HIGHER

7.8 Trigonometric and Exponential Graphs: 30-minute Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write down the amplitude and the vertical shift of $y = -2\cos(0.5x) + 1$.

(Total for Question 1 is 2 marks)

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2 Solve $2^x = 8$.

(Total for Question 2 is 2 marks)

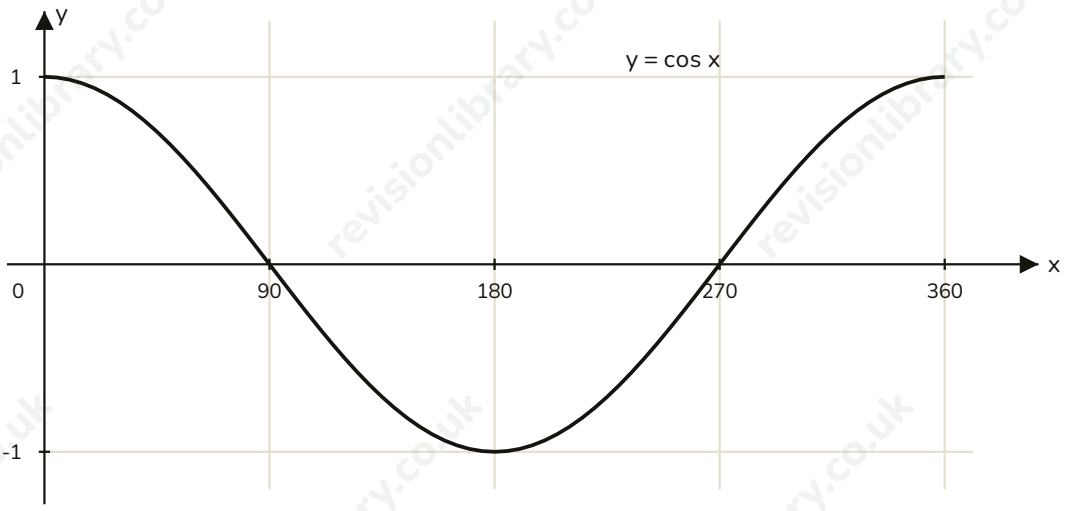
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3 For $y = \sin(x - 30) + 2$, find the x-coordinate of the first maximum after $x = 0$ (in degrees) and the value of that maximum.

(Total for Question 3 is 2 marks)

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4 The graph of $y = \cos x$ is shown for $0 \leq x \leq 360$.



(a) Write down the coordinates of the two points where the graph of $y = \cos x$ crosses the x-axis, for $0 \leq x \leq 360$. **(1)**

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(b) Given that cos 50 degrees = 0.643 (3 s.f.), use the symmetry of the graph to write down the value of cos 310 degrees. **(1)**

.....

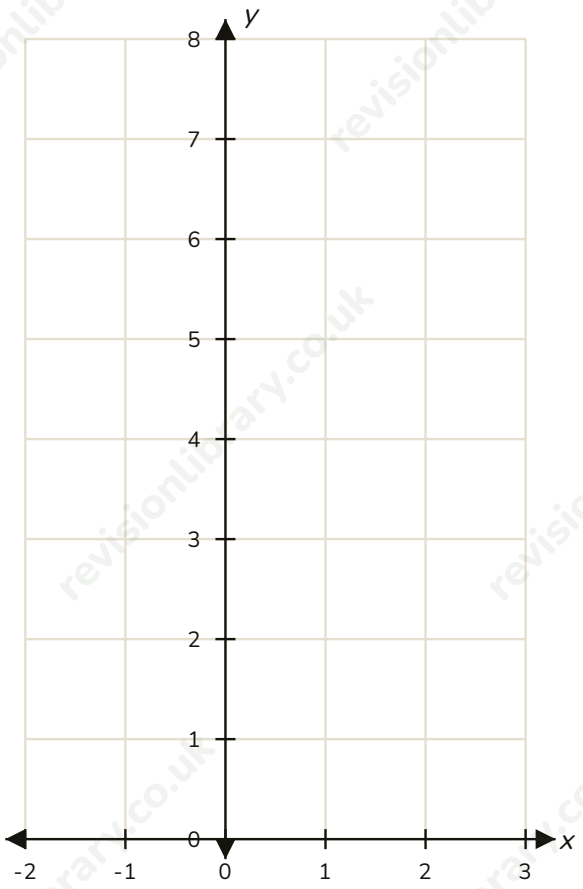
(c) Given that cos 50 degrees = 0.643 (3 s.f.), write down the value of cos 230 degrees. **(1)**

.....

(Total for Question 4 is 3 marks)

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5 $y = 2^x$



(a) Complete the table of values for $y = 2^x$. **(3)**

x	-2	-1	0	1	2	3
y	___	___	___	___	___	___

(b) State the value of y when x = 0 for any graph of the form $y = k^x$, where $k > 0$. **(1)**

(Total for Question 5 is 4 marks)

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6 The graph of $y = a^x$ passes through the points (0, 1) and (2, 18). Find the value of a. Give your answer in exact form and to 3 significant figures.

(Total for Question 6 is 2 marks)

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7 A colony of bacteria in a laboratory sample is modelled by $P = 200 \times 1.15^t$, where P is the population and t is the time in hours after the sample was taken.

(a) Calculate the population after 5 hours, giving your answer to the nearest whole number. **(2)**

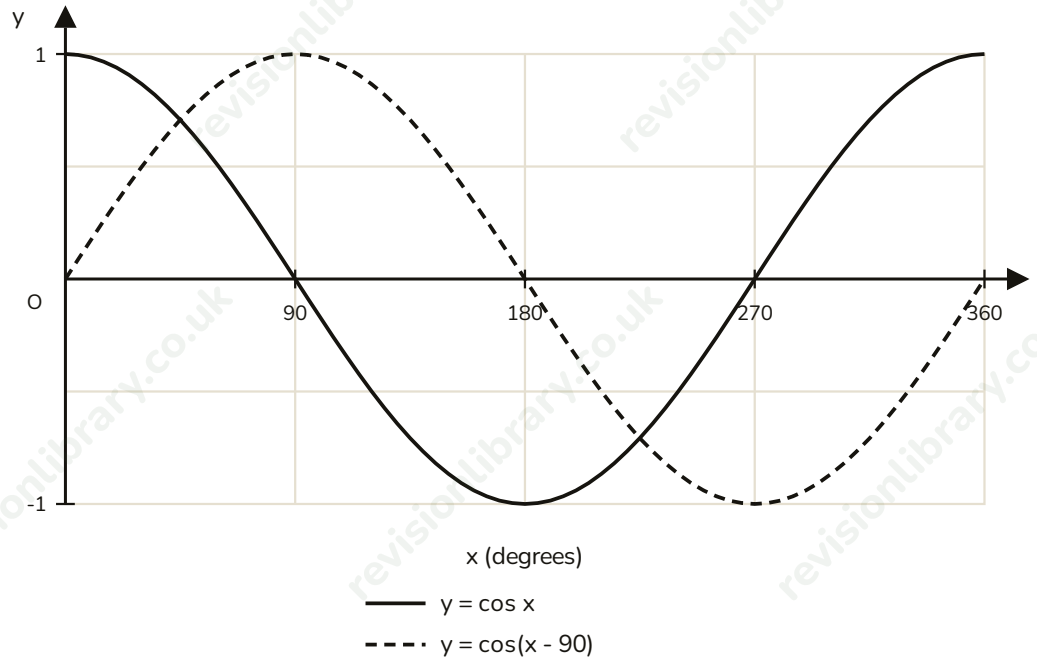
(b) Find the first whole number of hours, t, for which the population exceeds 500. **(2)**

(c) Give a reason why this exponential model may not be realistic for very large values of t. **(1)**

(Total for Question 7 is 5 marks)

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8 The graph of $y = \cos(x - 90)$ is a transformation of $y = \cos x$.



(a) Describe fully the transformation from $y = \cos x$ to $y = \cos(x - 90)$. **(1)**

(b) By considering this transformation, or otherwise, write $\cos(x - 90)$ in terms of $\sin x$. **(2)**

(Total for Question 8 is 3 marks)

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Mark scheme · 7.8 Trigonometric and Exponential Graphs: 30-minute Pack

Question 1

amplitude = 2 cao (ignore sign) **B1**

vertical shift = +1 cao **B1**

Answer: Amplitude = 2; vertical shift = +1.

Question 2

use $8 = 2^3$ or use logs (recognise powers) **M1**

x = 3 cao **A1**

Answer: 3

Question 3

x-coordinate = 120 degrees cao (since sin has max at 90 and phase shift +30) **B1**

maximum value = 3 cao (1 + 2) **B1**

Answer: First maximum at x = 120 degrees; maximum value = 3.

Question 4

(a) (90, 0) and (270, 0) both required **B1**

(a) Answer: (90, 0) and (270, 0)

(b) 0.643 (using cos(360-x) = cos x) **B1**

(b) Answer: 0.643

(c) -0.643 (using cos(180+x) = -cos x) **B1**

(c) Answer: -0.643

Question 5

(a) 0.25 and 0.5 correct **B1**

(a) 1 and 2 correct **B1**

(a) 4 and 8 correct **B1**

(a) Answer: 0.25, 0.5, 1, 2, 4, 8

(b) y = 1 **B1**

(b) Answer: y = 1

Question 6

use $a^2 = 18$ from point (2,18) (and $a^0 = 1$ checks) **M1**

$a = \sqrt{18} = 3\sqrt{2} = 4.24$ to 3 s.f. cao **A1**

Answer: $a = \sqrt{18} = 3\sqrt{2}$ approx 4.24 (3 s.f.).

Question 7

(a) 200×1.15^5 **M1**

(a) 402 awrt **A1**

(a) Answer: 402

(b) trial values shown, e.g. t=6 gives 462.6, t=7 gives 532.0 **M1**

(b) t = 7 cao **A1**

(b) Answer: t = 7

(c) sensible limiting factor stated, e.g. limited space/food/resources so growth cannot continue indefinitely **B1**

(c) Answer: The population cannot grow forever because resources such as space, food or oxygen are limited.

Question 8

(a) translation by vector (90, 0) (oe: 90 degrees to the right) **B1**

(a) Answer: Translation by vector (90, 0)

(b) recognises shifted cosine graph matches the sine graph **M1**

(b) sin x oe **A1**

(b) Answer: cos(x - 90) = sin x

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