PEARSON EDEXCEL INTERNATIONAL GCSE MATHEMATICS A (4MA1) · HIGHER TIER

Graph Transformations: exam questions

10 questions · 23 marks · mark schemes at the end

Name _____ Date _____ Score / 23

- Calculators are allowed on both 4MA1 Higher papers (1H and 2H). Show your working: most marks are for method.
- Mark schemes start after the questions. M marks are for a correct method, A marks for an accurate answer that follows a correct method, and B marks for a correct result on its own.
- Online, with more practice: igcsemathrevision.com/igcse-frontend/4ma1/exam-questions/graph-transformations

1. **3 marks**

The curve $y = f(x)$ has a maximum point at $(2, 5)$.

Write down the coordinates of the turning point of each of these curves.

(a) $y = f(x) + 3$ **(1)**

(b) $y = f(x - 4)$ **(1)**

(c) $y = -f(x)$ **(1)**

2. **2 marks**

Describe fully the single transformation that maps the graph of $y = x^2$ onto the graph of

(a) $y = (x + 3)^2$ **(1)**

(b) $y = x^2 - 5$ **(1)**

3. **3 marks**

The graph of $y = x^2$ is mapped onto the graph of $y = x^2 + 4x + 1$ by a single transformation.

Describe the transformation fully.

4. **2 marks**

The graph of $y = \sin x$ is translated to give the graph of $y = \sin(x - 30°)$.

Find the coordinates of the maximum point of $y = \sin(x - 30°)$ for $0 \leqslant x \leqslant 360°$.

5. **2 marks**

The curve $y = f(x)$ passes through the point $(3, -2)$.

Write down the coordinates of the point that this maps to on

(a) $y = f(-x)$ **(1)**

(b) $y = f(x) + 2$ **(1)**

6. **2 marks**

The graph of $y = \cos x$ is reflected in the x-axis.

(a) Write down the equation of the new graph. **(1)**

(b) Write down the coordinates of the maximum point of the new graph for $0 \leqslant x \leqslant 360°$. **(1)**

7. 3 marks

$f(x) = x^2 - 2x$ and $g(x) = f(x + 1)$.

(a) Show that $g(x) = x^2 - 1$. **(2)**

(b) Describe the transformation that maps $y = f(x)$ onto $y = g(x)$. **(1)**

8. 2 marks

$f(x) = (x - 1)(x - 5)$

Solve $f(x + 2) = 0$.

9. 2 marks

The curve $y = f(x)$ has a turning point at $(-1, 4)$.

Find the coordinates of the turning point of the curve $y = f(x + 2) - 3$.

10. 2 marks

The graph of $y = x^3$ is translated to give the graph of $y = (x - 2)^3 + 1$.

(a) Write down the vector of the translation. **(1)**

(b) Find the coordinates of the point where the new graph crosses the y-axis. **(1)**

Answers and worked solutions

Question 1 — 3 marks

(a)

B1 $(2, 8)$

(b)

B1 $(6, 5)$

(c)

B1 $(2, -5)$

Answer: (a) $(2, 8)$; (b) $(6, 5)$; (c) $(2, -5)$

Question 2 — 2 marks

(a)

B1 translation by vector $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$

(b)

B1 translation by vector $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

Answer: (a) translation $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$; (b) translation $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

Question 3 — 3 marks

M1 $(x + 2)^2 - 4 + 1$

A1 $(x + 2)^2 - 3$

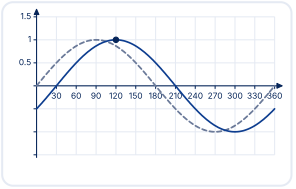
A1 translation by vector $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$

Answer: translation $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$

Question 4 — 2 marks

M1 translation $30°$ to the right, or $x - 30 = 90$

A1 $(120°, 1)$



Answer: $(120°, 1)$

Question 5 — 2 marks

(a)

B1 $(-3, -2)$

(b)

B1 $(3, 0)$

Answer: (a) $(-3, -2)$; (b) $(3, 0)$

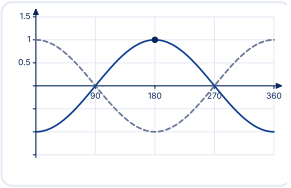
Question 6 — 2 marks

(a)

B1 $y = -\cos x$

(b)

B1 $(180°, 1)$



Answer: (a) $y = -\cos x$; (b) $(180°, 1)$

Question 7 — 3 marks

(a)

M1 $(x + 1)^2 - 2(x + 1)$

A1 $x^2 + 2x + 1 - 2x - 2 = x^2 - 1$ shown

(b)

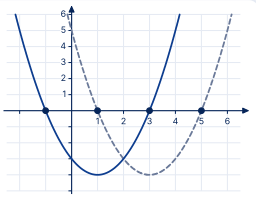
B1 translation by vector $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$

Answer: (a) shown; (b) translation $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$

Question 8 — 2 marks

M1 $(x + 1)(x - 3) = 0$, or roots 1 and 5 moved 2 to the left

A1 $x = -1$ or $x = 3$

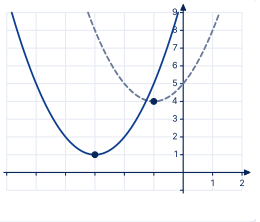


Answer: $x = -1$ or $x = 3$

Question 9 — 2 marks

M1 x—coordinate -3 or y—coordinate 1

A1 $(-3, 1)$



Answer: $(-3, 1)$

Question 10 — 2 marks

(a)

B1 $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$

(b)

B1 $(0, -7)$

Answer: (a) $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$; (b) $(0, -7)$

Online, with every solution: igcsemathrevision.com/igcse-frontend/4ma1/exam-questions/graph-transformations
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