



## Multiple Transformations of Functions Exam Questions (Sheet 2)

**Q1.**

Figure 2 shows part of the curve with equation

$$y = f(x)$$

The curve passes through the points  $P(-1.5, 0)$  and  $Q(0, 5)$  as shown.

On separate diagrams, sketch the curve with equation

(a)  $y = |f(x)|$

(2)

(b)  $y = f(|x|)$

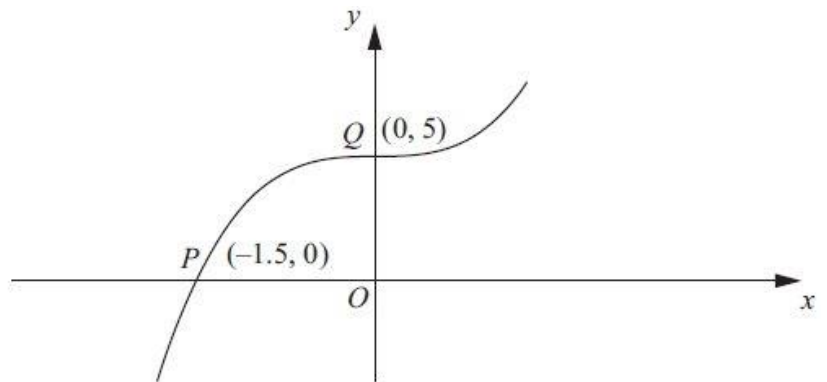
(2)

(c)  $y = 2f(3x)$

(3)

Indicate clearly on each sketch the coordinates of the points at which the curve crosses or meets the axes.

**(Total 7 marks)**



**Figure 2**

**Q2.**

Figure 1 shows part of the graph of  $y = f(x), x \in \mathbb{R}$ .

The graph consists of two line segments that meet at the point  $R(4, -3)$ , as shown in Figure 1.

Sketch, on separate diagrams, the graphs of

(a)  $y = 2f(x + 4)$ ,

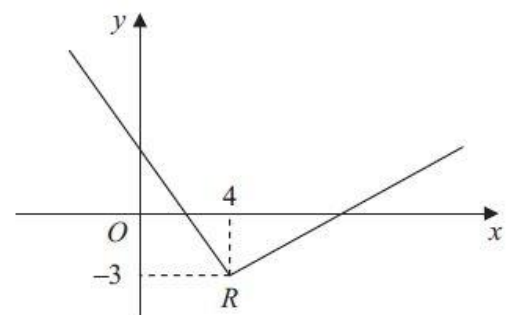
(3)

(b)  $y = |f(x)|$

(3)

On each diagram, show the coordinates of the point corresponding to  $R$ .

**(Total 6 marks)**



**Figure 1**



Q3.

Figure 1 shows the graph of  $y = f(x)$ ,  $1 < x < 9$ .

The points  $T(3, 5)$  and  $S(7, 2)$  are turning points on the graph.

Sketch, on separate diagrams, the graphs of

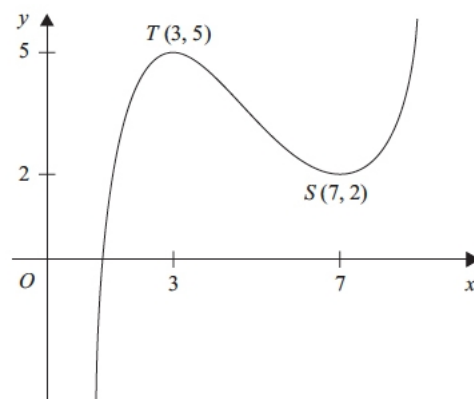
(a)  $y = 2f(x) - 4$ ,

(3)

(b)  $y = |f(x)|$

(3)

Indicate on each diagram the coordinates of any turning points on your sketch.



(Total 6 marks)

Q4.

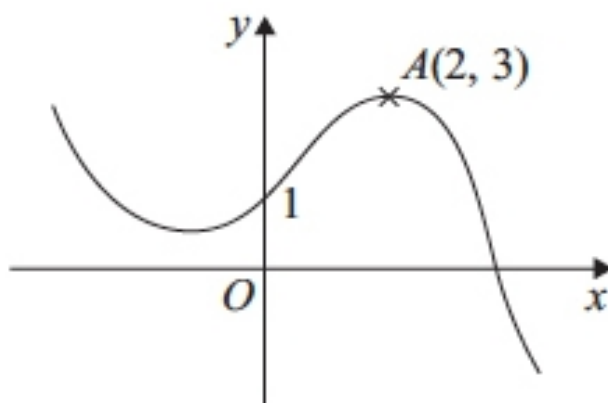


Figure 1

Figure 1 shows a sketch of the graph of  $y = f(x)$ .

The graph intersects the  $y$ -axis at the point  $(0, 1)$  and the point  $A(2, 3)$  is the maximum turning point.

Sketch, on separate axes, the graphs of

(i)  $y = f(-x) + 1$ ,

(ii)  $y = f(x + 2) + 3$ ,

(iii)  $y = 2f(2x)$ .

On each sketch, show the coordinates of the point at which your graph intersects the  $y$ -axis and the coordinates of the point to which  $A$  is transformed.

(9)

(Total 9 marks)



Q5.

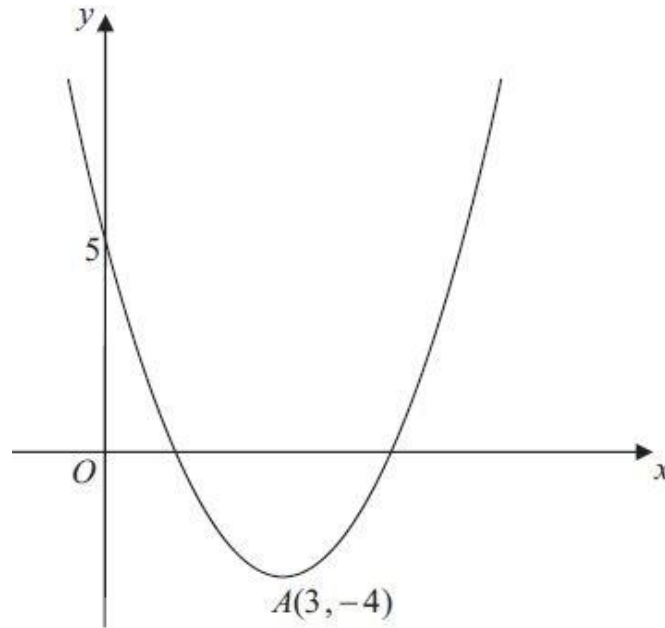


Figure 2

Figure 2 shows a sketch of the curve with the equation  $y = f(x)$ ,  $x \in \mathbb{R}$ .

The curve has a turning point at  $A(3, -4)$  and also passes through the point  $(0, 5)$ .

(a) Write down the coordinates of the point to which  $A$  is transformed on the curve with equation

(i)  $y = |f(x)|$ ,

(ii)  $y = 2f\left(\frac{1}{2}x\right)$ .

(4)

(b) Sketch the curve with equation

$$y = f(|x|)$$

On your sketch show the coordinates of all turning points and the coordinates of the point at which the curve cuts the  $y$ -axis.

(3)

The curve with equation  $y = f(x)$  is a translation of the curve with equation  $y = x^2$ .

(c) Find  $f(x)$ .

(2)

(d) Explain why the function  $f$  does not have an inverse.

(1)

(Total 10 marks)



**Q6.**

The point  $P(-2, -5)$  lies on the curve with equation  $y = f(x)$ ,  $x \in \mathbb{R}$

Find the point to which  $P$  is mapped, when the curve with equation  $y = f(x)$  is transformed to the curve with equation

(a)  $y = f(x) + 2$

(1)

(b)  $y = |f(x)|$

(1)

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

(2)

(Total for question = 4 marks)

**Q7.**

Sketch the graph of  $y = \ln |x|$ , stating the coordinates of any points of intersection with the axes.

(3)

(Total 3 marks)

**Q8.**

Given that

$$f(x) = \ln x, \quad x > 0$$

sketch on separate axes the graphs of

(i)  $y = f(x)$ ,

(ii)  $y = |f(x)|$ ,

(iii)  $y = -f(x - 4)$ .

Show, on each diagram, the point where the graph meets or crosses the  $x$ -axis.

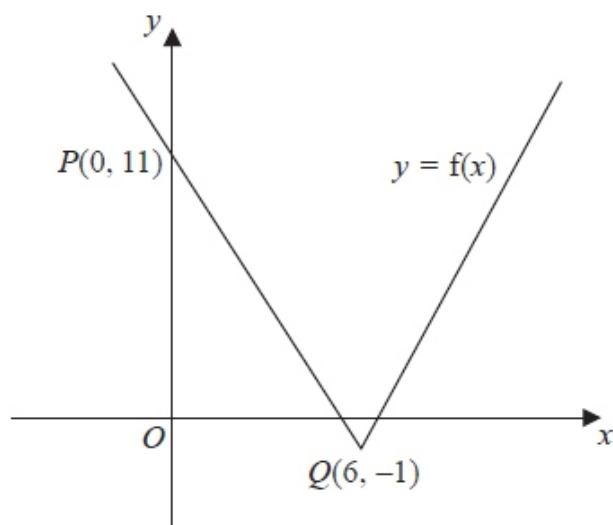
In each case, state the equation of the asymptote.

(7)

(Total 7 marks)



Q9.



**Figure 1**

Figure 1 shows part of the graph with equation  $y = f(x)$ ,  $x \in \mathbb{R}$ .

The graph consists of two line segments that meet at the point  $Q(6, -1)$ .

The graph crosses the  $y$ -axis at the point  $P(0, 11)$ .

Sketch, on separate diagrams, the graphs of

(a)  $y = |f(x)|$

(2)

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

(3)

On each diagram, show the coordinates of the points corresponding to  $P$  and  $Q$ .

Given that  $f(x) = a|x - b| - 1$ , where  $a$  and  $b$  are constants,

(c) state the value of  $a$  and the value of  $b$ .

(2)

**(Total 7 marks)**