HIGHER

2.7 Functions: Domain and Range Restrictions: 1-hour Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 $h(x) = 2/(x + 3) + 4$

(a) State the largest possible domain of h.

(b) State the range of h.

(Total for Question 1 is 3 marks)

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2 $g(x) = \sqrt{x}$

$h(x) = 3x - 3$

Find gh(x) and state the largest possible domain of gh.

(Total for Question 2 is 3 marks)

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3 Consider $g(x) = 3/(x - 4)$. State the single value of x that must be excluded from the domain because it makes the expression undefined.

(Total for Question 3 is 1 mark)

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4 $f(x) = 2/(3x - 3)$

State the value of x that must be excluded from the domain of f.

(Total for Question 4 is 2 marks)

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5 $h(x) = \sqrt{-3x + 3}$

Find the largest possible domain of h, giving your answer as an inequality for x.

(Total for Question 5 is 2 marks)

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6 $g(x) = (x + 1)^2 - 5$, for $x \leq -1$.

(a) Find $g^{-1}(x)$.

(b) State the domain of g^{-1}.

(Total for Question 6 is 5 marks)

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7 $g(x) = x^2 + 4x + 3$, for $-3 \leq x \leq 1$.

Find the range of g.

(Total for Question 7 is 4 marks)

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8 $g(x) = x^2 + 1$, for all real numbers x.
Find the range of g.

(Total for Question 8 is 2 marks)

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9 $f(x) = x^2 - 4$, for $x \geq k$.
Find the smallest value of k for which f has an inverse.

(Total for Question 9 is 3 marks)

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10 $g(x) = 1/x$
$h(x) = x - 4$
Find gh(x) and state the largest possible domain of gh.

(Total for Question 10 is 3 marks)

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11 $g(x) = 1/(3x + 5)$
State the value of x that must be excluded from the domain of g.

(Total for Question 11 is 2 marks)

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12 $h(x) = \sqrt{x + 2}$. State the restriction on x so that h(x) is real, and give the domain in inequality form.

(Total for Question 12 is 1 mark)

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13 $f(x) = (x + 4)^2 + 6$, for $x \geq -4$.

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

(b) State the domain of f^{-1}.

(Total for Question 13 is 5 marks)

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14 $g(x) = x^2 - 2x + 1$, for $-1 \leq x \leq 0$.

Find the range of g.

(Total for Question 14 is 4 marks)

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15 $f(x) = 4/(x + 1) + 2$

(a) State the largest possible domain of f.

(b) State the range of f.

(Total for Question 15 is 3 marks)

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Mark scheme · 2.7 Functions: Domain and Range Restrictions: 1-hour Pack

Question 1

$x \neq -3$ since the denominator would be 0	**B1**
$2/(x + 3)$ can take every value except 0, so h(x) can never equal 4	**M1**
range: $h(x) \neq 4$	**A1**

Answer: (a) $x \neq -3$; (b) $h(x) \neq 4$

Question 2

$gh(x) = \sqrt{3x - 3}$	**M1**
requires $3x - 3 \geq 0$	**M1**
$gh(x) = \sqrt{3x - 3}$, domain $x \geq 1$	**A1**

Answer: $gh(x) = \sqrt{3x - 3}$, domain $x \geq 1$

Question 3

$x = 4$ cao	**B1**

Answer: $x = 4$

Question 4

the denominator cannot be zero: $3x - 3 = 0$	**M1**
$x = 1$ is excluded, domain $x \neq 1$	**A1**

Answer: $x \neq 1$

Question 5

the expression under the square root must be at least 0: $-3x + 3 \geq 0$	**M1**
$x \leq 1$ (the inequality reverses on dividing by a negative number)	**A1**

Answer: $x \leq 1$

Question 6

$y = (x + 1)^2 + (-5)$ and rearranges: $(x + 1)^2 = y - (-5)$	**M1**
takes the negative square root because $x \leq -1$	**M1**
$g^{-1}(x) = -\sqrt{x + 5} - 1$	**A1**
domain of g^{-1} is the range of g	**B1**
$x \geq -5$	**B1**

Answer: (a) $g^{-1}(x) = -\sqrt{x + 5} - 1$; (b) $x \geq -5$

Question 7

completes the square or differentiates to find the turning point at $x = -2$ (value -1)	**M1**
evaluates the end points: $g(-3) = 0$, $g(1) = 8$	**M1**
decides whether the turning point $x = -2$ lies in the domain $-3 \leq x \leq 1$: it does	**M1**
$-1 \leq g(x) \leq 8$	**A1**

Answer: $-1 \leq g(x) \leq 8$

Question 8

$x^2 \geq 0$ for every real x, with the minimum 0 at $x = 0$	**M1**
$g(x) \geq 1$	**A1**

Answer: $g(x) \geq 1$

Question 9

completes the square: $f(x) = x^2 - 4$	**M1**
turning point at $x = 0$	**A1**
$k = 0$ (the function is one-to-one on one side of its turning point)	**A1**

Answer: $k = 0$

Question 10

$gh(x) = 1/(x - 4)$	**M1**
requires $x - 4 \neq 0$	**M1**
$gh(x) = 1/(x - 4)$, domain $x \neq 4$	**A1**

Answer: $gh(x) = 1/(x - 4)$, domain $x \neq 4$

Question 11

the denominator cannot be zero: $3x + 5 = 0$	**M1**
$x = -5/3$ is excluded, domain $x \neq -5/3$	**A1**

Answer: $x \neq -5/3$

Question 12

$x \geq -2$ or domain $x \geq -2$ cao	**B1**

Answer: $x \geq -2$

Question 13

$y = (x + 4)^2 + (6)$ and rearranges: $(x + 4)^2 = y - (6)$	**M1**
takes the positive square root because $x \geq -4$	**M1**
$f^{-1}(x) = \sqrt{x - 6} - 4$	**A1**
domain of f^{-1} is the range of f	**B1**
$x \geq 6$	**B1**

Answer: (a) $f^{-1}(x) = \sqrt{x - 6} - 4$; (b) $x \geq 6$

Question 14

completes the square or differentiates to find the turning point at $x = 1$ (value 0)	**M1**
evaluates the end points: $g(-1) = 4$, $g(0) = 1$	**M1**
decides whether the turning point $x = 1$ lies in the domain $-1 \leq x \leq 0$: it does not	**M1**
$1 \leq g(x) \leq 4$	**A1**

Answer: $1 \leq g(x) \leq 4$

Question 15

$x \neq -1$ since the denominator would be 0	**B1**
$4/(x + 1)$ can take every value except 0, so f(x) can never equal 2	**M1**
range: $f(x) \neq 2$	**A1**

Answer: (a) $x \neq -1$; (b) $f(x) \neq 2$

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