HIGHER

2.2 Functions: Composite and Inverse Functions: 1-hour Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 $f(x) = 4x - 5$

Find $f^{-1}(x)$.

(Total for Question 1 is 3 marks)

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2 $f(x) = 3x + 4$

$g(x) = 2x + 1$

Find $f^{-1}(g(5))$.

(Total for Question 2 is 3 marks)

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3 $p(x) = x^2 - 2$

$q(x) = 5x - 3$

Find $qp(x)$. Give your answer in its simplest form.

(Total for Question 3 is 3 marks)

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4 $g(x) = 4x - 9$
$h(x) = 3x + 3$
Find $gg(4)$.

(Total for Question 4 is 3 marks)

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5 $f(x) = 3x - 4$
(a) Find $f^{-1}(x)$.
(b) Solve $f(x) = f^{-1}(x)$.

(Total for Question 5 is 4 marks)

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6 $g(x) = 2x + 6$
Find $g^{-1}(x)$.

(Total for Question 6 is 3 marks)

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7 $f(x) = 3x + 1$
Find $f^{-1}(3)$.

(Total for Question 7 is 2 marks)

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8 $f(x) = 3x + 1$
$g(x) = x^2 + 5$
Solve $fg(x) = 28$.

(Total for Question 8 is 4 marks)

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9 $f(x) = 2x^2 - 1$
$g(x) = 5x + 6$
Find $gf(x)$. Give your answer in its simplest form.

(Total for Question 9 is 3 marks)

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10 $f(x) = -3x - 4$
(a) Find $f^{-1}(x)$.
(b) Solve $f(x) = f^{-1}(x)$.

(Total for Question 10 is 4 marks)

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11 $h(x) = -2x - 7$
Find $h^{-1}(x)$.

(Total for Question 11 is 3 marks)

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12 $f(x) = 4x - 5$
$g(x) = 4x - 3$
Find $f^{-1}(g(10))$.

(Total for Question 12 is 3 marks)

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13 The function f is defined by $f(x) = 3x + 2$. Find the inverse function $f^{-1}(x)$ by swapping variables and rearranging, and state $f^{-1}(x)$ as an algebraic expression.

(Total for Question 13 is 4 marks)

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Mark scheme · 2.2 Functions: Composite and Inverse Functions: 1-hour Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

writes $y = 4x - 5$ and swaps x and y (or rearranges for x)	**M1**
isolates the new subject: $y = (x + 5)/4$	**M1**
$f^{-1}(x) = (x + 5)/4$	**A1**

Answer: $f^{-1}(x) = (x + 5)/4$

Question 2

$g(5) = 11$	**M1**
finds f^{-1} of this value by solving $3x + 4 = 11$	**M1**
$f^{-1}(g(5)) = 7/3$	**A1**

Answer: $f^{-1}(g(5)) = 7/3$

Question 3

substitutes the inner function into the outer: $q(p(x)) = q(x^2 - 2)$	**M1**
expands brackets and collects like terms	**M1**
$qp(x) = 5x^2 - 13$ cao	**A1**

Answer: $qp(x) = 5x^2 - 13$

Question 4

$g(4) = 7$	**M1**
$g(7)$	**M1**
$gg(4) = 19$	**A1**

Answer: $gg(4) = 19$

Question 5

$y = 3x - 4$ and rearranges for x	**M1**
$f^{-1}(x) = (x + 4)/3$	**A1**
sets $3x - 4 = (x + 4)/3$	**M1**
$x = 2$	**A1**

Answer: (a) $f^{-1}(x) = (x + 4)/3$; (b) $x = 2$

Question 6

writes $y = 2x + 6$ and swaps x and y (or rearranges for x)	**M1**
isolates the new subject: $y = (x - 6)/2$	**M1**
$g^{-1}(x) = (x - 6)/2$	**A1**

Answer: $g^{-1}(x) = (x - 6)/2$

Question 7

solves $3x + 1 = 3$, or finds $f^{-1}(x) = (x - (1))/3$	**M1**
$f^{-1}(3) = 2/3$	**A1**

Answer: $f^{-1}(3) = 2/3$

Question 8

$fg(x) = 3x^2 + 16$	**M1**
rearranges $3x^2 + 16 = 28$ to $3x^2 - 12 = 0$ or isolates the squared term	**M1**
takes both square roots or factorises	**M1**
$x = -2$ or $x = 2$	**A1**

Answer: $x = -2$ or $x = 2$

Question 9

substitutes the inner function into the outer: $g(f(x)) = g(2x^2 - 1)$	**M1**
expands brackets and collects like terms	**M1**
$gf(x) = 10x^2 + 1$ cao	**A1**

Answer: $gf(x) = 10x^2 + 1$

Question 10

$y = -3x - 4$ and rearranges for x	**M1**
$f^{-1}(x) = (-x - 4)/3$	**A1**
sets $-3x - 4 = (-x - 4)/3$	**M1**
$x = -1$	**A1**

Answer: (a) $f^{-1}(x) = (-x - 4)/3$; (b) $x = -1$

Question 11

writes $y = -2x - 7$ and swaps x and y (or rearranges for x)	**M1**
isolates the new subject: $y = (-x - 7)/2$	**M1**
$h^{-1}(x) = (-x - 7)/2$	**A1**

Answer: $h^{-1}(x) = (-x - 7)/2$

Question 12

$g(10) = 37$	**M1**
finds f^{-1} of this value by solving $4x - 5 = 37$	**M1**
$f^{-1}(g(10)) = 21/2$	**A1**

Answer: $f^{-1}(g(10)) = 21/2$

Question 13

starts with $y = 3x + 2$ and swaps x and y or writes $x = 3y + 2$	**M1**
rearranges correctly: $x - 2 = 3y$ or $y = (x - 2)/3$ seen	**M1**
$f^{-1}(x) = (x - 2)/3$ cao	**A1**
states domain restriction or checks composition eg $f(f^{-1}(x)) = x$, oe	**B1**

Answer: $f^{-1}(x) = (x - 2)/3$

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