HIGHER

7.8 Trigonometric and Exponential Graphs: 1-hour Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Without using a calculator, write down the exact value of each of the following.

(a) sin 30 degrees **(1)**

.....

(b) cos 60 degrees **(1)**

.....

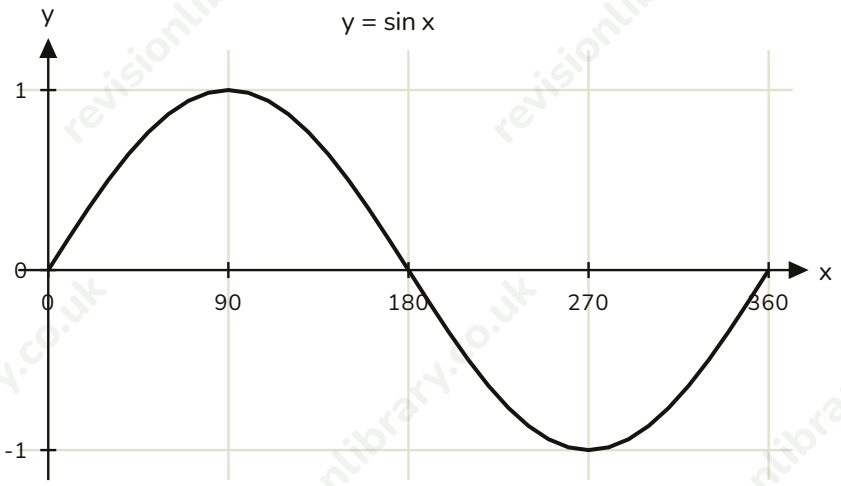
(c) tan 45 degrees **(1)**

.....

(Total for Question 1 is 3 marks)

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2 The diagram shows the graph of $y = \sin x$ for $0 \leq x \leq 360$.



(a) Write down the maximum value of sin x and the value of x, in the given range, at which it occurs. **(2)**

.....

(b) Write down the period of the graph $y = \sin x$. **(1)**

.....

(c) Write down all the values of x in the range $0 \leq x \leq 360$ for which $\sin x = 0$. **(1)**

.....

(Total for Question 2 is 4 marks)

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3 Given that sin 25 degrees = 0.423 (3 s.f.),

(a) use the symmetry of the sine graph to write down the value of sin 155 degrees. **(1)**

.....

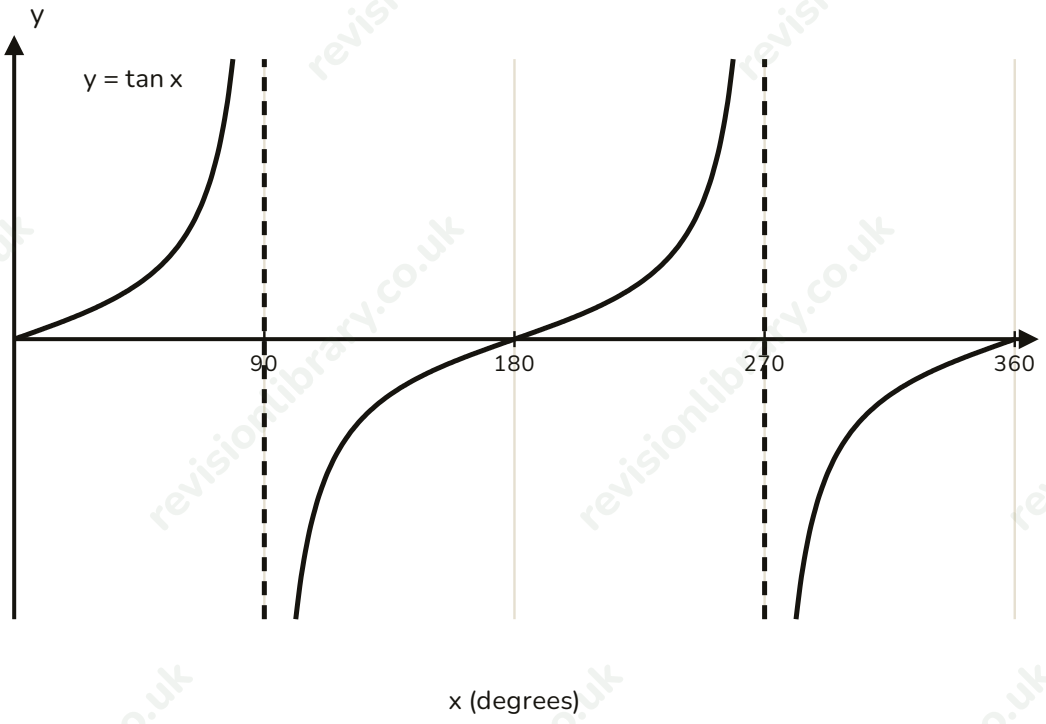
(b) Hence write down the two solutions of sin x = 0.423 in the range $0 \leq x \leq 360$. **(2)**

.....

(Total for Question 3 is 3 marks)

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4 The graph of y = tan x has vertical asymptotes.



(a) Write down the equations of the two asymptotes of y = tan x for $0 < x < 360$. **(2)**

.....

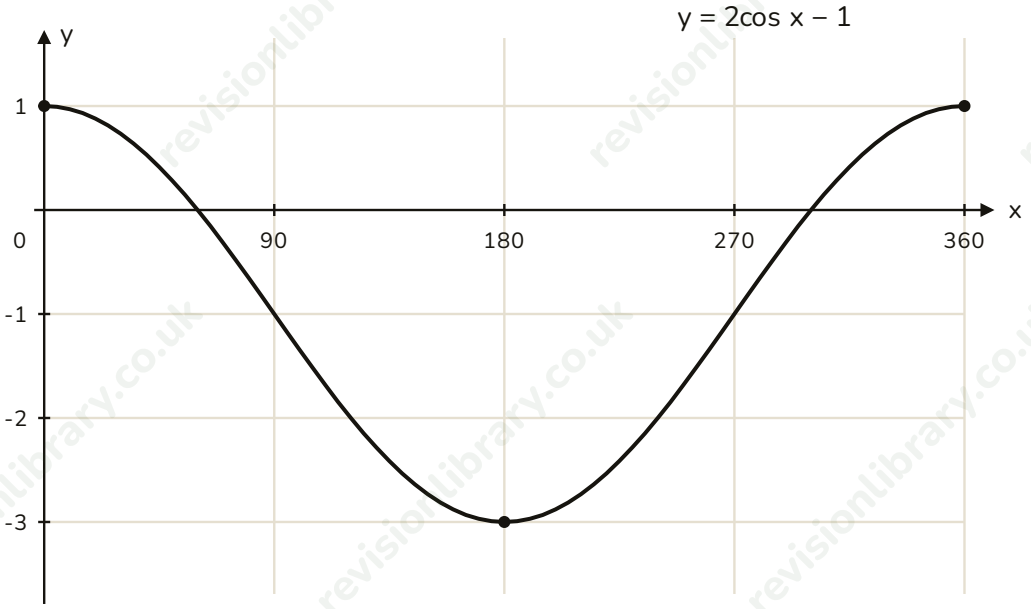
(b) Write down the period of the graph y = tan x. **(1)**

.....

(Total for Question 4 is 3 marks)

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5 The graph of $y = 2\cos x - 1$ is a transformation of $y = \cos x$.



(a) Write down the maximum and minimum values of $y = 2\cos x - 1$. **(2)**

.....

(b) Write down the coordinates of the y-intercept of the graph. **(1)**

.....

(c) State the period of the graph. **(1)**

(Total for Question 5 is 4 marks)

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6 Two savings accounts are modelled by $A = 500 \times 1.03^t$ and $B = 400 \times 1.045^t$, where t is the number of complete years the money has been invested. Find the first whole number of years, t, after which the value of account B first exceeds the value of account A.

(Total for Question 6 is 5 marks)

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7 The graph of $y = 3^x$ is an exponential curve.

(a) Write down the coordinates of the point where the graph crosses the y-axis. **(1)**

.....

(b) Write down the equation of the horizontal asymptote of the graph. **(1)**

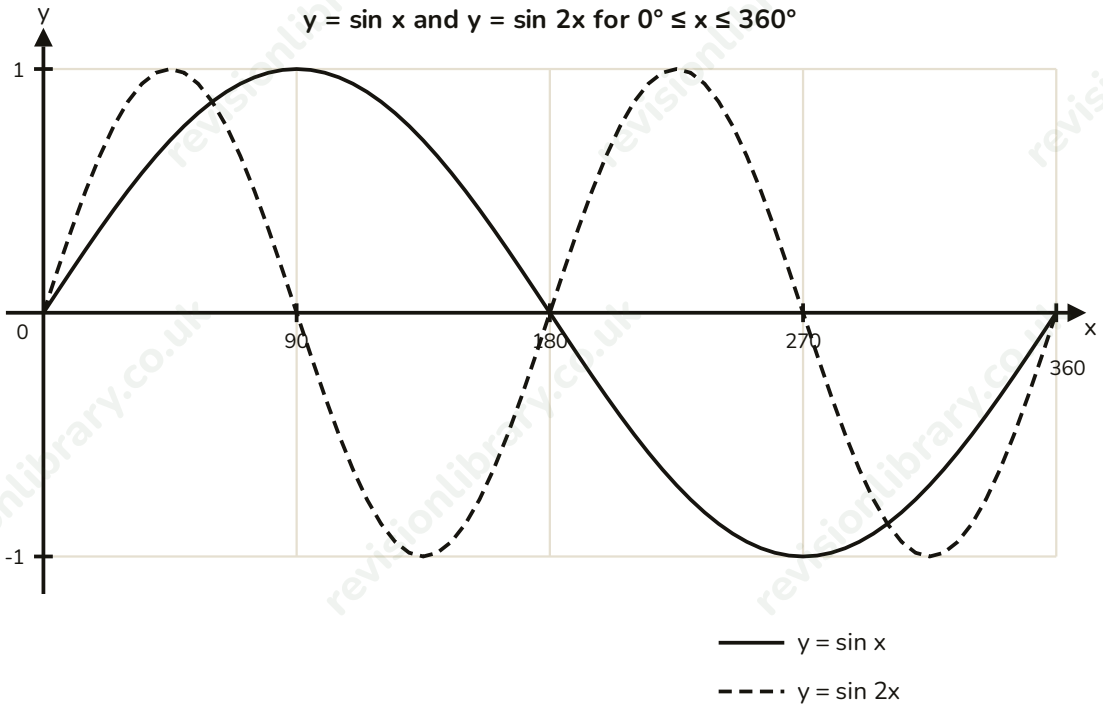
.....

(c) State whether $y = 3^x$ is increasing or decreasing as x increases. **(1)**

(Total for Question 7 is 3 marks)

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8 The graph of $y = \sin 2x$ is a transformation of $y = \sin x$.



(a) Describe fully the transformation from $y = \sin x$ to $y = \sin 2x$. **(1)**

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

(c) Write down the number of complete cycles the graph of $y = \sin 2x$ makes for $0 \leq x \leq 360$. **(1)**

(Total for Question 8 is 3 marks)

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9 A curve has equation $y = a \times b^x$, where a and b are positive constants. The curve passes through the points (0, 12) and (2, 48). Find the values of a and b, and hence write down the equation of the curve.

(Total for Question 9 is 5 marks)

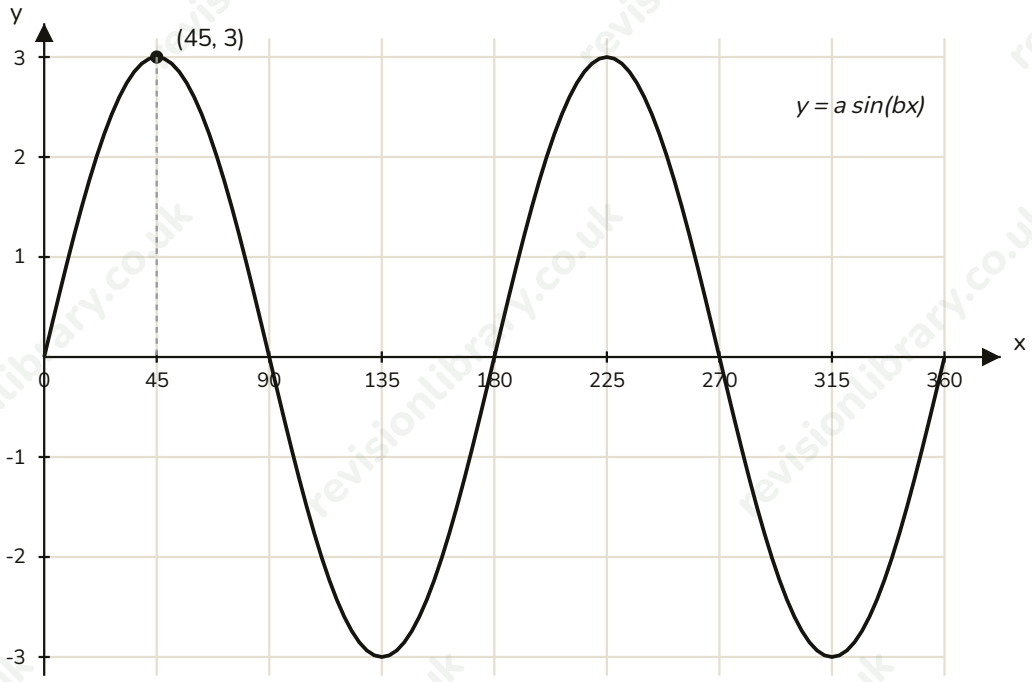
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10 Solve $2 \sin x + 1 = 0$ for $0 \leq x \leq 360$, giving all solutions.

(Total for Question 10 is 4 marks)

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11 The graph shows $y = a \sin(bx)$ for $0 \leq x \leq 360$, where a and b are positive constants. The maximum point of the curve is at (45, 3), and the curve completes exactly 2 full cycles between $x = 0$ and $x = 360$. Find the values of a and b.



(Total for Question 11 is 4 marks)

12 Solve $10^{3x + 2} = 100000$

(Total for Question 12 is 2 marks)

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13 Write down the maximum value and the minimum value of $y = 3 \cos x + 4$.

(Total for Question 13 is 2 marks)

---

14 The graph of $y = a^x$ passes through the point (3, 125). Work out the value of y when $x = -1$.

(Total for Question 14 is 3 marks)

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Mark scheme · 7.8 Trigonometric and Exponential Graphs: 1-hour Pack

Question 1

(a) 1/2 oe (e.g. 0.5) **B1**

(a) Answer: 1/2

(b) 1/2 oe (e.g. 0.5) **B1**

(b) Answer: 1/2

(c) 1 cao **B1**

(c) Answer: 1

Question 2

(a) maximum value = 1 **B1**

(a) x = 90 **B1**

(a) Answer: Maximum = 1 at x = 90

(b) 360 **B1**

(b) Answer: 360 degrees

(c) 0, 180, 360 all stated (oe) **B1**

(c) Answer: x = 0, 180, 360

Question 3

(a) 0.423 (using sin(180-x) = sin x) **B1**

(a) Answer: 0.423

(b) x = 25 **B1**

(b) x = 155 **B1**

(b) Answer: x = 25, 155

Question 4

(a) x = 90 **B1**

(a) x = 270 **B1**

(a) Answer: x = 90 and x = 270

(b) 180 **B1**

(b) Answer: 180 degrees

Question 5

(a) maximum = 1 **B1**

(a) minimum = -3 **B1**

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

(b) (0, 1) **B1**

(b) Answer: (0, 1)

(c) 360 **B1**

(c) Answer: 360 degrees

Question 6

attempts trial values of A and B at t=15 **M1**

A15 awrt 779, B15 awrt 774 (B < A) **A1**

attempts trial values of A and B at t=16 **M1**

A16 awrt 802, B16 awrt 809 (B > A) **A1**

t = 16 stated as conclusion **B1**

Answer: t = 16

Question 7

(a) (0, 1) **B1**

(a) Answer: (0, 1)

(b) y = 0 **B1**

(b) Answer: y = 0

(c) increasing (since base 3 > 1) **B1**

(c) Answer: Increasing

Question 8

(a) stretch, scale factor 1/2, parallel to the x-axis (oe) **B1**

(a) Answer: Horizontal stretch, scale factor 1/2, parallel to the x-axis

(b) 180 **B1**

(b) Answer: 180 degrees

(c) 2 **B1**

(c) Answer: 2

Question 9

substitutes x=0 into $y=a \times b^x$ to find a **M1**

a = 12 **A1**

substitutes (2,48) and a=12 to form $12b^2=48$ **M1**

b = 2 cao **A1**

$y = 12 \times 2^x$ stated (ft) **B1**

Answer: $a = 12$, $b = 2$, $y = 12 \times 2^x$

Question 10

rearranges to sin x = -0.5 **M1**

finds reference angle $\sin^{-1}(0.5) = 30$ **M1**

x = 210 **A1**

x = 330 **A1**

Answer: x = 210 and x = 330

Question 11

identifies the amplitude as the maximum value, since there is no vertical shift **M1**

a = 3 **A1**

uses two full cycles to find period = 360 / 2 = 180 degrees, or uses the first maximum to obtain 45b = 90 **M1**

b = 2 **A1**

Answer: a = 3, b = 2

Question 12

writes 100000 as 10^5 **M1**

x = 1 **A1**

Answer: x = 1

Question 13

maximum 7 **B1**

minimum 1 **B1**

Answer: maximum = 7, minimum = 1

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Question 14

a = 5	**B1**
$5^{-1} = 1/5^{1}$	**M1**
1/5 cao	**A1**

Answer: 1/5

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