# 1.17 Pure: Functions, Graphs and Transformations: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** The function f is defined by $f(x) = 2(x + 4)^2 - 1$, for $x \geq -4$.

**(a)** State the range of f. **(1)**

**(b)** Find an expression for $f^{-1}(x)$, and state its domain. **(4)**

**(c)** Find the value of $f^{-1}(17)$. **(2)**

**(Total for Question 1 is 7 marks)**

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**2** Solve the following involving the modulus function.

**(a)** Solve $|2x - 3| = x - 8$. **(4)**

**(b)** Solve $|2x - 3| < 4$. **(2)**

**(Total for Question 2 is 6 marks)**


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**3** The graph of $y = f(x)$ is transformed in each of the ways described below.

**(a)** Describe fully the single transformation that maps the graph of $y = f(x)$ onto the graph of $y = f(x - 3)$. **(2)**

**(b)** Describe fully the single transformation that maps $y = f(x)$ onto $y = f(3x)$. **(2)**

**(c)** The graph $y = f(x)$ is mapped onto $y = 3f(x - 3) + 4$ by a sequence of transformations. State the three transformations in a suitable order. **(3)**

**(Total for Question 3 is 7 marks)**

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**4** The curve C has equation $y = (x + 4)(x - 2)^2$.

**(a)** Write down the coordinates of the points where C meets the x-axis, and state which is a point where the x-axis is a tangent. **(2)**

**(b)** Find the coordinates of the point where C meets the y-axis. **(2)**

**(c)** Show that C has a stationary point at $x = -2$ and find its y coordinate. **(3)**

**(Total for Question 4 is 7 marks)**


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# Mark scheme · 1.17 Pure: Functions, Graphs and Transformations: 30-minute Pack

## Question 1

(a) $f(x) \geq -1$ **B1**

**(a) Answer: $f(x) \geq -1$**

(b) sets $y = 2(x + 4)^2 - 1$ and rearranges to $(x + 4)^2 = (y + 1)/2$ **M1**

(b) $x = -4 + \sqrt{(y + 1)/2}$ choosing the positive root since $x \geq -4$ **A1**

(b) $f^{-1}(x) = -4 + \sqrt{(x + 1)/2}$ **B1**

(b) domain $x \geq -1$ **B1**

**(b) Answer: $f^{-1}(x) = -4 + \sqrt{(x + 1)/2}$, $x \geq -1$**

(c) substitutes into the inverse function (or solves $f(x) = 17$) **M1**

(c) -1 **A1**

**(c) Answer: -1**

## Question 2

(a) squares both sides, or considers $2x - 3 = x - 8$ and $2x - 3 = -(x - 8)$ **M1**

(a) obtains the candidate solutions -5, 11/3 **A1**

(a) checks each candidate in the original equation (the right side must be non-negative) **M1**

(a) no solutions **A1**

**(a) Answer: no solutions**

(b) $-4 < 2x - 3 < 4$ **M1**

(b) $-1/2 < x < 7/2$ **A1**

**(b) Answer: $-1/2 < x < 7/2$**

## Question 3

(a) translation **B1**

(a) by the vector (3, 0), i.e. 3 units in the positive x direction **B1**

**(a) Answer: translation by (3, 0)**

(b) stretch **B1**

(b) scale factor 1/3 parallel to the x axis **B1**

**(b) Answer: stretch, scale factor 1/3, x direction**

(c) translation by (3, 0) **B1**

(c) stretch scale factor 3 parallel to the y axis **B1**

(c) translation by (0, 4) **B1**

**(c) Answer: translate (3, 0); stretch y by 3; translate (0, 4)**

## Question 4

(a) (-4, 0) and (2, 0) **B1**

(a) the x-axis touches C at (2, 0) because of the repeated factor **B1**

**(a) Answer: (-4, 0), (2, 0); tangent at x = 2**

(b) sets $x = 0$ **M1**

(b) (0, 16) **A1**

**(b) Answer: (0, 16)**

(c) $dy/dx = (x - 2)^2 + 2(x + 4)(x - 2)$ **M1**

(c) factorises as $(x - 2)(3x + 6) = 0$ **A1**

(c) $x = -2$ and $y = 32$ **A1**

**(c) Answer: x = -2, y = 32**


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