

# FUNCTIONS: COMBINATIONS OF TRANSFORMATIONS

## A2 Unit 3: Pure Mathematics B

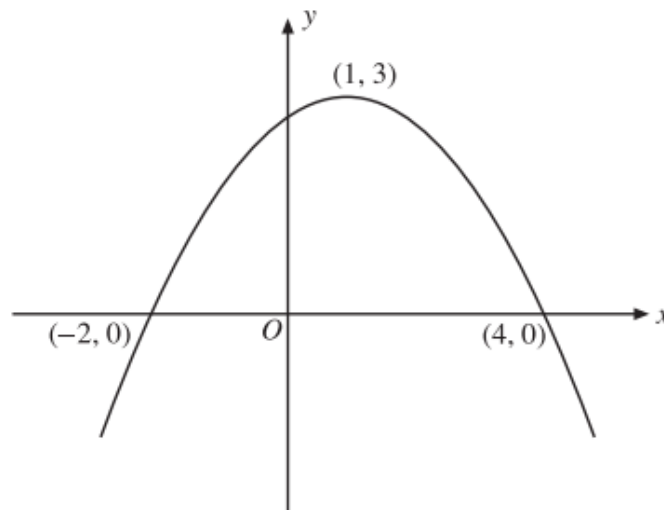
### WJEC past paper questions: 2010 – 2017

Total marks available 39 (approximately 50 minutes)

1. (a) Solve the inequality  $|3x + 1| \leq 5$ . [3]
- (b) The function  $f$  is defined by  $f(x) = |x|$ .
- (i) Sketch the graph of  $y = f(x)$ .
- (ii) On a separate set of axes, sketch the graph of  $y = f(x - 3) + 2$ . On your sketch, indicate the coordinates of the point on the graph where the value of the  $y$ -coordinate is least and the coordinates of the point where the graph crosses the  $y$ -axis. [4]

(Summer 10)

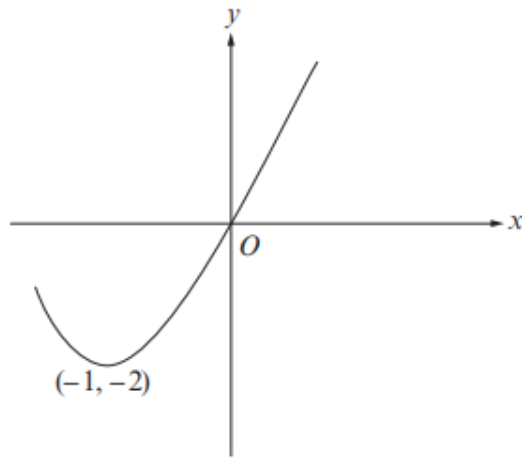
2. The diagram shows a sketch of the graph of  $y = f(x)$ . The graph passes through the points  $(-2, 0)$  and  $(4, 0)$  and has a maximum point at  $(1, 3)$ .



Sketch the graph of  $y = -3f(x + 2)$ , indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the  $x$ -axis. [3]

(January 11)

3. The diagram shows a sketch of the graph of  $y = f(x)$ . The graph passes through the origin and has a minimum point at  $(-1, -2)$ .



Sketch the graph of  $y = -4f(2x)$ , indicating the coordinates of the stationary point. [3]

(Summer 12)

4. Given that  $f(x) = \ln x$ , sketch, on the same diagram, the graphs of  $y = f(x)$  and  $y = \frac{1}{2}f(x+3)$ . Label the coordinates of the point of intersection of each of the graphs with the  $x$ -axis. Indicate the behaviour of each of the graphs for large positive and negative values of  $y$ . [5]

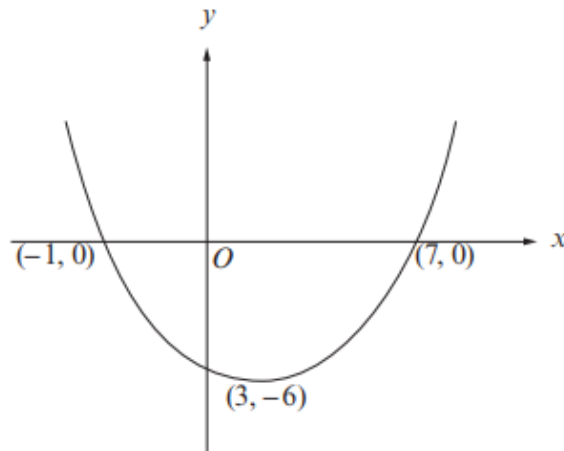
(Summer 11)

5. The function  $f$  is defined by  $f(x) = e^x$ .

- (a) Sketch the graph of  $y = f(x)$ . Write down the coordinates of the point of intersection of the graph with the  $y$ -axis. [2]
- (b) Using a separate set of axes,
- sketch the graph of  $y = f(3x) - 4$ , indicating the behaviour of your graph for large negative values of  $x$ ,
  - write down the coordinates of the point of intersection of the graph with the  $y$ -axis,
  - find the  $x$ -coordinate of the point of intersection of the graph with the  $x$ -axis. Give your answer correct to three decimal places. [4]

(January 12)

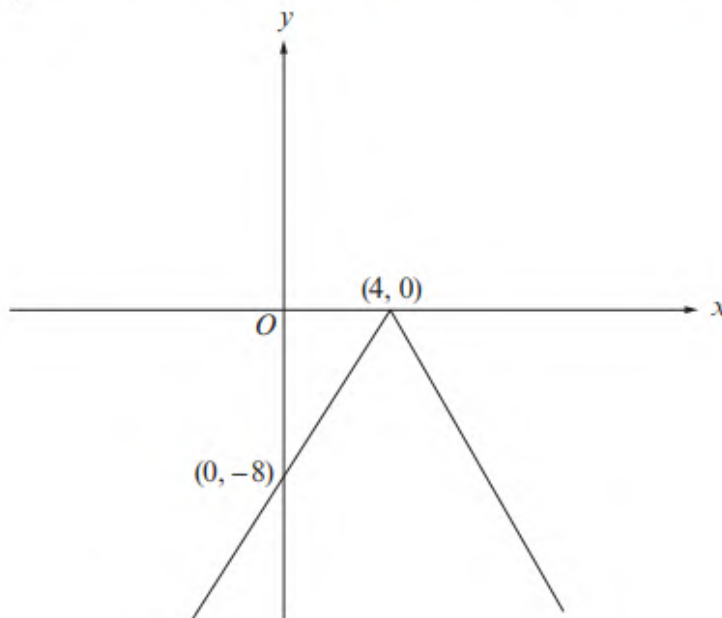
6. The diagram shows a sketch of the graph of  $y = f(x)$ . The graph passes through the points  $(-1, 0)$  and  $(7, 0)$  and has a minimum point at  $(3, -6)$ .



Sketch the graph of  $y = -\frac{2}{3}f(x + 4)$ , indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the  $x$ -axis. [3]

(Summer 13)

7. (i) Sketch the graph of  $y = |x|$ .  
 (ii) The diagram below shows a sketch of the graph of  $y = a|x + b|$ , where  $a$  and  $b$  are constants. The graph meets the  $x$ -axis at the point  $(4, 0)$  and the  $y$ -axis at the point  $(0, -8)$ .



Find the value of  $a$  and the value of  $b$ . [3]

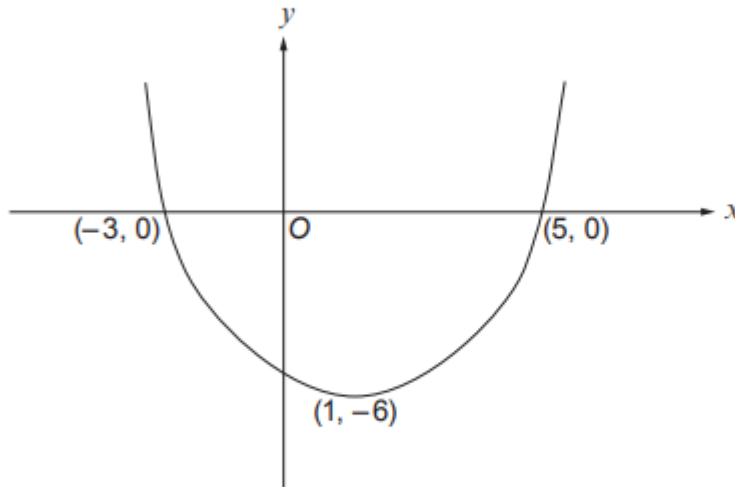
(January 13)

8. Given that  $f(x) = \ln x$ , sketch, on the same diagram, the graphs of  $y = f(x)$  and  $y = \frac{2}{3}f(x + 4)$ .

Label the coordinates of the point of intersection of **each** of the graphs with the  $x$ -axis.  
Indicate the behaviour of **each** of the graphs for large positive and negative values of  $y$ . [5]

(Summer 15)

9. The diagram shows a sketch of the graph of  $y = f(x)$ . The graph passes through the points  $(-3, 0)$  and  $(5, 0)$  and has a minimum point at  $(1, -6)$ .



- (i) The graph of  $y = 4f(x + a)$  passes through the origin. Write down the possible values of  $a$ .
- (ii) The  $y$ -coordinate of the stationary point on the graph of  $y = bf(x + 2)$  is 4. Write down the value of  $b$ . [2]

(Summer 16)

10. The graph of  $y = f(x)$  has a single maximum which is situated at the point  $(-2, 4)$ . The graph of  $y = af(x + b)$  has a single minimum which is situated at the point  $(4, -2)$ . Find the values of the constants  $a$  and  $b$ . [2]

(Summer17)