EXCEL IN MATHSCI
HIGHER MATHEMATICS • TOPIC RESOURCE

2026–27
Portfolio 3

Functions and Graphs

PUPIL WORKSHEET

Skills covered: Intercepts; completing the square; domains and ranges; composite and inverse functions; graph transformations; exponential and logarithmic graphs.

Instructions: Attempt all questions. Show sufficient working to justify your answers. Give exact values unless a degree of accuracy is stated. Each section is separate for targeted revision.

Prerequisite core skills revise earlier learning; *topic practice* develops individual techniques; *exam-style and challenge* combines skills.

Pupil: _____ **Date:** _____

SECTION A | Prerequisite core skills

Question 1

[3 marks]

Find the coordinates of the points where $y = x^2 - 5x + 6$ meets the coordinate axes.

Question 2

[3 marks]

Express $x^2 - 6x + 4$ in completed-square form and state its minimum value.

Question 3

[3 marks]

Express $1 + 4x - x^2$ in completed-square form and state its maximum turning point.

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Question 4

[2 marks]

State the range of $f(x) = 2(x+1)^2 - 3$, for $x \in \mathbb{R}$.

Question 5

[2 marks]

Let $A = \{-2, -1, 0, 1, 2\}$ and $B = \{0, 2, 4, 6\}$. Find $A \cap B$ and $A \cup B$.

Question 6

[3 marks]

State the largest possible domain in $\mathbb{R}$ of each function: (a) $f(x) = \sqrt{x-4}$; (b) $g(x) = \dfrac{x-2}{x^2-9}$.

SECTION B | Topic practice

Question 7

[4 marks]

Given $f(x) = 3x - 2$ and $g(x) = x^2 + 1$, find (a) $f(g(x))$ and (b) $g(f(x))$.

Question 8

[4 marks]

Given $f(x) = 4x + 7$, find $f^{-1}(x)$. Show that $f(f^{-1}(x)) = x$.

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Question 9

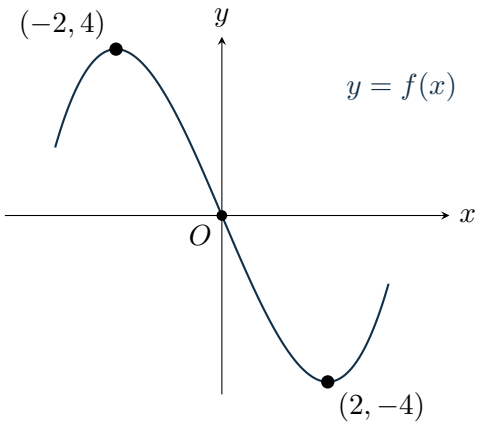
[4 marks]

Express $g(x) = 3x^2 - 12x + 8$ in the form $a(x+b)^2 + c$. Hence state the coordinates of its minimum turning point.

Question 10

[4 marks]

The diagram shows $y = f(x)$, with a maximum turning point at $(-2, 4)$ and a minimum turning point at $(2, -4)$. Sketch $y = f(x-1) + 2$, indicating the coordinates of both turning points.



Question 11

[5 marks]

For the function f in Question 10, sketch $y = -2f(x+1)$ and state the coordinates and natures of its turning points.

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Question 12

[4 marks]

For $f(x) = x^2 - 4x + 1$, find simplified expressions for (a) $f(x+2)$, (b) $f(x) + 2$, (c) $f(2x)$.

Question 13

[4 marks]

For $y = 2^{x-1} + 3$, state the domain, range and equation of the horizontal asymptote. Give one point on the curve.

Question 14

[4 marks]

For $y = \log_3(x+2)$, state the vertical asymptote and domain. Find the points at which $y = 0$ and $y = 1$.

SECTION C | Exam-style and challenge

Question 15

[5 marks]

Given $f(x) = \dfrac{2x-5}{3}$, find $f^{-1}(x)$. Hence solve $f(x) = f^{-1}(x)$.

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Question 16

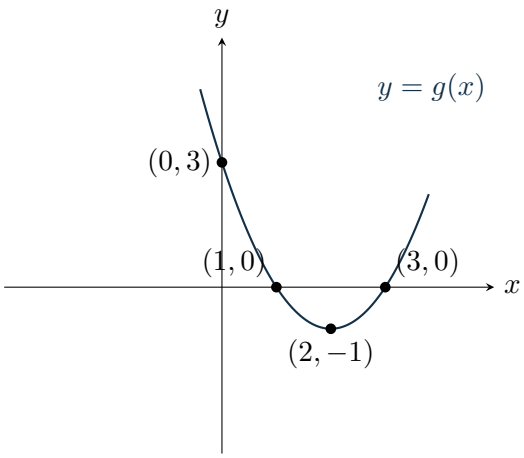
[5 marks]

The equation $x^2 + (k-2)x - k - 3 = 0$ has one root $x = -1$. Find k and hence the second root.

Question 17

[5 marks]

The diagram shows $y = g(x)$. Sketch $y = g(2 - x) + 1$, labelling the turning point and all intercepts.



Question 18

[5 marks]

Let $f(x) = \sqrt{x+1}$ and $g(x) = 2x - 5$. Find $f(g(x))$ and $g(f(x))$, stating the real domain of each.

— End of pupil worksheet —

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