HIGHER

2.2 Functions: Composite and Inverse Functions: Test Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Let f be the function defined by f(x) = 2x + 3. For the function f in this context, find f(0).

(Total for Question 1 is 1 mark)

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2 Let f(x) = (x + 2)/3. Solve f(x) = 5 for x by rearrangement, showing a correct method and final value for the function named here.

(Total for Question 2 is 2 marks)

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3 Let f(x) = x - 4 and g(x) = x/5. Find and simplify fg(x) and gf(x) for the functions named, and state whether fg = gf as functions.

(Total for Question 3 is 2 marks)

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4 g(x) = (-3x + 1)/(2x + 2), for $x \neq -1$
Find $g^{-1}(x)$.

(Total for Question 4 is 5 marks)

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5 $f(x) = -2x + 4$
$g(x) = x^2 + 6x + 9$
Solve $fg(x) = -28$.

(Total for Question 5 is 4 marks)

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6 $f(x) = x^2 - 1$
$g(x) = x + 3$
Find $fg(2)$.

(Total for Question 6 is 3 marks)

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7 $f(x) = 1/(x - 4) - 3$, for $x \neq 4$
Find $f^{-1}(x)$.

(Total for Question 7 is 4 marks)

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8 $f(x) = -2x + 4$
$g(x) = x^2 - 4$
Solve $fg(x) = 4$.

(Total for Question 8 is 4 marks)

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9 Let $f(x) = 4x - 5$ and $g(x) = x^2$. Work out fg(2) and gf(2), where fg(x) means f(g(x)) and gf(x) means g(f(x)).

(Total for Question 9 is 3 marks)

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10 Let $f(x) = 2x + 1$ and $g(x) = x - 3$. Show that the composite $fg(x) = 2x - 5$, where fg(x) denotes f(g(x)).

(Total for Question 10 is 3 marks)

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11 The function f is defined by $f(x) = x/2 - 7$. Find $f^{-1}(x)$ by swapping variables and rearranging, and give $f^{-1}(3)$.

(Total for Question 11 is 3 marks)

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12 Let $f(x) = 2x + 1$ and $g(x) = (x - 1)/2$. By inspection or composition, show whether g is the inverse of f by calculating $f(g(x))$ and $g(f(x))$. Name the conclusion for the functions in this question.

(Total for Question 12 is 3 marks)

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13 Given $f(x) = 2x + 3$ and $g(x) = x^2$, solve the equation $f(g(x)) = 11$ for x, where $f(g(x))$ denotes f composed with g, and show working.

(Total for Question 13 is 3 marks)

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Mark scheme · 2.2 Functions: Composite and Inverse Functions: Test Pack

Question 1

f(0) = 3 cao **B1**

Answer: 3

Question 2

multiplies both sides by 3 or shows rearrangement 3f(x) = x + 2 **M1**

x = 13 cao **A1**

Answer: x = 13

Question 3

finds fg(x) = f(g(x)) = g(x) - 4 = x/5 - 4 and gf(x) = g(f(x)) = (x - 4)/5 **M1**

states fg(x) = x/5 - 4, gf(x) = (x - 4)/5 and concludes they are not equal as functions cao **A1**

Answer: fg(x) = x/5 - 4; gf(x) = (x - 4)/5. They are not equal as functions.

Question 4

y = (-3x + 1)/(2x + 2), so y(2x + 2) = -3x + 1 **M1**

expands and collects the x terms on one side **M1**

factorises out x and divides **M1**

swaps x and y **M1**

$g^{-1}(x) = (-2x + 1)/(2x + 3)$ **A1**

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

Question 5

$fg(x) = -2x^2 - 12x - 14$ **M1**

rearranges $-2x^2 - 12x - 14 = -28$ to $-2x^2 - 12x + 14 = 0$ or isolates the squared term **M1**

takes both square roots or factorises **M1**

x = -7 or x = 1 **A1**

Answer: x = -7 or x = 1

Question 6

g(2) = 5 **M1**

f(5) **M1**

fg(2) = 24 **A1**

Answer: fg(2) = 24

Question 7

y = 1/(x - 4) - 3; subtracts -3 to isolate the fraction **M1**

multiplies by the denominator and divides to isolate x: x - 4 = 1/(x + 3) **M1**

swaps x and y **M1**

$f^{-1}(x) = 1/(x + 3) + 4$ **A1**

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

Question 8

$fg(x) = -2x^2 + 12$ **M1**

rearranges $-2x^2 + 12 = 4$ to $-2x^2 + 8 = 0$ 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

evaluates g(2) = 4 and substitutes into f, or shows f(g(2)) process **M1**

evaluates f(2) = 3 and substitutes into g, or shows g(f(2)) process **M1**

fg(2) = 11 and gf(2) = 9 cao **A1**

Answer: fg(2) = 11; gf(2) = 9

Question 10

substitutes g(x) into f: f(g(x)) = 2(g(x)) + 1 **M1**

substitutes g(x) = x - 3 giving 2(x - 3) + 1 **M1**

simplifies to fg(x) = 2x - 5 cao **A1**

Answer: fg(x) = 2x - 5

Question 11

writes y = x/2 - 7 and swaps to x = y/2 - 7 or equivalent **M1**

rearranges to y = 2(x + 7) or y = 2x + 14 **M1**

$f^{-1}(x) = 2x + 14$ and $f^{-1}(3) = 20$ cao **A1**

Answer: $f^{-1}(x) = 2x + 14$; $f^{-1}(3) = 20$

Question 12

computes f(g(x)) = 2((x - 1)/2) + 1 and simplifies to x **M1**

computes g(f(x)) = (2x + 1 - 1)/2 and simplifies to x **M1**

concludes g is the inverse of f since both compositions give x cao **A1**

Answer: Both f(g(x)) = x and g(f(x)) = x, so g is the inverse of f

Question 13

writes $f(g(x)) = 2x^2 + 3$ and sets equal to 11 **M1**

solves $2x^2 + 3 = 11$ to get $x^2 = 4$ **M1**

x = 2 or x = -2 cao **A1**

Answer: x = 2 or x = -2

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