

TRANSFORMATIONS OF FUNCTIONS

GRADE 7

Examination Practice Questions

You should have:

A ruler, protractor, compasses, a pen, pencil, eraser, calculator.
For some questions, you may need tracing paper.

Instructions

- Use **black** ink or ball-point pen.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**

Information

- The marks for each question are shown in brackets.
- Use the number of marks for each question as a guide as to how much time to spend on each question. As a rough guide, you can multiply the number of marks by 1.2 to see how many minutes you should spend on a question.
- Questions been carefully compiled from or modelled on a variety of past papers and will generally get more challenging as the document progresses. Some of the later questions will go beyond the core grade level for this topic.

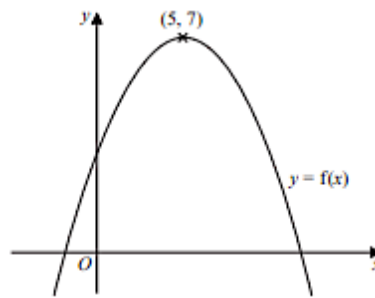
Advice

- Read each question carefully before you start to answer it.
- Don't forget to have fun.
- Check your answers at the end.

Q1.

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The diagram shows a sketch of the curve with equation $y = f(x)$



There is only one maximum point on the curve.
The coordinates of this maximum point are $(5, 7)$

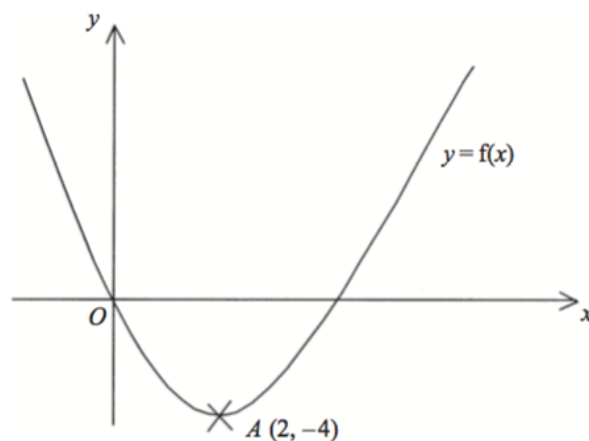
Write down the coordinates of the maximum point on the curve with equation $y = f(x) + 3$

$(5, 10)$
(1 mark)

Q2.

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This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O .



The only vertex of the curve is at $A(2, -4)$.

Write down the coordinates of the vertex of the curve with equation $y = f(x) - 5$.

$(2, -9)$
(1 mark)

Q3.

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The curve with equation $y = f(x)$ has one turning point.

The coordinates of this turning point are $(-6, -4)$

Write down the coordinates of the turning point on the curve with equation $y = f(x) + 5$

$(-6, 1)$

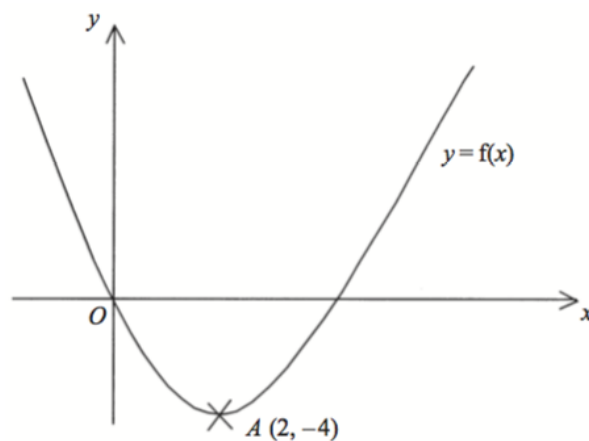
(1 mark)

Q4.

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This is a sketch of the curve with equation $y = f(x)$.

It passes through the origin O .

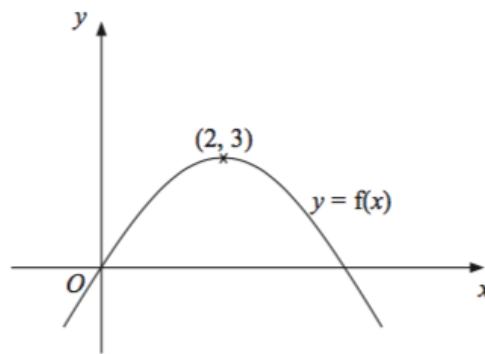


The only vertex of the curve is at $A(2, -4)$.

Write down the coordinates of the vertex of the curve with equation $y = f(x - 3)$.

$(5, -4)$

(1 mark)



The diagram shows part of the curve with equation $y = f(x)$.

The coordinates of the maximum point of this curve are (2, 3).

Write down the coordinates of the maximum point of the curve with equation $y = f(x - 2)$

(4, 3)
.....
(1 mark)

A curve has equation $y = f(x)$. There is only one maximum point on the curve.

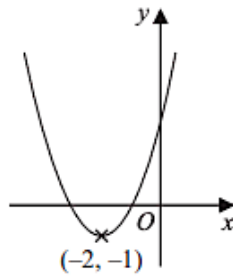
The coordinates of this maximum point are (4, 3)

Write down the coordinates of the maximum point on the curve with equation $y = f(x - 5)$

(9, 3)
.....
(1 mark)

Q7.

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The diagram shows the curve with equation $y = f(x)$

The coordinates of the minimum point of the curve are $(-2, -1)$

Write down the coordinates of the minimum point of the curve with equation $y = \frac{1}{2}f(x)$

$(-2, -\frac{1}{2})$

(1 mark)

Q8.

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A curve has equation $y = f(x)$

The coordinates of the minimum point on this curve are $(-9, 15)$

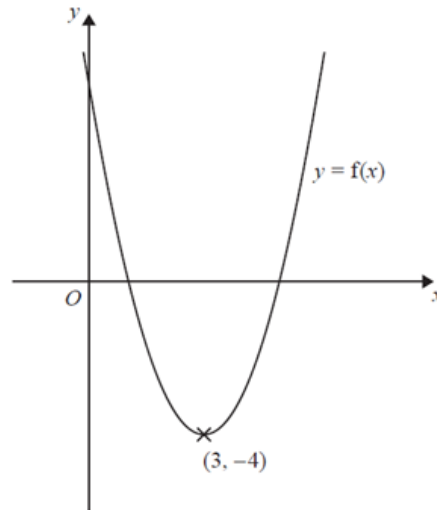
Write down the coordinates of the minimum point on the curve with equation $y = \frac{1}{3}f(x)$

$(-9, 5)$

(1 mark)

Q9.

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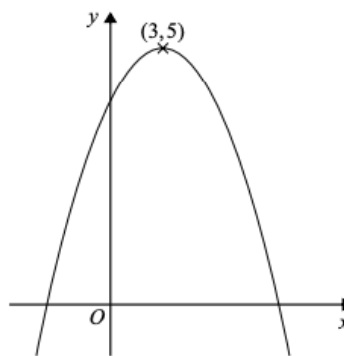
The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the minimum point of this curve are $(3, -4)$.

Write down the coordinates of the minimum point of the curve with equation $y = f(2x)$

$(1.5, -4)$
(1 mark)

Q10.

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The diagram shows part of the curve with equation $y = f(x)$
The coordinates of the maximum point of the curve are $(3, 5)$

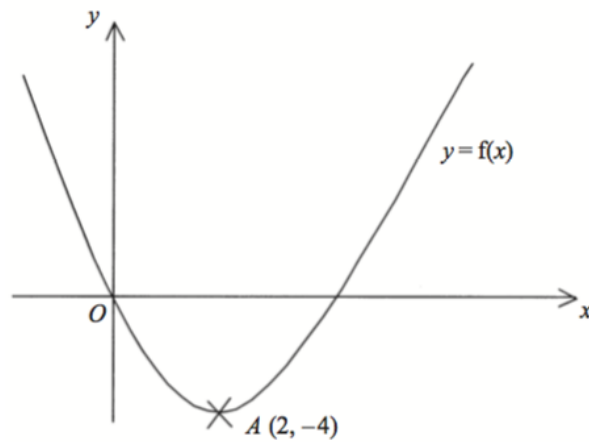
Write down the coordinates of the maximum point of the curve with equation $y = f(3x)$

$(1, 5)$
(1 mark)

Q11.

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This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O .



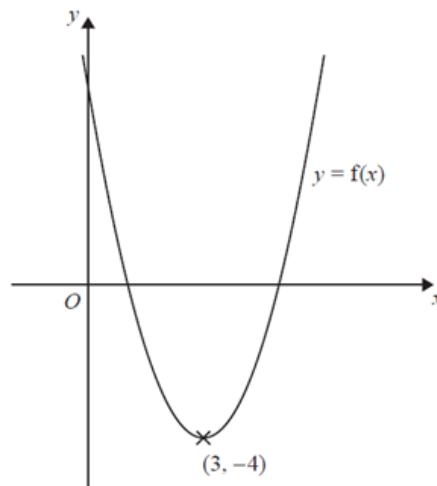
The only vertex of the curve is at $A(2, -4)$.

Write down the coordinates of the vertex of the curve with equation $y = -f(x)$.

$(2, 4)$
(1 mark)

Q12.

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The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the minimum point of this curve are $(3, -4)$.

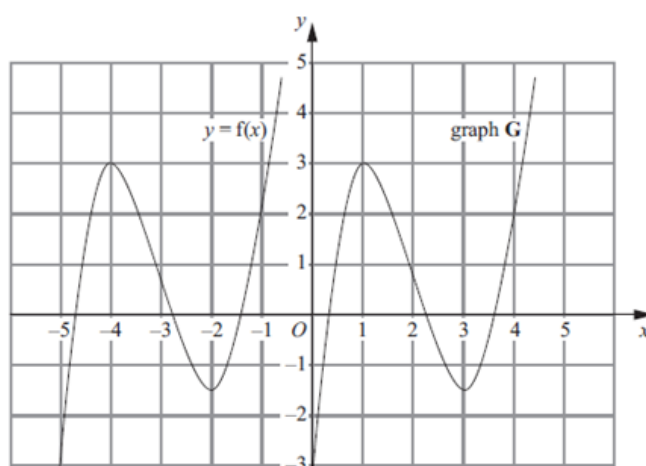
Write down the coordinates of the minimum point of the curve with equation $y = f(-x)$

$(-3, -4)$
(1 mark)

Q13.

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The graph of $y = f(x)$ is shown on the grid.



The graph of $y = f(x)$ has a maximum point at $(-4, 3)$.

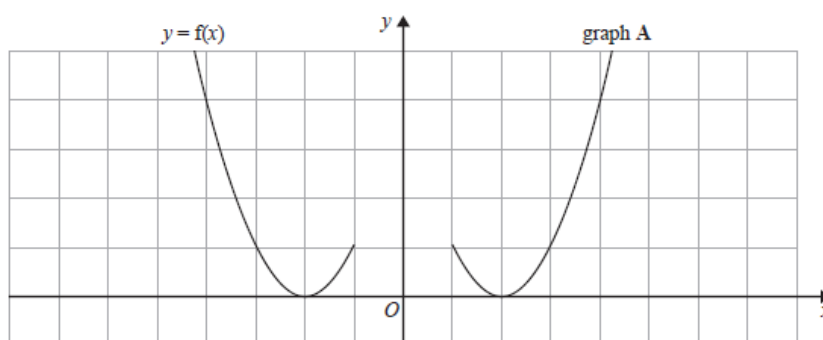
Write down the coordinates of the maximum point of the graph of $y = f(-x)$.

B_1 B_1
 $(4, 3)$
 (2 marks)

Q14.

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The graph of $y = f(x)$ is shown on the grid.



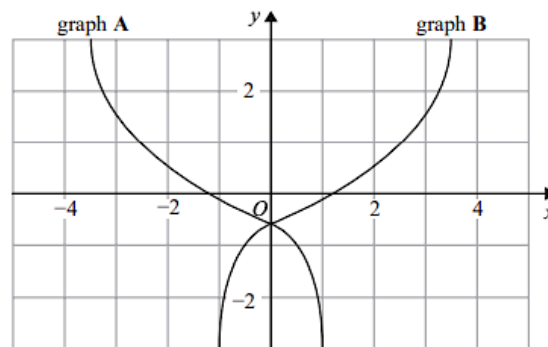
Graph A is a reflection of the graph of $y = f(x)$.

Write down the equation of graph A.

$f(-x)$
 (1 mark)

Q15.

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On the grid, graph A has been reflected to give graph B.
The equation of graph A is $y = g(x)$.

Write down the equation of graph B.

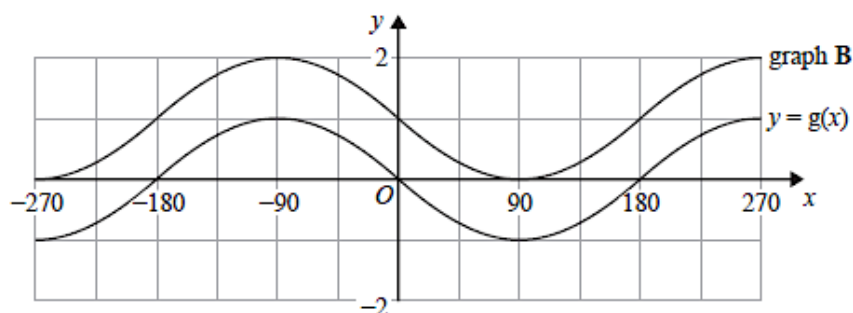
$$g(-x)$$

(1 mark)

Q16.

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The graph of $y = g(x)$ is shown on the grid.



Graph B is a translation of the graph of $y = g(x)$.

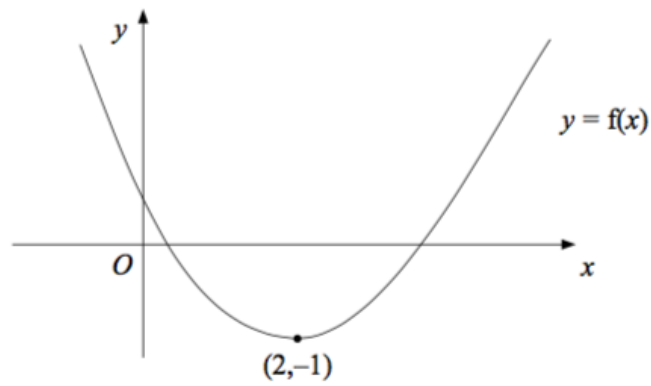
(a) Write down the equation of graph B.

$$g(x) + 1$$

(1 mark)

Q17.

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The diagram shows part of the curve with equation $y = f(x)$

The minimum point of the curve is at $(2, -1)$. The curve $y = f(x)$ is reflected in the y axis.

Find the equation of the curve following this transformation.

$$f(-x)$$

(1 mark)

Q18.

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The curve with equation $y = f(x)$ is transformed to give the curve with equation $y = f(x) - 4$

Describe the transformation.

$$\begin{pmatrix} 0 \\ -4 \end{pmatrix}$$

(1 mark)

Q19.

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The equation of a curve **C** is $y = x^2 + 3x + 4$

The curve **C** is transformed to curve **S** under the translation $\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

Find an equation of curve **S**.

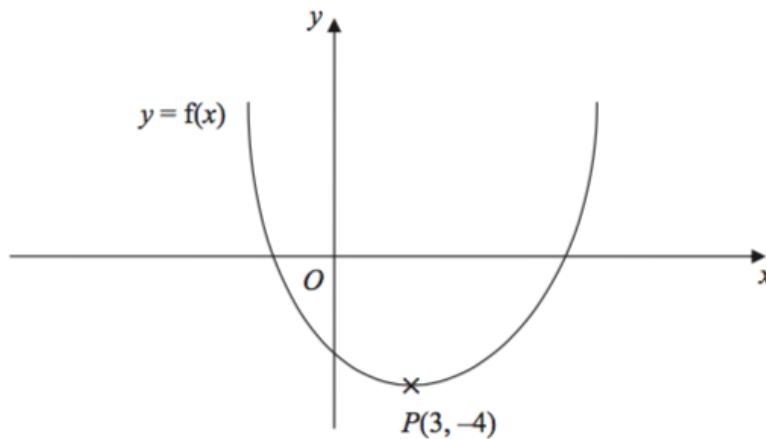
$$y = (x - 4)^2 + 3(x - 4) + 10$$

(2 marks)

Q20.

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This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at $P(3, -4)$.



Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$

B_1 B_1
 $(-2, 2)$
 (2 marks)

Q21.

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The graph of the curve C with equation $y = f(x)$ is transformed to give the graph of the curve S with equation $y = f(-x) - 3$

The point on C with coordinates $(7, 2)$ is mapped to the point Q on S .

Find the coordinates of Q .

B_1 B_1
 $(-7, -1)$
 (2 marks)

Q22.

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The graph of $y = h(x)$ intersects the x -axis at two points.

The coordinates of the two points are $(-1,0)$ and $(6,0)$

The graph of $y = h(x + a)$ passes through the point with coordinates $(2,0)$, where a is a constant.

Find the two possible values of a

$$a = -3 \quad a = 4$$

.....
(2 marks)

Q23.

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Give the vector for the translation that maps the curve with equation $y = x^2$ on to the curve with equation $y = x^2 - 6x + 10$.

TRANSLATION :

$$\begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

.....
(4 marks)

QUESTIONS FROM MATHEMATICAL COMPETITIONS

Q1.

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The line with equation $y = 2x + 3$ is reflected in the x -axis.

What is the equation of the new line?

$$y = -1(2x + 3)$$

$$y = -f(x)$$

$$y = -2x - 3$$

Q2.

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The graph of $y = \frac{1}{x}$ is reflected in the line $y = 1$. The resulting image is reflected in the line $y = -x$.

What is the equation of the final graph?

USE EASY COORDINATES TO

CHECK: $x = 1$ $y = \frac{1}{1} \therefore (1, 1)$

→ REFLECTION IN $y = 1 \therefore (1, 1)$

→ REFLECTION IN $y = -x \therefore (-1, -1)$

ONLY $y = \frac{-1}{x+2}$ HAS THESE COORDINATES

(A)

The following sequence of transformations is applied to the curve $y = 4x^2$

1. Translation by $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$

$$\textcircled{1} y = 4(x-3)^2 \rightarrow y = 4(x-3)^2 - 5$$

2. Reflection in the x -axis

3. Stretch parallel to the x -axis with scale factor 2

What is the equation of the resulting curve?

$$\textcircled{2} y = -f(x) \therefore y = -4(x-3)^2 + 5$$

$$\textcircled{3} y = -4\left(\frac{x}{2} - 3\right)^2 + 5$$

$$\therefore y = -4\left(\frac{x}{2} - 3\right)^2 + 5$$