

QQQ – Pure Year 2 – Chapter 2 – Functions (Version 2)

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1. The point $P(6, -4)$ 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)

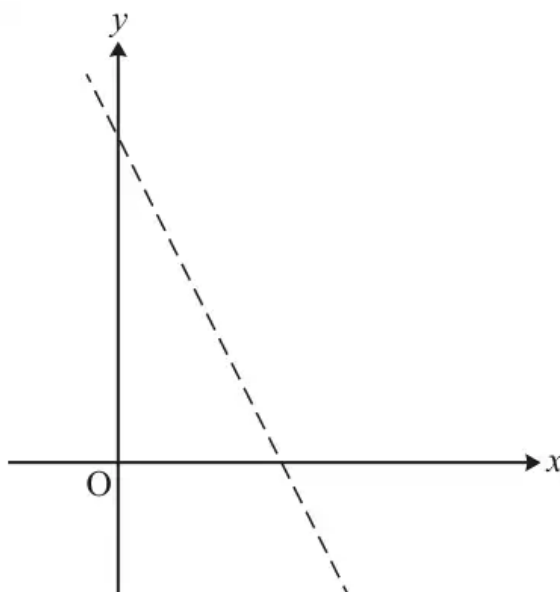
(b) $y = f^{-1}(x)$ (1)

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

(Total 4 marks)

Edexcel June 2025 Paper 1 Q1

2. The straight line $y = 5 - 2x$ is shown in the diagram.



- (a) On the copy of the diagram in the Printed Answer Booklet, sketch the graph of $y = |5 - 2x|$. [1]

- (b) Solve the inequality $|5 - 2x| < 3$. [3]

(Total 4 marks)

OCR MEI June 2023 Paper 3 Q2

3. The function f is defined by

$$f(x) = \frac{1}{2}(x^2 + 1), \quad x \geq 0$$

- (a) Find the range of f . [1 mark]
- (b) (i) Find $f^{-1}(x)$ [3 marks]
(ii) State the range of $f^{-1}(x)$ [1 mark]
- (c) State the transformation which maps the graph of $y = f(x)$ onto the graph of $y = f^{-1}(x)$ [1 mark]
- (d) Find the coordinates of the point of intersection of the graphs of $y = f(x)$ and $y = f^{-1}(x)$ [2 marks]

(Total 8 marks)

AQA June 2019 Paper 1 Q6

4. In this question you must show detailed reasoning.

The functions f and g are defined for all real values of x by

$$f(x) = x^3 \quad \text{and} \quad g(x) = x^2 + 2.$$

- (i) Write down expressions for
- (a) $fg(x)$, [1]
(b) $gf(x)$. [1]
- (ii) Hence find the values of x for which $fg(x) - gf(x) = 24$. [6]

(Total 8 marks)

OCR A June 2018 Paper 3 Q4

Solutions

1.

Mark scheme (a)

Scheme	Marks	AO
$(4, -4)$ or e.g. $x = 4, y = -4$ o.e.	B1	1.1b
	(1)	

Notes

General guidelines for all parts:

Remember to check answers written against the questions.

If there is any contradiction, mark the answers given in the body of the scripts.

If there is no labelling, mark the responses in the order given.

The coordinates need to be values not just a calculation e.g. **not** $6 - 2$ for 4

Points can be written as a coordinate pair or separately as $x = \dots, y = \dots$

Do not allow coordinates written the wrong way round but isw if necessary e.g.

$x = 4, y = -4 \rightarrow (-4, 4)$ scores B1 and isw

Condone missing brackets (one or both) e.g. $x = 4, y = -4$ or $(4, -4$ or $4, -4$ for $(4, -4)$

Condone a missing comma e.g. $(4 - 4)$ for $(4, -4)$

Condone use of a semi-colon e.g. $(4 ; -4)$ for $(4, -4)$

Condone vector notation e.g. $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$ for $(4, -4)$ and condone $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$

B1: $(4, -4)$ o.e. see above

Mark scheme (b)

Scheme	Marks	AO
$(-4, 6)$ or e.g. $x = -4, y = 6$ o.e.	B1	1.1b
	(1)	

Notes

General guidelines for all parts:

Remember to check answers written against the questions.

If there is any contradiction, mark the answers given in the body of the scripts.

If there is no labelling, mark the responses in the order given.

The coordinates need to be values not just a calculation e.g. **not** $6 - 2$ for 4

Points can be written as a coordinate pair or separately as $x = \dots, y = \dots$

Do not allow coordinates written the wrong way round but isw if necessary e.g.

$x = 4, y = -4 \rightarrow (-4, 4)$ scores B1 and isw

Condone missing brackets (one or both) e.g. $x = 4, y = -4$ **or** $(4, -4$ **or** $4, -4$ for $(4, -4)$

Condone a missing comma e.g. $(4 - 4)$ for $(4, -4)$

Condone use of a semi-colon e.g. $(4 ; -4)$ for $(4, -4)$

Condone vector notation e.g. $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$ for $(4, -4)$ and condone $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$

B1: $(-4, 6)$ o.e. see above

Mark scheme (c)

Scheme	Marks	AO
$(6, \dots)$ or $(\dots, 5)$ or $x = 6$ or $y = 5$ o.e.	M1	1.1b
$(6, 5)$ or $x = 6$ and $y = 5$	A1	1.1b
	(2)	
	(4 marks)	

Notes

General guidelines for all parts:

Remember to check answers written against the questions.

If there is any contradiction, mark the answers given in the body of the scripts.

If there is no labelling, mark the responses in the order given.

The coordinates need to be values not just a calculation e.g. **not** $6 - 2$ for 4

Points can be written as a coordinate pair or separately as $x = \dots, y = \dots$

Do not allow coordinates written the wrong way round but isw if necessary e.g.

$x = 4, y = -4 \rightarrow (-4, 4)$ scores B1 and isw

Condone missing brackets (one or both) e.g. $x = 4, y = -4$ **or** $(4, -4$ **or** $4, -4$ for $(4, -4)$

Condone a missing comma e.g. $(4 - 4)$ for $(4, -4)$

Condone use of a semi-colon e.g. $(4 ; -4)$ for $(4, -4)$

Condone vector notation e.g. $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$ for $(4, -4)$ and condone $\begin{pmatrix} 4 \\ -4 \end{pmatrix}$

M1: One correct coordinate. See above.

A1: Both coordinates correct. See above.

Note that MOA1 is not a possible mark profile.

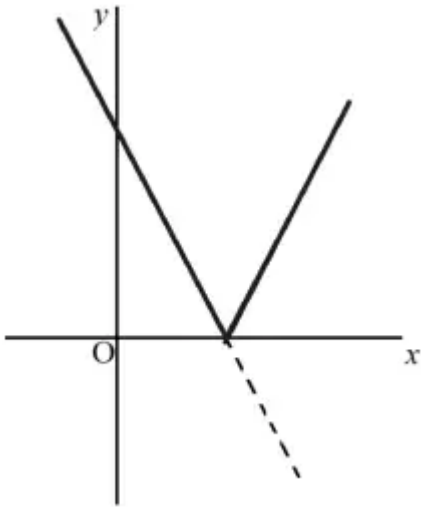
Note that in part (c), some candidates show their thinking by transforming the point piecewise e.g.

$$(6, -4) \rightarrow (6, 4) \rightarrow (6, 8) \rightarrow (6, 5)$$

In such cases, mark their final **pair** of coordinates

2.

Mark scheme (a)

Scheme	Marks	AO
	B1	1.1
	[1]	

Notes

B1: Going over the given line above the x -axis and to the left of the y -axis and then going up from the x -axis at the same angle (by eye)

Condone right hand line segment dotted/dashed

Mark scheme (b)

Scheme	Marks	AO
$-3 < 5 - 2x < 3$	M1	1.1a
$2 < 2x < 8$	A2	1.1
$1 < x < 4$ oe e.g. ' $1 < x$ and $x < 4$ '		1.1
	[3]	

Notes

M1: Could be treated as two separate inequalities (at least one correct) in x not $|x|$

OR $(5 - 2x)^2 < 9$

If only one linear inequality in x stated scores **M0 A0 A0**

OR $4x^2 - 20x + 16 < 0$ or $x^2 - 5x + 4 < 0$

OR $(x - 1)(x - 4) < 0$

Allow **M1** if treated as equations in x not $|x|$

A2: A1 if only one inequality correct

OR for $1 \leq x \leq 4$

OR for $1 < x, x < 4$

OR for ' $1 < x$ or $x < 4$ '

3.

Mark scheme (a)

Scheme	Marks	AO
Deduces the range of f Accept $f(x) \geq \frac{1}{2}$, $y \geq \frac{1}{2}$ or $[0.5, \infty)$ OE	B1	AO2.2a

Typical solution

$$\{y : y \geq \frac{1}{2}\}$$

Mark scheme (b)

Scheme	Marks	AO
(i) Rearranges formula, isolating squared term with at least one correct step seen.	M1	1.1a
Obtains inverse function in any correct form.	A1	1.1b
Obtains correct inverse function using $f^{-1}(x) = \dots$ and states correct domain	A1	2.5
(ii) States correct range Accept $f^{-1}(x) \geq 0$ OE	B1	1.1b

Typical solution

(i)

$$y = \frac{1}{2}(x^2 + 1)$$

$$2y = x^2 + 1$$

$$2y - 1 = x^2$$

$$x = \sqrt{2y - 1}$$

$$f^{-1}(x) = \sqrt{2x - 1}$$

$$x \geq \frac{1}{2}$$

(ii)

$$\{y : y \geq 0\}$$

Mark scheme (c)

Scheme	Marks	AO
Recalls correct transformation	B1	1.2

Typical solution

Reflection in $y = x$

Mark scheme (d)

Scheme	Marks	AO
Forms equation using two of the three expressions $x = \frac{x^2 + 1}{2} = \sqrt{2x - 1}$ allow their $\sqrt{2x - 1}$ PI by correct answer	M1	3.1a
Obtains $x=1$ and $y=1$ CSO	A1	1.1b
	(8 marks)	

Typical solution

$$x = \frac{x^2 + 1}{2}$$

(1, 1)

4.

Mark scheme (i)(a)

Scheme	Marks	AO
$fg(x) = f(x^2 + 2) = (x^2 + 2)^3$	B1	1.1
	[1]	

Mark scheme (i)(b)

Scheme	Marks	AO
$gf(x) = g(x^3) = (x^3)^2 + 2 (= x^6 + 2)$	B1	1.1
	[1]	

Notes

B1: No simplification required

Mark scheme (ii)

Scheme	Marks	AO
DR $(x^2 + 2)^3 = (x^2)^3 + 3(x^2)^2(2) + 3(x^2)(2)^2 + 2^3$	M1	1.1
$fg(x) = x^6 + 6x^4 + 12x^2 + 8$	A1	1.1
$fg(x) - gf(x) = 24 \Rightarrow 6x^4 + 12x^2 - 18 = 0$	A1	2.1
$x^4 + 2x^2 - 3 = 0 \Rightarrow (x^2 - 1)(x^2 + 3) = 0$	M1	1.1
$x^2 + 3 = 0$ has no real solutions	A1	2.4
$x^2 - 1 = 0 \Rightarrow x = \pm 1$	A1	2.2a
	[6]	

Notes

M1: Binomial expansion of their $(x^2 + 2)^3$ - correct powers and coefficients

Allow one slip

M1: Correct method for solving their quadratic in x^2

If M0 next two marks become B marks

A1: $x^2 + 3 \neq 0$ is acceptable for this mark