3.4 Trigonometric Graphs and Transformations: 1-hour Pack

Total Marks

AQA 8365 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State the period, in degrees, of each of the following graphs.

(a) $y = \sin(3x)$ **(1)**

(b) $y = \cos(x/2)$ **(1)**

(Total for Question 1 is 2 marks)

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2 State the equation of the graph obtained when $y = \sin(x)$ is reflected in the x-axis.

(Total for Question 2 is 1 mark)

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3 Describe fully the single transformation that maps $y = \sin(x)$ onto $y = 6\sin(x)$.

(Total for Question 3 is 1 mark)

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4 State the period, in degrees, of $y = \sin(3x)$, and the amplitude of $y = 2\sin(3x)$.

(Total for Question 4 is 2 marks)

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5 Solve $\sin(x) = -0.3$ for $-180 \leq x \leq 180$, giving your answers correct to 1 decimal place.

(Total for Question 5 is 4 marks)

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6 The graph of $y = 2\tan(3x)$ is drawn for $0 < x < 180$. Find the equations of the vertical asymptotes. Give the values of x.

(Total for Question 6 is 3 marks)

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7 The graph of $y = a\sin(bx) + c$, where a and b are positive integers and c is an integer, is drawn for $0 \leq x \leq 360$. The maximum value of y is -1, the minimum value of y is -3 and the period is 72 degrees. Find the values of a, b and c.

(Total for Question 7 is 4 marks)

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8 The graph of $y = a\sin(x) - 5$ passes through the point (210, -6). Find the value of a.

(Total for Question 8 is 3 marks)

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9 The graph of $y = 3 \tan(5x)$ is drawn for $0 < x < 180$. Find the equations of the vertical asymptotes. Give the values of x.

(Total for Question 9 is 3 marks)

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10 For $0 \leq x \leq 360$, the curve $y = 2 \sin(x - 15) - 4$ has a minimum point. Write down the coordinates of the minimum point.

(Total for Question 10 is 3 marks)

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11 The graph of $y = 5 \tan(2x)$ is drawn for $0 < x < 180$. Find the equations of the vertical asymptotes. Give the values of x.

(Total for Question 11 is 3 marks)

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12 Find the values of x between 0 and 360 inclusive where the graph of $y = 4 \sin(3x)$ crosses the x-axis.

(Total for Question 12 is 3 marks)

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13 The graph of $y = a \sin(bx) + c$, where a and b are positive integers and c is an integer, is drawn for $0 \leq x \leq 360$. The maximum value of y is 6, the minimum value of y is -6 and the period is 360 degrees. Find the values of a, b and c.

(Total for Question 13 is 4 marks)

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14 The graph of $y = 1 \tan(2x)$ is drawn for $0 < x < 180$. Find the equations of the vertical asymptotes. Give the values of x.

(Total for Question 14 is 3 marks)

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15 The graph of $y = a \cos(x) + 2$ passes through the point (180, -2). Find the value of a.

(Total for Question 15 is 3 marks)

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16 The graph of $y = -5 \cos(x) - 3$ is drawn for $0 \leq x \leq 360$. Write down the maximum value of y, the minimum value of y and the period of the graph.

(Total for Question 16 is 3 marks)

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17 Find the coordinates of the maximum point of $y = 4\sin(x) + 1$, for $0 \leq x \leq 360$.

(Total for Question 17 is 2 marks)

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18 The graph of $y = \tan(x)$ is translated by vector $(0, 5)$. Write down the equation of the resulting graph, and state its period in degrees.

(Total for Question 18 is 2 marks)

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19 Solve $\cos(2x) = 0.5$ for $0 \leq x \leq 360$, giving all solutions.

(Total for Question 19 is 5 marks)

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Mark scheme · 3.4 Trigonometric Graphs and Transformations: 1-hour Pack

Question 1

(a) 120 cao **B1**

(a) Answer: 120

(b) 720 cao **B1**

(b) Answer: 720

Question 2

y = -sin(x) cao **B1**

Answer: y = -sin(x)

Question 3

stretch, scale factor 6, parallel to the y-axis oe **B1**

Answer: Stretch, scale factor 6, parallel to the y-axis

Question 4

period = 120 cao **B1**

amplitude = 2 cao **B1**

Answer: period = 120, amplitude = 2

Question 5

$\sin^{-1}(-0.3) = -17.5$ (awrt, principal value, which lies in the given range) **M1**

x = -17.5 (awrt 1 d.p.) **A1**

use symmetry for the range $-180 \leq x \leq 180$ to find the second solution: -180 - (-17.5) **M1**

x = -162.5 (awrt 1 d.p.) **A1**

Answer: x = -17.5, -162.5 (to 1 d.p.)

Question 6

3x = 90 **M1**

3x = 90 + 180n used **M1**

x = 30, 90, 150 cao **A1**

Answer: x = 30, 90, 150

Question 7

a = (-1 - (-3))/2 or c = (-1 + (-3))/2 **M1**

a = 1 **A1**

c = -2 **A1**

b = 360/72 = 5 **B1**

Answer: a = 1, b = 5, c = -2

Question 8

substitutes x = 210, y = -6 **M1**

sin(210) = -1/2 used **M1**

a = 2 cao **A1**

Answer: a = 2

Question 9

5x = 90 **M1**

5x = 90 + 180n used **M1**

x = 18, 54, 90, 126, 162 cao **A1**

Answer: x = 18, 54, 90, 126, 162

Question 10

x-coordinate found from sin(x - 15) = -1 **M1**

x = 285 **A1**

y = -6 **B1**

Answer: (285, -6)

Question 11

2x = 90 **M1**

2x = 90 + 180n used **M1**

x = 45, 135 cao **A1**

Answer: x = 45, 135

Question 12

sin(3x) = 0 **M1**

3x = 0, 180, 360, ... **M1**

x = 0, 60, 120, 180, 240, 300, 360 cao **A1**

Answer: x = 0, 60, 120, 180, 240, 300, 360

Question 13

a = (6 - (-6))/2 or c = (6 + (-6))/2 **M1**

a = 6 **A1**

c = 0 **A1**

b = 360/360 = 1 **B1**

Answer: a = 6, b = 1, c = 0

Question 14

2x = 90 **M1**

2x = 90 + 180n used **M1**

x = 45, 135 cao **A1**

Answer: x = 45, 135

Question 15

substitutes x = 180, y = -2 **M1**

cos(180) = -1 used **M1**

a = 4 cao **A1**

Answer: a = 4

Question 16

maximum 2 **B1**

minimum -8 **B1**

period 360 degrees **B1**

Answer: maximum = 2, minimum = -8, period = 360 degrees

Question 17

maximum of 4sin(x) is 4, giving y = 4(1) + 1 = 5 **M1**

(90, 5) cao **A1**

Answer: (90, 5)

Question 18

y = tan(x) + 5 oe cao **B1**

180, ft from the equation **B1**

Answer: y = tan(x) + 5, period = 180

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Question 19

let u = 2x, so $0 \leq u \leq 720$	**M1**
first two solutions for u: 60 and 300 (using $\cos^{-1}(0.5) = 60$ and 360 - 60)	**M1**
further two solutions for u using the 360-degree period: 420 and 660	**A1**
divide all four values of u by 2 to return to x	**M1**
x = 30, 150, 210, 330 (all four required) cao	**A1**

Answer: x = 30, 150, 210, 330

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