1.7 Transformations of Functions

Question Paper

Course	Edexcel IAL Maths: Pure 1
Section	1. Algebra & Functions
Topic	1.7 Transformations of Functions
Difficulty	V. Hard

Time allowed: **60**

Score: **/48**

Percentage: **/100**

Question 1

The curve with equation $y = \mathrm{f}(x)$ has two asymptotes, for which the equations are $y = -3$ and $x = 2$.

Give the equations of the asymptotes for the curves with the following equations:

(i) $y + 3 = \mathrm{f}(x)$

(ii) $y = \mathrm{f}(x - 2)$

[4 marks]

Question 2

The curve with equation $y = \mathrm{f}(x)$ has two asymptotes, for which the equations are $y = 5$ and $x = -4$.

Give the equations of the asymptotes for the curves with the following equations:

(i) $\frac{1}{3}y = \mathrm{f}(x)$

(ii) $y = \mathrm{f}\left(\frac{1}{3}x\right)$

[4 marks]

Question 3

The curve with equation $y = \mathrm{f}(x)$ has two asymptotes, for which the equations are $y = -1$ and $x = -2$.

Give the equations of the asymptotes for the curves with the following equations:

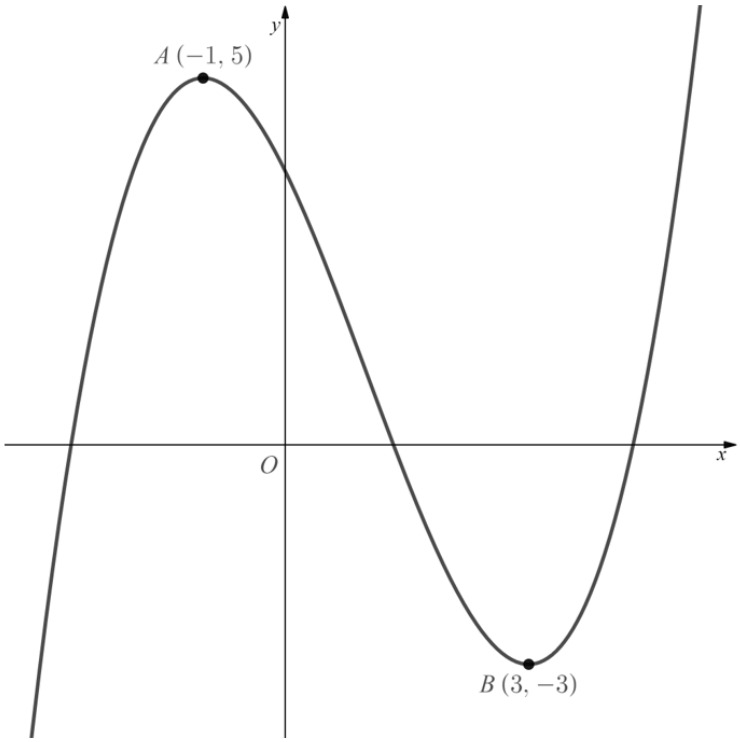
(i) $y = \mathrm{f}(-x)$

(ii) $-y = \mathrm{f}(x)$

[4 marks]

Question 4

The diagram below shows the graph of $y = \mathrm{f}(x)$. The two marked points $A(-1, 5)$ and $B(3, -3)$ lie on the graph.



(a) In separate diagrams sketch the curves with equation

(i) $y = \mathrm{f}\left(\frac{1}{3}x\right)$

(ii) $5y = \mathrm{f}(x)$

On each diagram, give the coordinates of the images of points A and B under the given transformation.

[4 marks]

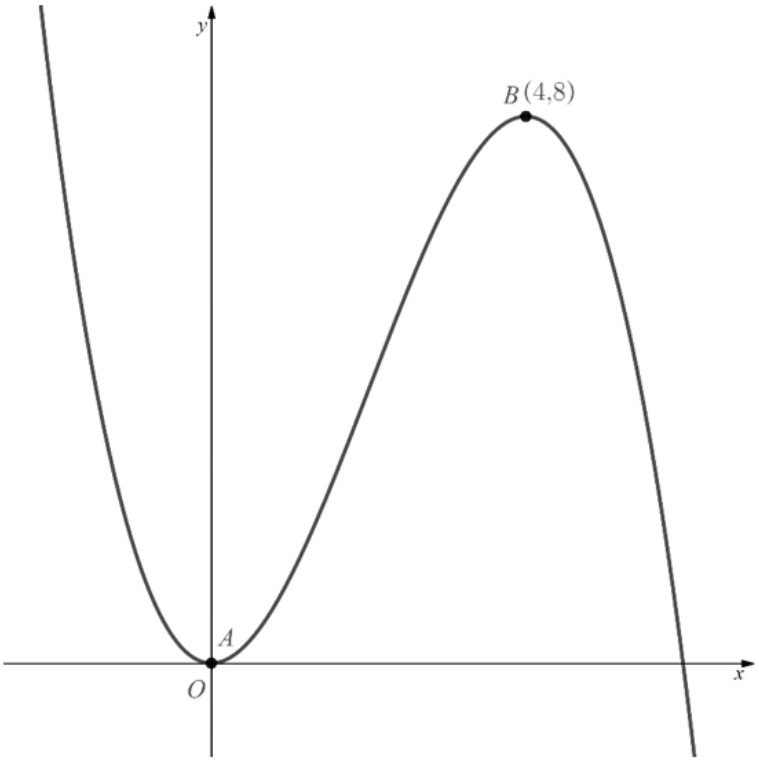
Question 4

(b) On the graph of $y = \mathrm{f}(ax)$ the image of one of the two marked points has an x coordinate of $\frac{5}{3}$. Given that $a > 0$, find the value of a.

[2 marks]

Question 5

The diagram below shows the graph of $y = \mathrm{f}(x)$. The marked point $B(4, 8)$ lies on the graph, and the graph meets the origin at the marked point A.



Consider the three following transformations of the graph

$$y = \mathrm{f}(-x) \qquad y = \mathrm{f}(ax) \qquad y = \mathrm{f}(x) + b$$

where a and b are constants, and $a > 0$.

State which of the transformations satisfies each of the following conditions, and determine the range of possible values of the variables a and b where relevant.

(i) The images of the two marked points under the transformation lie on opposite sides of the x-axis.

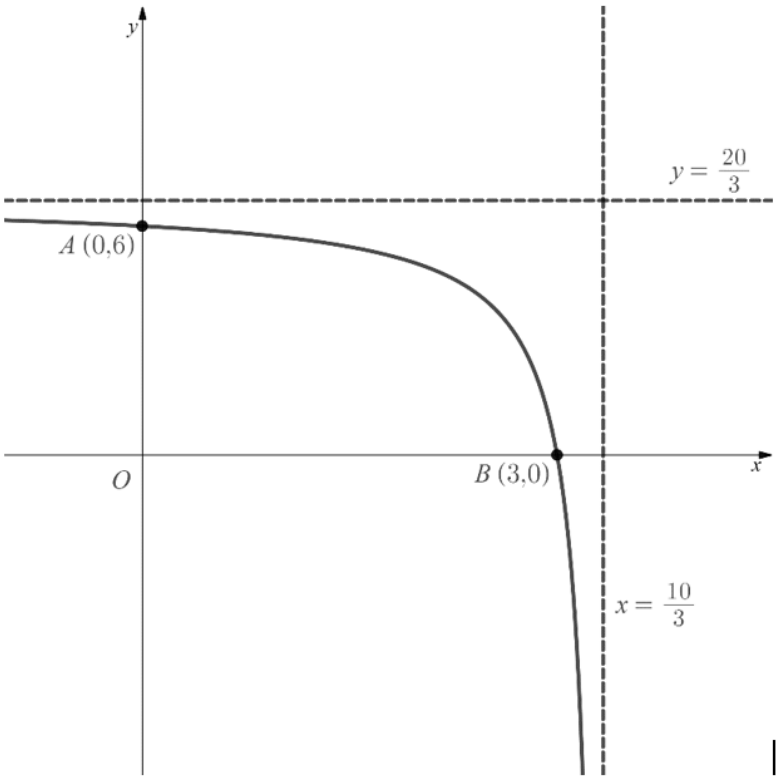
(ii) The image of point B under the transformation has coordinates (x, y), where $-6 < x < -3$.

(iii) The image of point B under the transformation has coordinates (x, y), where $0 < x < 3$.

[5 marks]

Question 6

The diagram below shows the graph of $y = \mathrm{f}(x)$. The graph intersects the coordinate axes at the two marked points $A(0, 6)$ and $B(3, 0)$. The graph has two asymptotes as shown, with equations $y = \frac{20}{3}$ and $x = \frac{10}{3}$.



(a) In separate diagrams sketch the curves with equation

(i) $y = \mathrm{f}\left(\frac{20}{3}x\right)$

(ii) $5y = 4\mathrm{f}(x)$

On each diagram give the coordinates of the images of points A and B under the given transformation, as well as stating the equations of the transformed asymptotes.

[6 marks]

Question 6

(b) The graph of $y = f(ax)$ has an asymptote with equation $x = k$, where $1 < k < 100$.
Find the range of possible values of a.

[2 marks]

Question 7

The function $f(x)$ is defined by the equation

$$f(x) = 9 - \frac{16}{(x-2)^2}$$

(a) Sketch the graph of $y = f(x)$, showing clearly the points where the curve crosses the coordinate axes and stating the equations of the asymptotes.

[6 marks]

Question 7

(b) The graph of $y = f(x + a)$ is such that, for all points $P(x, y)$ that lie on the graph, if the y coordinate is less than 5 then the x coordinate is less than zero. Find the range of possible values of a.

[2 marks]

Question 8

Given that $f(x) = x^3 - (2\sqrt{3})x^2 + 3x$

(a) Sketch the graph of $y = f(x)$, showing clearly the coordinates of the points where the curve crosses or touches the coordinate axes.

[6 marks]

Question 8

The functions $g(x)$ and $h(x)$ are defined by the equations

$$g(x) = f(-x)$$
$$h(x) = g(x + a)$$

(b) The graph of $h(x)$ touches the x-axis at the point $(5, 0)$. Find the value of a, giving your answer as an exact value.

[3 marks]