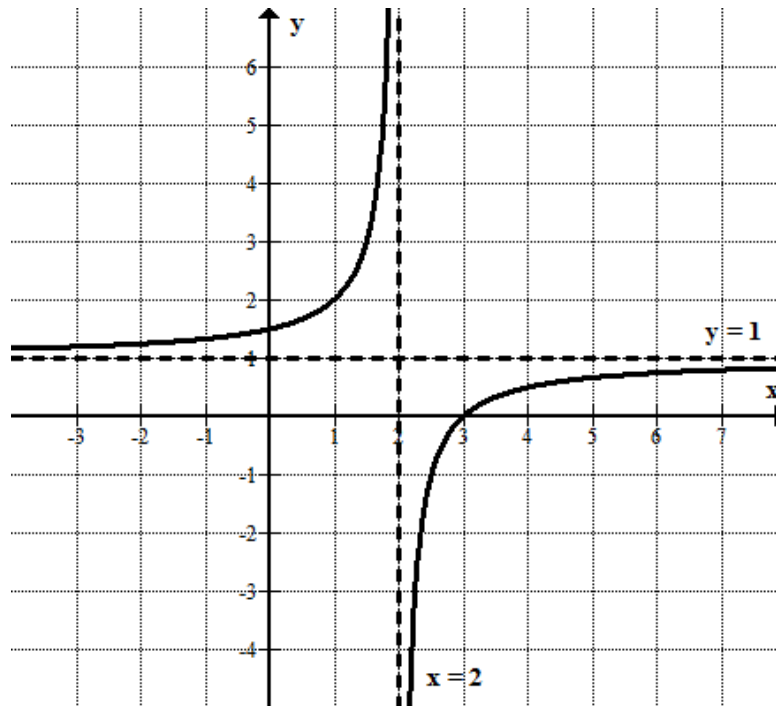
6. [Maximum mark: 5]

Sketch the graph of the function $y = \ln(x - 2)$. Indicate on the graph the vertical asymptote and the x -intercept.



7. [Maximum mark: 18]

The graph of the function $f(x) = \frac{x-6}{x-2}$ is shown below.



(a) Write down the images of the horizontal asymptote $y = 1$ under the following transformations

[9]

$y = f(x) + 2$	$y = 3$	$y = f(x + 2)$	
$y = f(x) - 2$		$y = f(x - 2)$	
$y = 2f(x)$		$y = f(2x)$	
$y = f(x)/2$		$y = f(x/2)$	
$y = -f(x)$		$y = f(-x)$	

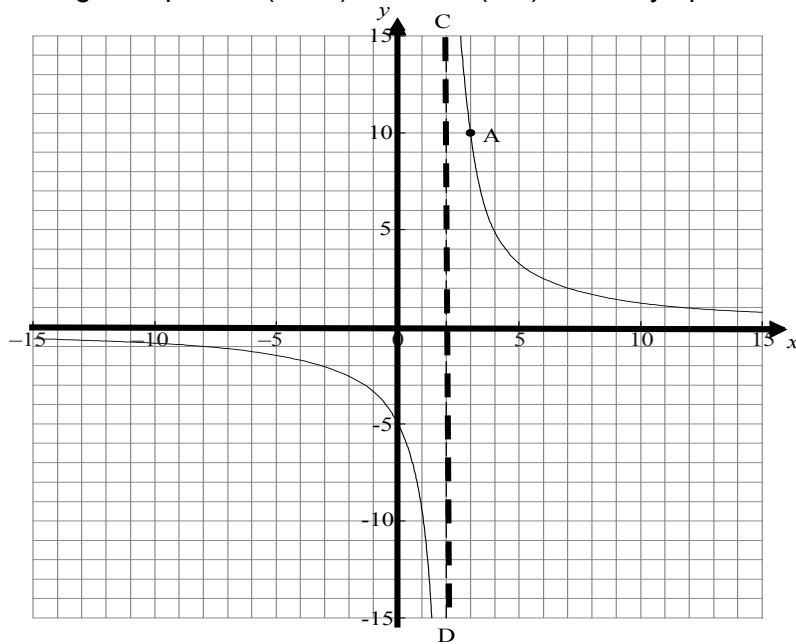
(b) Write down the images of the vertical asymptote $x = 2$ under the following transformations

[9]

$y = f(x) + 2$	$x = 2$	$y = f(x + 2)$	
$y = f(x) - 2$		$y = f(x - 2)$	
$y = 2f(x)$		$y = f(2x)$	
$y = f(x)/2$		$y = f(x/2)$	
$y = -f(x)$		$y = f(-x)$	

10. [Maximum mark: 6]

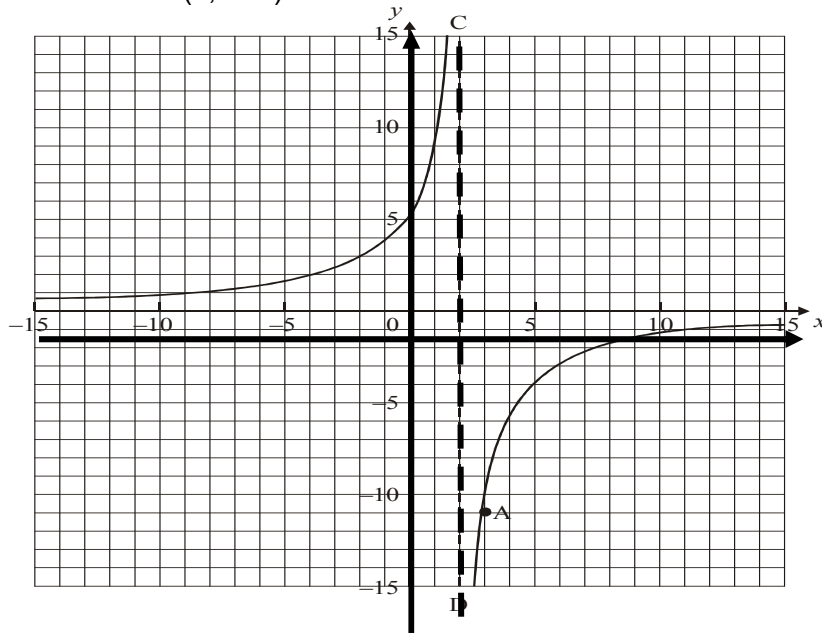
- (a) The diagram shows part of the graph of the function $f(x) = \frac{q}{x-p}$. The curve passes through the point A (3, 10). The line (CD) is an asymptote.



Find the value of (i) p (ii) q

[4]

- (b) The graph of $f(x)$ is transformed as shown in the following diagram. The point A is transformed to A' (3, -10).



Give a full geometric description of the transformation.

[2]

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11. [Maximum mark: 7]

The function $f(x)$ is defined as $f(x) = 3 + \frac{1}{2x-5}$, $x \neq \frac{5}{2}$.

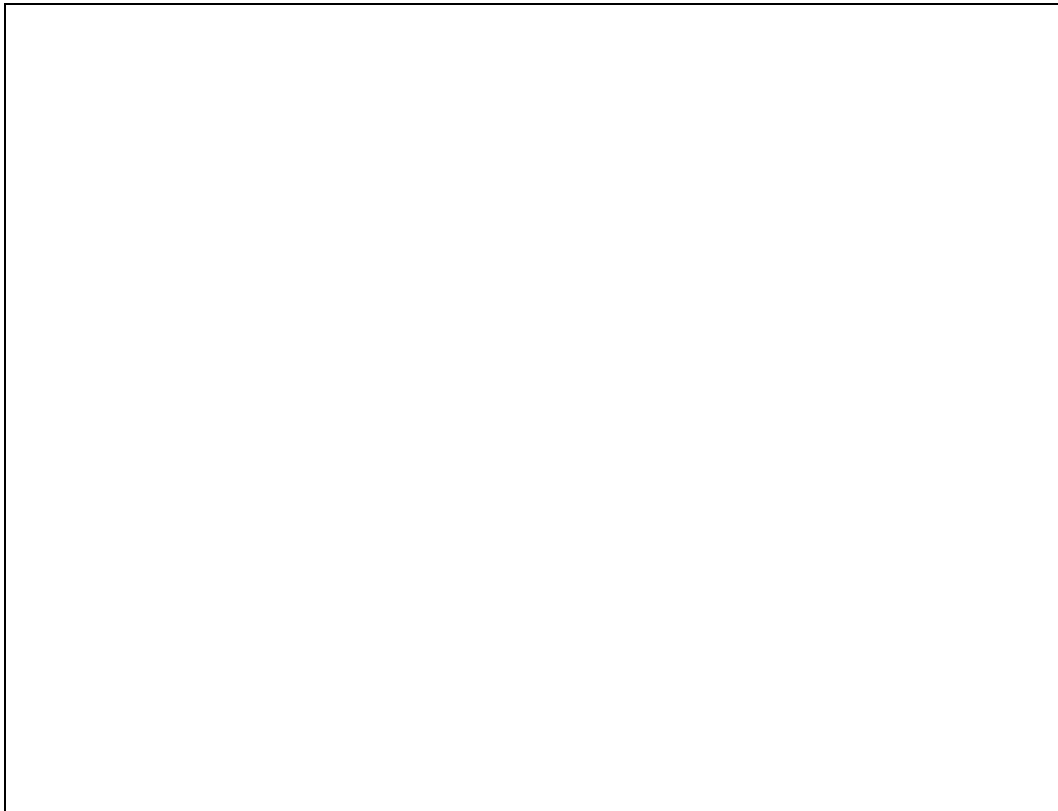
(a) Sketch the curve of f for $-5 \leq x \leq 5$, showing the asymptotes. [3]

(b) Using your sketch, write down

(i) the equation of each asymptote;

(ii) the value of the x -intercept;

(iii) the value of the y -intercept. [4]



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