HIGHER

7.8 Trigonometric and Exponential Graphs: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State the exact values of y = sin x for x = 0, 90, 180, 270 and 360 degrees.

(Total for Question 1 is 5 marks)

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2 Write down the amplitude and period (in degrees) of y = 4 sin(3x).

(Total for Question 2 is 2 marks)

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3 The graph of $y = 2\sin(0.5x) + 1$ is considered for $0 \leq x \leq 720$ degrees.

(a) State the amplitude. **(1)**

(b) State the period (in degrees). **(1)**

(c) State the equation of the midline. **(1)**

(d) Find all x in $0 \leq x \leq 720$ for which $y = 3$. **(2)**

(Total for Question 3 is 5 marks)

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4 For $y = -\sin(x + 45) - 1$, state the amplitude, period, phase shift (direction and degrees) and vertical shift.

(Total for Question 4 is 4 marks)

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5 Find the smallest positive solution (in degrees, 1 decimal place) of $3 \cos x = 1$.

(Total for Question 5 is 2 marks)

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6 Each equation below is a transformation of $y = \sin x$. Match each equation to the letter of the description that correctly describes its transformation.

A) Translation by vector (-90, 0)
B) Stretch, scale factor 4, parallel to the y-axis
C) Translation by vector (0, -3)
D) Stretch, scale factor 2, parallel to the x-axis

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

- ☐ A) Translation by vector (-90, 0)
- ☐ B) Stretch, scale factor 4, parallel to the y-axis
- ☐ C) Translation by vector (0, -3)
- ☐ D) Stretch, scale factor 2, parallel to the x-axis

(b) $y = \sin(x + 90)$ **(1)**

- ☐ A) Translation by vector (-90, 0)
- ☐ B) Stretch, scale factor 4, parallel to the y-axis
- ☐ C) Translation by vector (0, -3)
- ☐ D) Stretch, scale factor 2, parallel to the x-axis

(c) $y = 4 \sin x$ **(1)**

- ☐ A) Translation by vector (-90, 0)
- ☐ B) Stretch, scale factor 4, parallel to the y-axis
- ☐ C) Translation by vector (0, -3)
- ☐ D) Stretch, scale factor 2, parallel to the x-axis

(d) $y = \sin(x/2)$ **(1)**

- ☐ A) Translation by vector (-90, 0)
- ☐ B) Stretch, scale factor 4, parallel to the y-axis
- ☐ C) Translation by vector (0, -3)
- ☐ D) Stretch, scale factor 2, parallel to the x-axis

(Total for Question 6 is 4 marks)

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7 The value of a car, V pounds, after n years is modelled by $V = 15000 \times 0.88^n$.

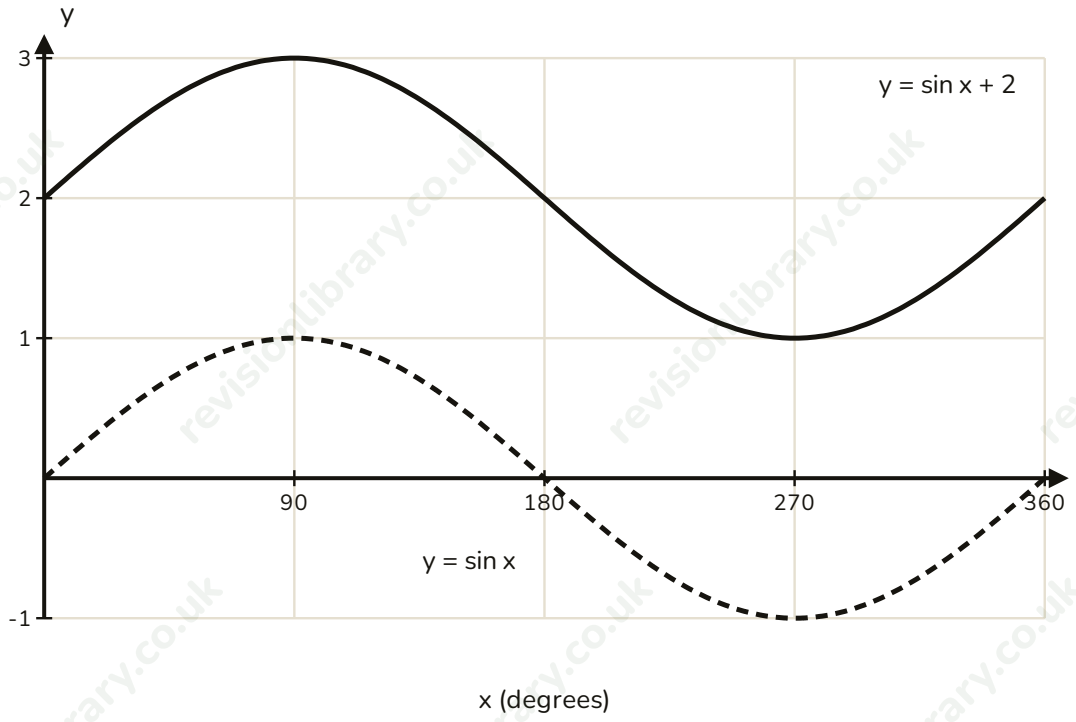
(a) Calculate the value of the car after 4 years, to the nearest pound. **(2)**

(b) State the equation of the horizontal asymptote of the graph of V against n, and explain what it represents in this context. **(2)**

(Total for Question 7 is 4 marks)

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8 The graph of $y = \sin x$ is translated by the vector (0, 2) to give the graph of $y = \sin x + 2$.



(a) Write down the maximum and minimum values of $y = \sin x + 2$. **(2)**

(b) State the period of $y = \sin x + 2$. **(1)**

(Total for Question 8 is 3 marks)

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9 Using a calculator, solve $\sin x = 0.6$ for $0 \leq x \leq 360$, giving your answers to 1 decimal place.

(Total for Question 9 is 4 marks)

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10 By using the symmetry property $\sin x = \sin(180 - x)$, or otherwise, find all the solutions of $\sin(3x) = 0.5$ in the range $0 \leq x \leq 360$.

(Total for Question 10 is 5 marks)

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11 Solve $10^{2x + 2} = 10000$

(Total for Question 11 is 2 marks)

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12 The graph of $y = k\,a^x$, where $a > 0$, passes through the points (0, 6) and (2, 54). Work out the value of k and the value of a.

(Total for Question 12 is 3 marks)

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13 For the graph of $y = 3\sin(6x)$, where x is in degrees, write down the amplitude and the period.

(Total for Question 13 is 2 marks)

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Mark scheme · 7.8 Trigonometric and Exponential Graphs: Test Pack

Question 1

sin 0 = 0 cao	**B1**
sin 90 = 1 cao	**B1**
sin 180 = 0 cao	**B1**
sin 270 = -1 cao	**B1**
sin 360 = 0 cao	**B1**

Answer: sin 0 = 0; sin 90 = 1; sin 180 = 0; sin 270 = -1; sin 360 = 0.

Question 2

amplitude = 4 cao	**B1**
period = 360/3 = 120 degrees cao	**B1**

Answer: Amplitude = 4; period = 120 degrees.

Question 3

(a) amplitude = 2 cao	**B1**

(a) Answer: 2

(b) period = 360/0.5 = 720 degrees cao	**B1**

(b) Answer: 720 degrees

(c) midline y = 1 cao	**B1**

(c) Answer: y = 1

(d) set 2 sin(0.5x) + 1 = 3 so sin(0.5x) = 1 and solve 0.5x = 90 + 360k	**M1**
(d) x = 180 degrees (only solution in $0 \leq x \leq 720$) cao	**A1**

(d) Answer: x = 180 degrees

Question 4

amplitude = 1 cao	**B1**
period = 360 degrees cao	**B1**
phase shift = 45 degrees left (because x + 45) cao	**B1**
vertical shift = -1 cao	**B1**

Answer: Amplitude 1, period 360 degrees, phase shift 45 degrees left, vertical shift -1.

Question 5

use cos x = 1/3 and take arccos	**M1**
x = arccos(1/3) = 70.5 degrees awrt	**A1**

Answer: 70.5 degrees (to 1 dp).

Question 6

(a) C	**B1**

(a) Answer: C

(b) A	**B1**

(b) Answer: A

(c) B	**B1**

(c) Answer: B

(d) D	**B1**

(d) Answer: D

Question 7

(a) 15000×0.88^4	**M1**
(a) 8995 awrt	**A1**

(a) Answer: £8995

(b) V = 0	**B1**
(b) the value of the car decreases towards £0 but never actually reaches it (oe)	**B1**

(b) Answer: V = 0; the car's value keeps decreasing but never reaches zero.

Question 8

(a) maximum = 3	**B1**
(a) minimum = 1	**B1**

(a) Answer: Maximum = 3, minimum = 1

(b) 360	**B1**

(b) Answer: 360 degrees

Question 9

$\sin^{-1}(0.6) = 36.9$ (awrt)	**M1**
x = 36.9 cao	**A1**
180 - 36.9 (ft their first solution)	**M1**
x = 143.1 cao	**A1**

Answer: x = 36.9 and x = 143.1

Question 10

identifies base solutions of sin u = 0.5 as u = 30 or u = 150	**M1**
recognises that since $0 \leq 3x \leq 1080$, three repeats of the period must be considered	**M1**
at least 4 of the 6 values of u correct: 30, 150, 390, 510, 750, 870	**A1**
all 6 values of u correct with no extras	**A1**
divides by 3 correctly to give x = 10, 50, 130, 170, 250, 290 (cao, all 6, no extras)	**A1**

Answer: x = 10, 50, 130, 170, 250, 290

Question 11

writes 10000 as 10^4	**M1**
x = 1	**A1**

Answer: x = 1

Question 12

k = 6	**B1**
$54 = 6 \times a^2$ or $a^2 = 9$	**M1**
a = 3	**A1**

Answer: k = 6, a = 3

Question 13

amplitude 3	**B1**
period 360/6 = 60 degrees	**B1**

Answer: amplitude = 3, period = 60 degrees

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