1.18 Pure: Trigonometric Graphs: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 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(4x). **(2)**

(c) The graph y = f(x) is mapped onto y = 4f(x - 3) + 5 by a sequence of transformations. State the three transformations in a suitable order. **(3)**

(Total for Question 1 is 7 marks)

2 This question is about trigonometric identities and equations.

(a) Show that (1 - cos 2x)/sin 2x = tan x, for sin 2x ≠ 0. **(3)**

(b) Hence solve (1 - cos 2x)/sin 2x = 3 for 0 ≤ x < 360 degrees, giving your answers to 1 decimal place. **(3)**

(Total for Question 2 is 6 marks)

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3 $f(x) = 8 \sin x + 6 \cos x$, where x is in degrees.

(a) Express $f(x)$ in the form $R \sin(x + \alpha)$, where $R > 0$ and $0 < \alpha < 90$ degrees. Give R as an exact value and α to 1 decimal place. **(4)**

(b) Write down the maximum value of $f(x)$, and the smallest positive value of x at which it occurs, to 1 decimal place. **(2)**

(c) Solve $f(x) = 1$ for $0 \leq x < 360$ degrees, giving your answers to 1 decimal place. **(4)**

(Total for Question 3 is 10 marks)

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4 In this question x is measured in degrees and $0 \leq x < 360$.

(a) Solve the quadratic equation $2y^2 - y = 0$ and hence state the possible values of $\cos x$. **(2)**

(b) Hence solve $2\cos^2 x - \cos x = 0$ for $0 \leq x < 360$, in degrees. **(4)**

(Total for Question 4 is 6 marks)

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Mark scheme · 1.18 Pure: Trigonometric Graphs: 30-minute Pack

Question 1

(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 1/4 parallel to the x axis **B1**

(b) Answer: stretch, scale factor 1/4, x direction

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

(c) stretch scale factor 4 parallel to the y axis **B1**

(c) translation by (0, 5) **B1**

(c) Answer: translate (3, 0); stretch y by 4; translate (0, 5)

Question 2

(a) uses $\cos 2x = 1 - 2\sin^2 x$ for the numerator and $\sin 2x = 2 \sin x \cos x$ for the denominator **M1**

(a) numerator $2 \sin^2 x$, denominator $2 \sin x \cos x$ **A1**

(a) cancels 2 sin x and states sin x/cos x = tan x (cso) **A1**

(a) Answer: $(1 - \cos 2x)/\sin 2x = 2 \sin^2 x/(2 \sin x \cos x) = \tan x$

(b) uses the identity to write tan x = 3 **M1**

(b) x = 71.6 **A1**

(b) x = 251.6 (180 degrees added) **A1**

(b) Answer: x = 71.6, 251.6

Question 3

(a) R cos α = 8 and R sin α = 6 **M1**

(a) R = 10 **A1**

(a) tan α = 6/8 **M1**

(a) α = 36.9 degrees **A1**

(a) Answer: f(x) = 10 sin(x + 36.9)

(b) maximum 10 **B1**

(b) x + 36.9 = 90, so x = 53.1 **B1**

(b) Answer: maximum 10 at x = 53.1

(c) sin(x + 36.9) = 1/10 **M1**

(c) x + 36.9 = 5.7 or 174.3 (and adds 360 if needed) **M1**

(c) x = 137.4 **A1**

(c) x = 328.9 **A1**

(c) Answer: x = 137.4, 328.9

Question 4

(a) factorises or uses the quadratic formula **M1**

(a) cos x = 0 or cos x = 1/2 **A1**

(a) Answer: cos x = 0 or 1/2

(b) finds a solution of cos x = 0 using inverse cos **M1**

(b) solutions from cos x = 0: 90, 270 **A1**

(b) repeats for cos x = 1/2 **M1**

(b) all solutions: 60, 90, 270, 300 degrees **A1**

(b) Answer: 60, 90, 270, 300 degrees

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