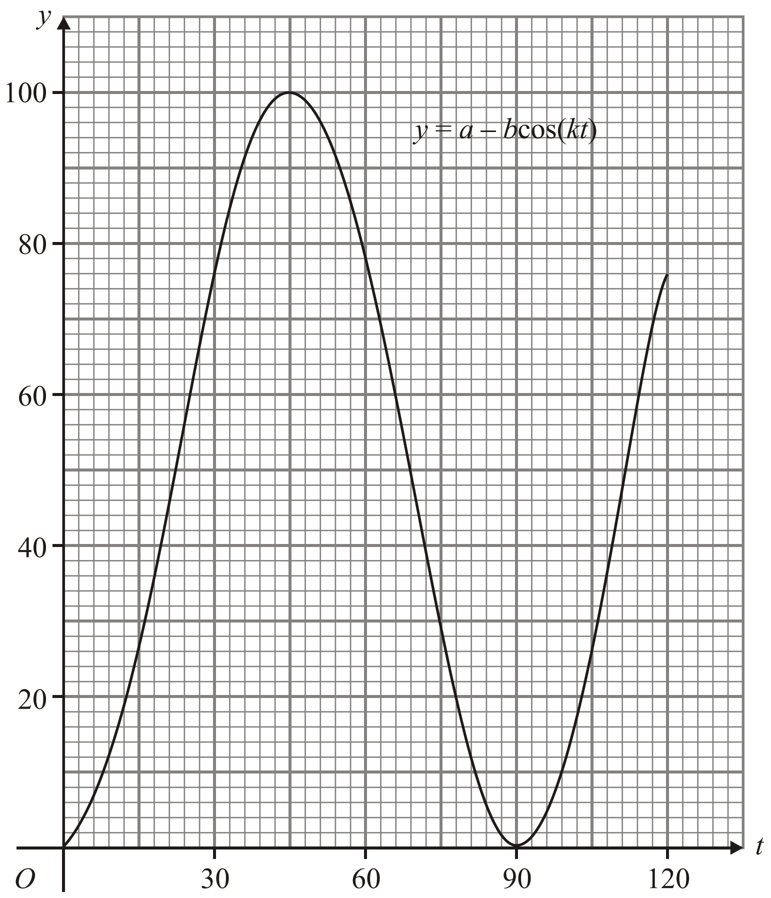
1.



The graph of $y = a - b\cos(kt)$, for values of t between 0° and 120°, is drawn on the grid.

Use the graph to find an estimate for the value of

(i) a,

....

(ii) b,

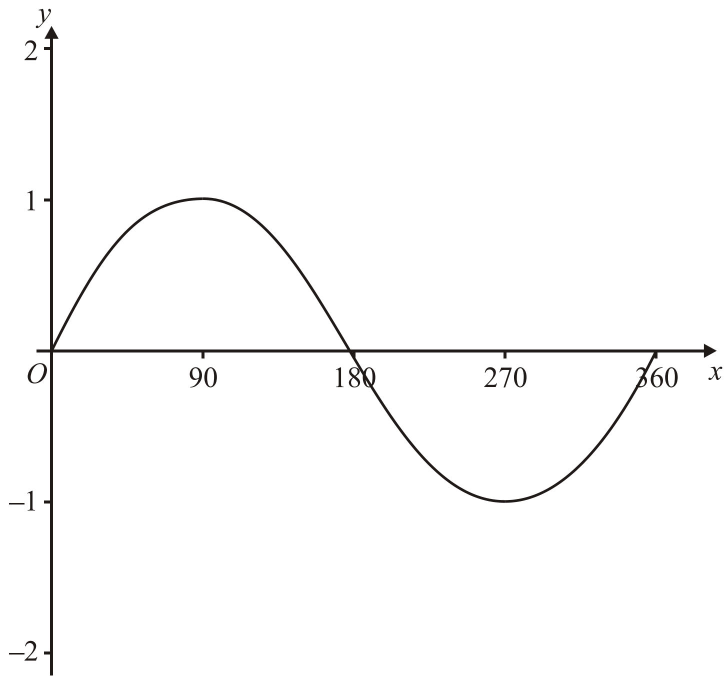
....

(iii) k.

....

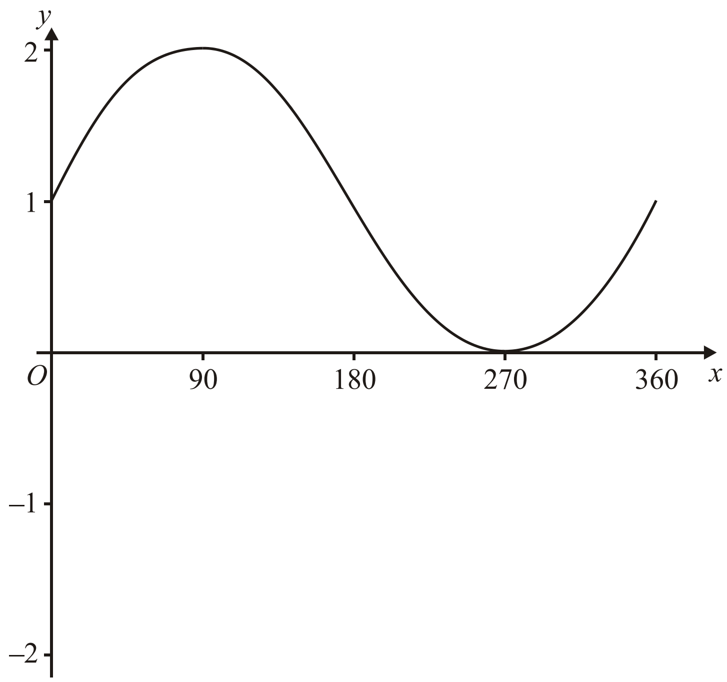
(Total 3 marks)

2. A sketch of the curve $y = \sin x°$ for $0 \le x \le 360$ is shown below.



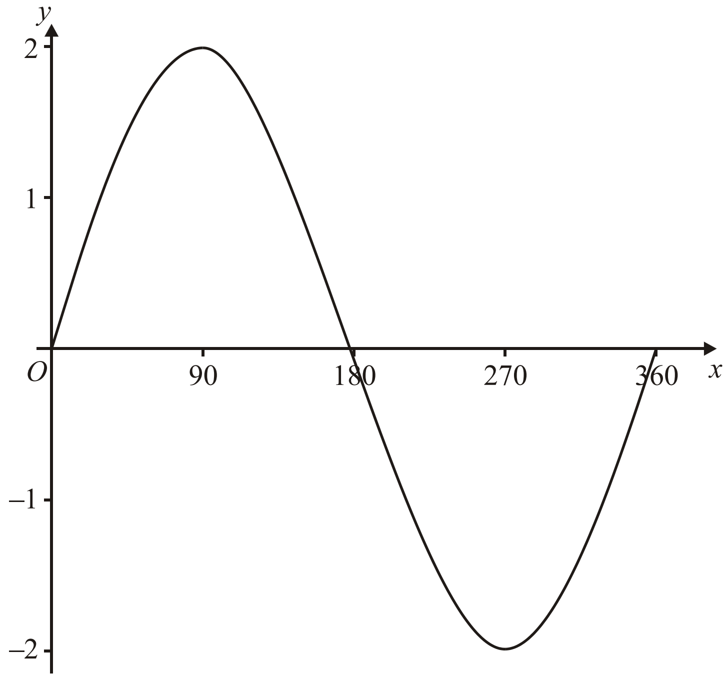
(a) Using the sketch above, or otherwise, find the equation of each of the following two curves.

(i)



(i) Equation $y =$ ....

(ii)



(ii) Equation y = ...

(2)

(b) Describe fully the sequence of two transformations that maps the graph of $y = \sin x°$ onto the graph of $y = 3 \sin 2x°$

....

....

....

....

(3)

(Total 5 marks)

3.

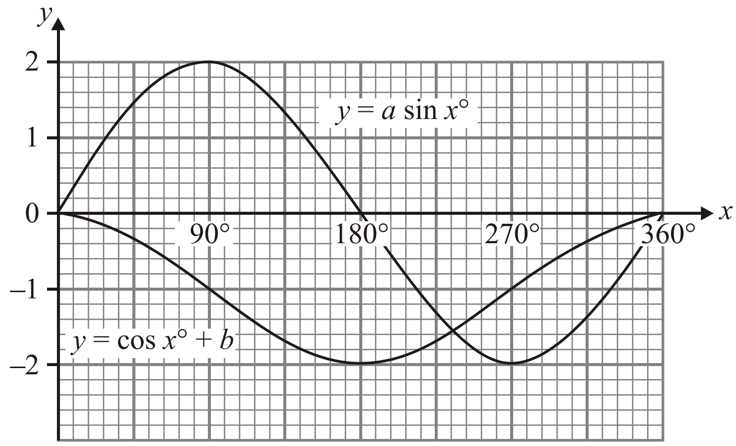


Diagram **NOT** accurately drawn

The diagram shows part of two graphs.

The equation of one graph is $y = a \sin x°$
The equation of the other graph is $y = \cos x° + b$

(a) Use the graphs to find the value of a and the value of b.

a = ...

b = ...

(2)

(b) Use the graphs to find the values of x in the range $0° \leq x \leq 720°$ when $a \sin x° = \cos x° + b$.

x = ...

(2)

(c) Use the graphs to find the value of $a \sin x° - (\cos x° + b)$ when $x = 450°$.

....

(2)
(Total 6 marks)

4. Diagram 1 is a sketch of part of the graph of $y = \sin x°$.

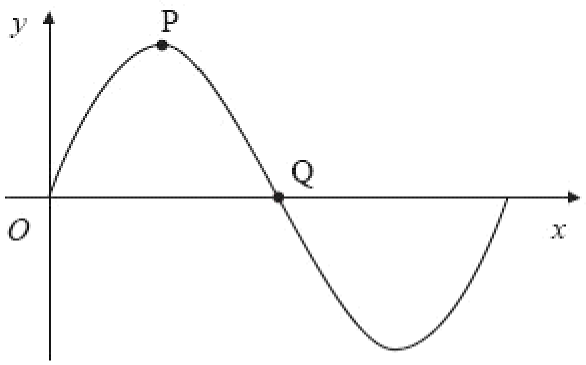


Diagram 1

(a) Write down the coordinates of

(i) *P*,

(…… , ……)

(ii) *Q*.

(…… , ……)

(2)

Diagram 2 is a sketch of part of the graph of $y = 3 \cos 2x°$.

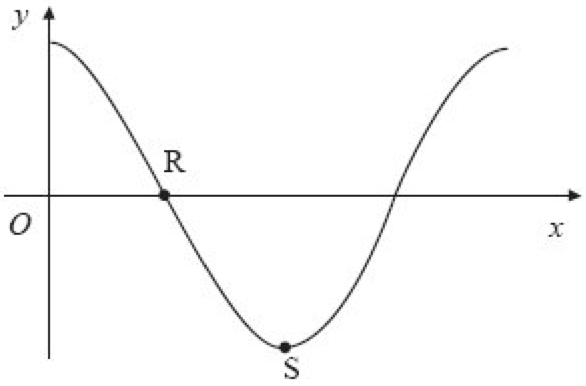


Diagram 2

(b) Write down the coordinates of

(i) *R*,

(…… , ……)

(ii) *S*

(…… , ……)

(2)
(Total 4 marks)

5.

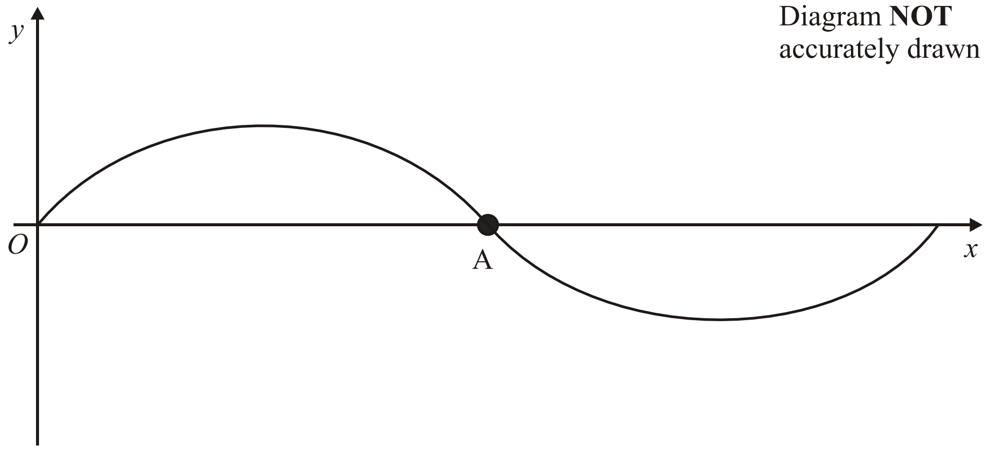


Diagram **NOT** accurately drawn

The diagram shows a sketch of part of the curve $y = \sin x°$.

(a) Write down the coordinates of point A.

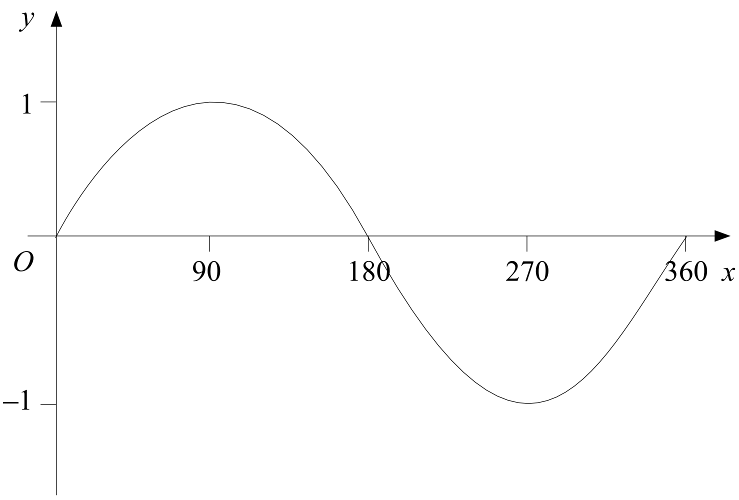
(.................... , ...)

(1)

(b) On the same diagram, sketch the graph of $y = \sin 2x°$.

(2)
(Total 3 marks)

6. Here is a sketch of the curve $y = \sin x°$ for $0 \le x \le 360$.



(a) Given that $\sin 30° = \frac{1}{2}$, write down the value of

(i) $\sin 150°$

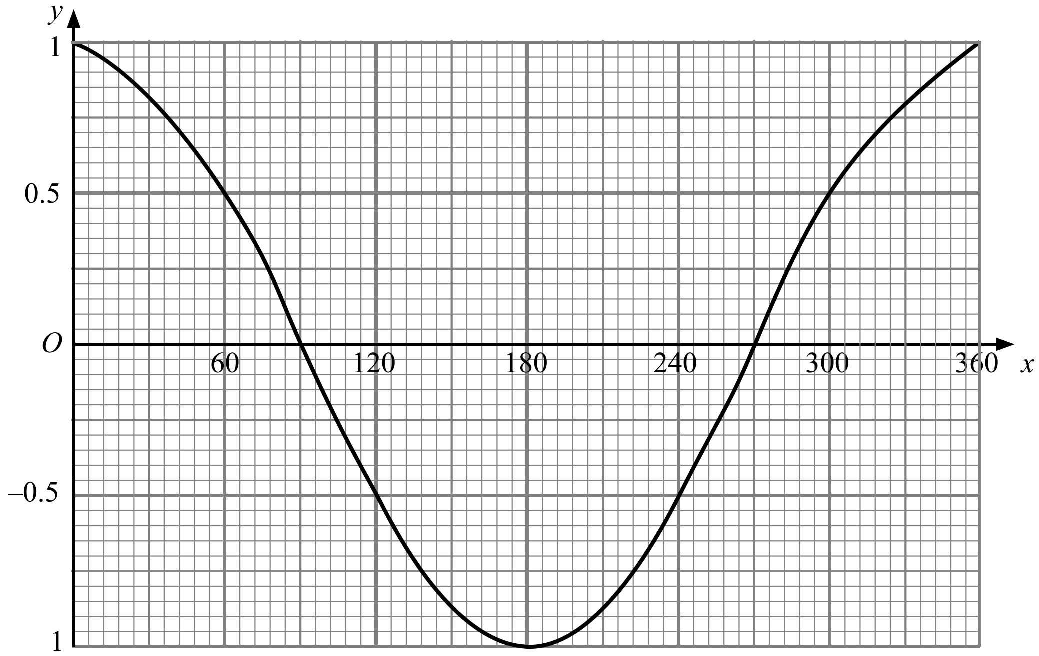
....

(ii) $\sin 330°$

....

(2)

The graph of $y = \cos x^{\circ}$ for $0 \leq x \leq 360$ is drawn below.



(b) Use the graph to find estimates of the solutions, in the interval $0 \leq x \leq 360$, of the equation

(i) $\cos x^{\circ} = -0.4$

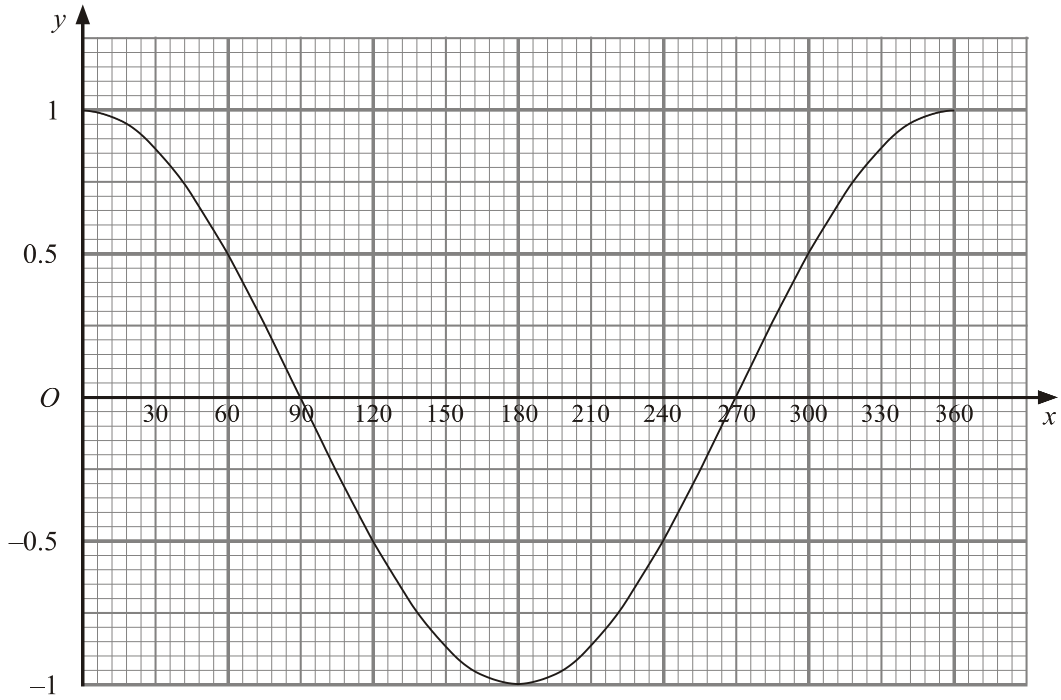
....

(ii) $4\cos x^{\circ} = 3$

....

(4)
(Total 6 marks)

7. Here is a graph of the curve $y = \cos x°$ for $0 \le x \le 360$

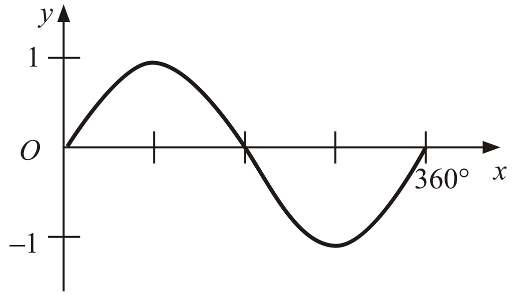


Use the graph to solve $\cos x° = 0.75$ for $0 \le x \le 360$

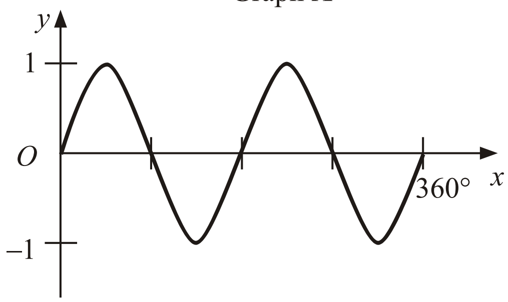
....

(Total 2 marks)

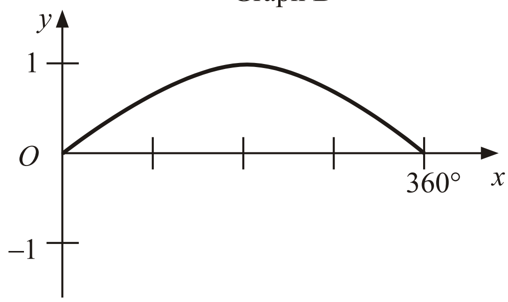
8. Here is the graph of $y = \sin x$, where $0° \leq x \leq 360°$



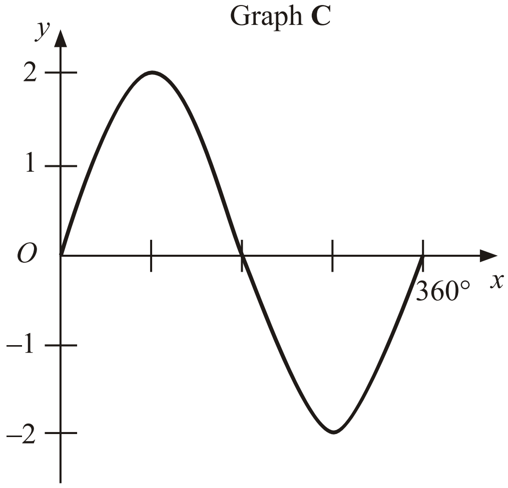
Graph **A**



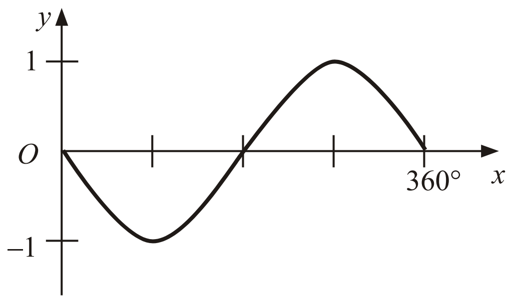
Graph **B**



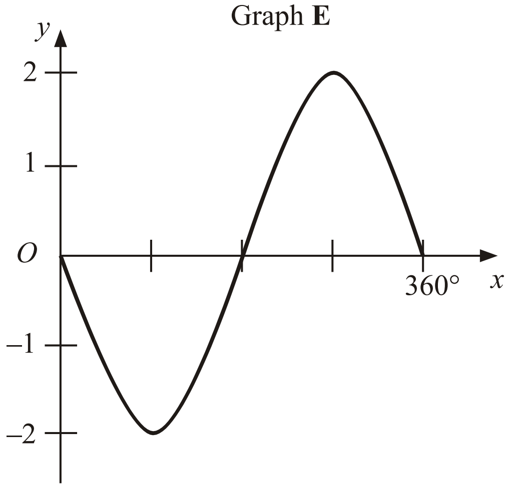
Graph **C**



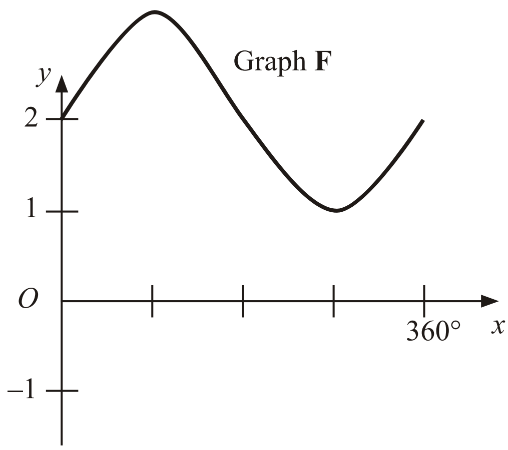
Graph **D**



Graph **E**



Graph **F**

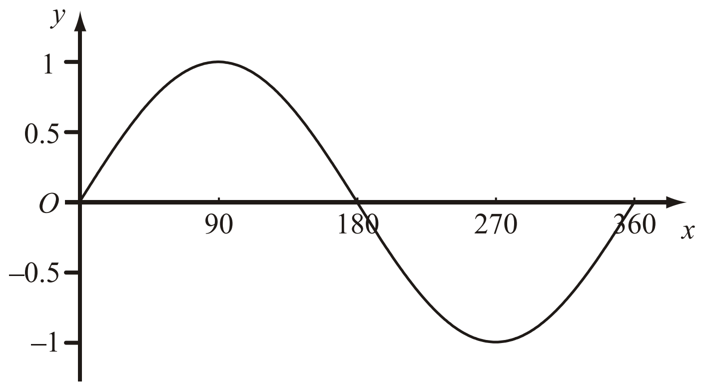


Match each of the graphs **A**, **B**, **C**, **D**, **E** and **F** to the equations in the table.

Equation	**Graph**
$y = 2 \sin x$	
$y = -\sin x$	
$y = \sin 2x$	
$y = \sin x + 2$	
$y = \sin \frac{1}{2} x$	
$y = -2\sin x$	

(Total 4 marks)

9. The diagram shows a sketch of the curve $y = \sin x°$ for $0 \leq x \leq 360$



The exact value of $\sin 60° = \dfrac{\sqrt{3}}{2}$

(a) Write down the exact value of

(i) sin 120°,

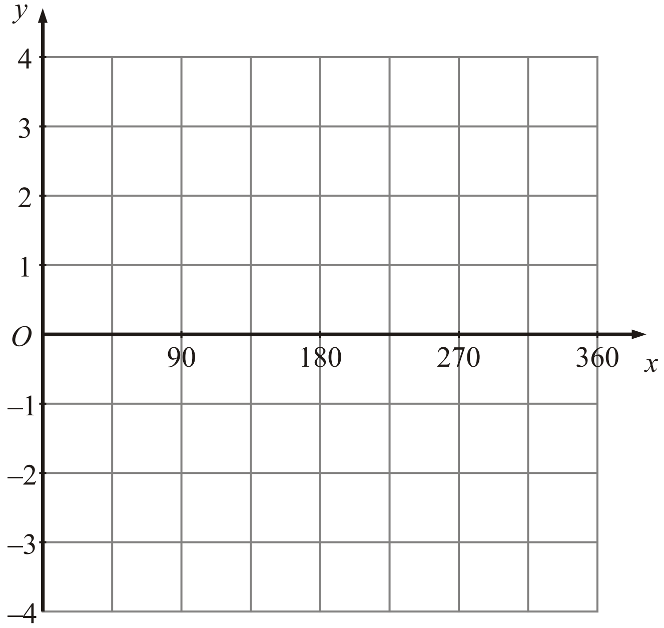
....

(ii) sin 240°.

....

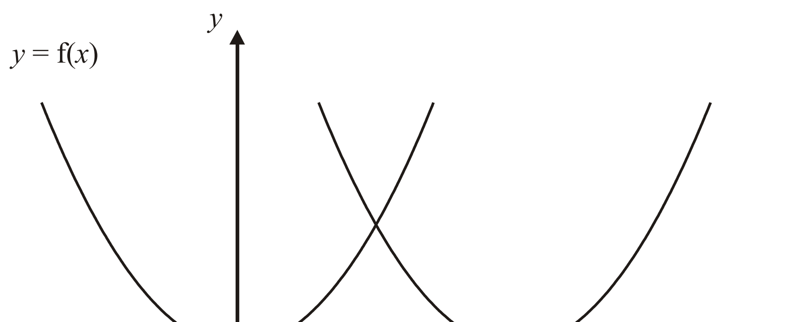
(2)

(b) On the grid below, sketch the graph of $y = 4 \sin 2x°$ for $0 \le x \le 360$



(2)
(Total 4 marks)

10.

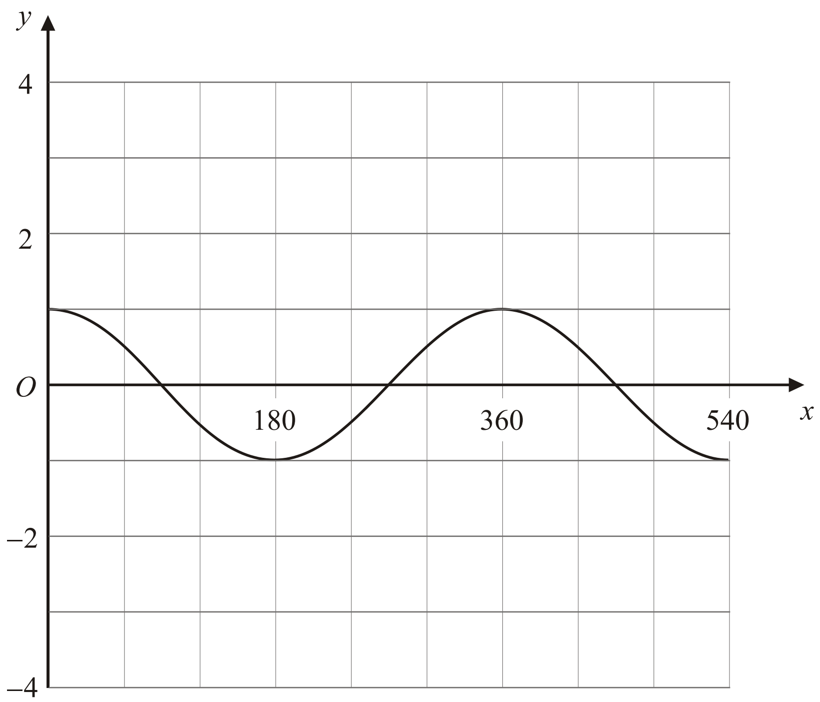


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

(a) Find an equation of the translated curve.

....

(2)



The grid shows the graph of $y = \cos x°$ for values of x from 0 to 540

(b) On the grid, sketch the graph of $y = 3 \cos (2x°)$ for values of x from 0 to 540

(2)
(Total 4 marks)

11. The diagram shows a sketch of the curve $y = \cos x°$ for $0 \leq x \leq 360$

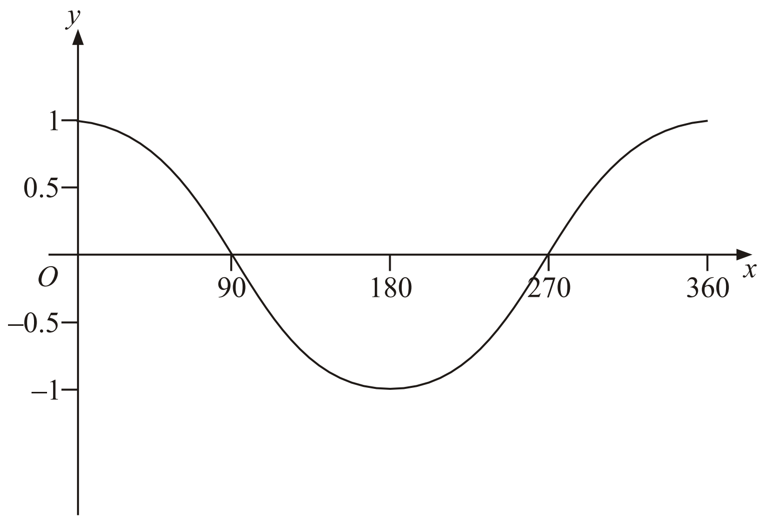


Diagram **NOT** accurately drawn

The value of cos 60° is 0.5

(a) Write down the value of cos 300°

....

(1)

(b) Write down one solution to the equation $\cos x° = -0.5$

....

(1)
(Total 2 marks)

1. 50
50
4 3

B1 50 or $\frac{100}{2}$

B1 for 50 or "a"

B1 4 or $\frac{360}{90}$ oe

[3]

2. (a) (i) $y = 1 + \sin x$ 2

B1 for $y = 1 + \sin x$

(ii) $y = 2\sin x$

B1 for $y = 2\sin x$

SC both (i) f(x) + 1, (ii) 2f(x) B1

(b) Stretch parallel to y-axis scale factor 3 3

Stretch parallel to x-axis scale factor $\frac{1}{2}$

M1 for 'stretch'

A1 for Stretch parallel to y-axis scale factor 3 oe

A1 for Stretch parallel to x-axis scale factor $\frac{1}{2}$ oe

SC if M0 award B1 for "sf 3 vertically" ***and*** *"sf $\frac{1}{2}$ horizon."*

[5]

3. (a) a = 2,

b = –1 2

B1 cao

B1 cao

(b) 0, 234, 360, 594, 720 2

B2 for all 5 tolerance of ± 5° on 234 and 594

(B1 for 3)

(c) 2 – (0 – 1) 2

M1 for "a" – (0 + "b") or using 90°

A1 for 3 cao

[6]

4. (a) (i) (90, 1) 2

B1 cao could be indicated on diagram

(ii) (180, 0)

B1 cao could be indicated on diagram

(b) (i) (45, 0) 2

B1 cao could be indicated on diagram

(ii) (90, – 3)

B1 cao could be indicated on diagram

[4]

5. (a) (180,0) 1

B1 cao

(b) Sketch of $y = \sin 2x°$ 2

M1 for a sine curve stretched by SF2 or $\frac{1}{2}$ parallel to x-axis

A1 for correct curve between 0 and 180 or 0 and 360

[3]

6. (a) (i) 1/2 2

B1 cao oe

(ii) –1/2

B1 cao oe

(b) (i) Draws horizontal line $y = –0.4$ 4

114 and 246

M1 for use of $y = –0.4$ (may be implied by one correct solution)

(ii) Draws horizontal line $y = 0.75$

36 and 324

A1 for both 114 ± 6 and 246 ± 6
M1 for use of $y = 0.75$ (may be implied by one correct solution)
A1 for both 36 ± 6 and 324 ± 6

[6]

7. 42

318 2

B1 for answer in range 36 – 48
B1 for answer in range 312 – 324

[2]

8. C
D
A
F
B
E 4

B4 for all 6 correct
(B3 for 4 or 5 correct)
(B2 for 2 or 3 correct)
(B1 for 1 correct)

[4]

9. (a) (i) $\frac{\sqrt{3}}{2}$

B1 cao

$-\frac{\sqrt{3}}{2}$ 2

B1 cao

(b) 2

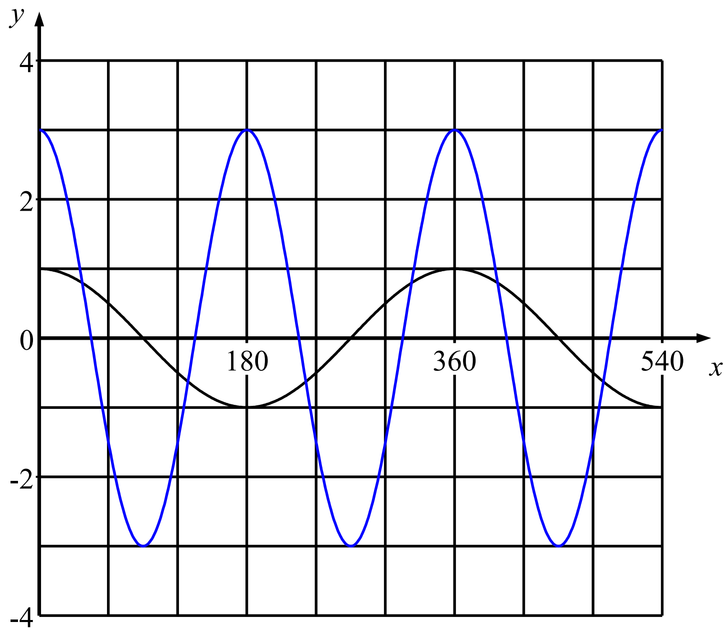
B2 cao
[B1 for sine curve, starting from the origin with amplitude 4,
OR B1 cuts x axis at 90, 180, 270, 360 and starts from 0]

[4]

10. (a) $y = \mathrm{f}(x - 4)$ 2

B2 cao
(B1 for f(x – 4) or y = f(x + a), a ≠ –4, a ≠ 0)

(b)



2

B2 cao
(B1 cosine curve with either correct amplitude or correct period, but not both)

[4]

11. (a) 0.5 2

B1 cao

(b) 120 or 240

B1 accept 120 ± 360 n or 240 ± 360 n
(where n *is an integer)*

[2]

1. Mathematics A Paper 6

This question proved to be too challenging. There were essentially two possible approaches that candidates could take. One involves a basic knowledge of the trigonometric curve and realising that the constant b is given by the amplitude of the curve. The constant a can be found by noticing that at $t = 0$, $y = a-b = 0$, so that $a = b$. The value of the constant k can be found from the observation that
$k \times 90 = 360$. The second approach involves the use of transformations, a translation parallel to the y - axis, a stretch along the y - axis and a stretch parallel to the x - axis. Many candidates thought that $a = 100$, $b = 100$ and $k = 90$.

Mathematics B Paper 19

Very few correct answers were seen for this question which was often omitted by candidates.

2. Mathematics A Paper 5

It is a pleasure to report that a majority of candidates graded above C gained at least some credit for correct answer(s) in parts (a) of this final question. As expected part (b) was a challenge to all but the top grade candidates. The examiners required the correct terminology for the transformations to be used (stretch) and also clear indications of the directions and scale factors.

Mathematics B Paper 18

Correct answers to part (a) were seen from approximately half of candidates although $y = \sin 2x$ was a common incorrect answer for the second graph. Few candidates were able to describe the transformations in (b) with the majority of the candidates describing the shape of the graph.

3. Part (a) of this question involving the understanding of trigonometrical curves was understood by about 60% of candidates, with 30% scoring full marks. In part (b) only 25% of candidates obtained any marks with only a third of these gaining full marks. Part (c) was answered more successfully than part (b) with 20% of candidates obtaining fall marks.

4. Specification A

Many grade A candidates were able to gain two marks for part (a), but did less well in part (b). Coordinates were often given the wrong way round.
In part (a), candidates either achieved all or none of the marks.
In Part (b), many candidates did not read the question carefully and gave answers for $y = \cos x$ and, less frequently, for $y = \cos 2x$. Some other common answers were:
(180, –1), (180, –3) or (180, 3).

Specification B

In part (a) about half of the candidates were able to give at least one correct coordinate but in part (b) this fell to around 15%.

5. Many candidates transposed the x and y coordinates in part (a). A = (90, 0) was also a common answer. There were some correct answers in part (b), although marks tended to be lost by candidates who did not consider carefully enough how the new curve looked near 0 and 360.

6. Many candidates were able to score at least 1 mark in part (a) and 2 marks in part (b). The most common incorrect answers in part (a) were (i) 2.5 and (ii) 5.5, resulting from the calculations $\frac{150}{30} = 5$, $5 \times \frac{1}{2} = 2.5$ and $\frac{330}{30} = 11$, $11 \times \frac{1}{2} = 5.5$.
In part (b), candidates often gave only the first angle in each interval, (i) 114° and (ii) 36°, and with more success in (i) than in (ii).

7. Many candidates attempted this question and most were able to score at least 1 mark, usually for 42°. Some candidates had difficult interpreting the scale on the x-axis, whilst others didn't realise that they had to give two solutions to the equation. Some candidates, unsure about what exactly they were being asked to do, presented their final answer as $42 \le x \le 318$, or as cos (42), or as (318 – 42 =) 276.

8. The vast majority of candidates were able to score at least one mark in this question. A common mistake was to interchange the answer for $y = \sin 2x$ with $y = \frac{1}{2}x$ (common) or $y = 2 \sin x$.

9. This question was very poorly answered indeed. In part (a), the usual attempts made were to double $\frac{\sqrt{3}}{2}$ (since 120 = 2 × 60) in (i), sometimes inadvertently resulting in the correct answer, and quadruple (since 240 = 4 × 60) in (ii). A number of candidates ignored the information given and estimated the answers from the given graph; answers of (i) 0.8 and (ii) – 0.8 were not uncommon.

In part (b), some success was achieved if a candidate realised that the resulting graph was also a sine curve of amplitude 4 units, but this was not the norm.

10. Part (a) was answered quite well with a good proportion of candidates recognising the transformation and remembering how to write the equation down. Many candidates used a combination of f, x and 4 but opted for the wrong one so that $y = f(x + 4)$ and $y = 4f(x)$ were common incorrect answers. Relatively few fully correct answers were seen in part (b). Where one of the two marks was awarded, this was usually for drawing a graph with the correct amplitude. Graphs with the correct period but incorrect amplitude were much rarer.

Some candidates doubled the period rather than halving it. Marks were sometimes lost because the curve was not drawn accurately enough or only drawn for part of the given range. Not all candidates attempted this question but most of those who did tried to draw some sort of wave.

× 60) in (i), sometimes inadvertently resulting in the correct answer, and quadruple (since 240 = 4 × 60) in (ii). A number of candidates ignored the information given and estimated the answers from the given graph; answers of (i) 0.8 and (ii) – 0.8 were not uncommon.

In part (b), some success was achieved if a candidate realised that the resulting graph was also a sine curve of amplitude 4 units, but this was not the norm.

11. Understanding of trigonometric functions was not good and only the most able gained marks on this question. The most common answer seen in part (a) was 2.5 applying a scale factor of 5 (300 ÷ 60) on 0.5. In part (b), –60 was the most common error, in both cases, candidates ignoring the graph and just trying to use the given information.