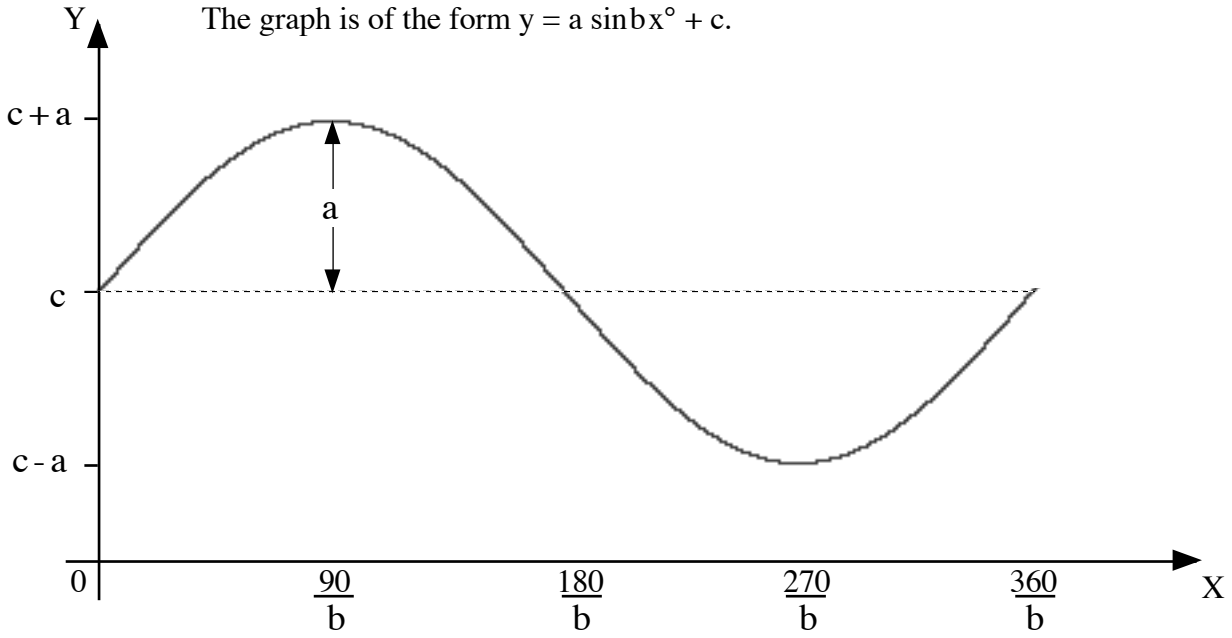
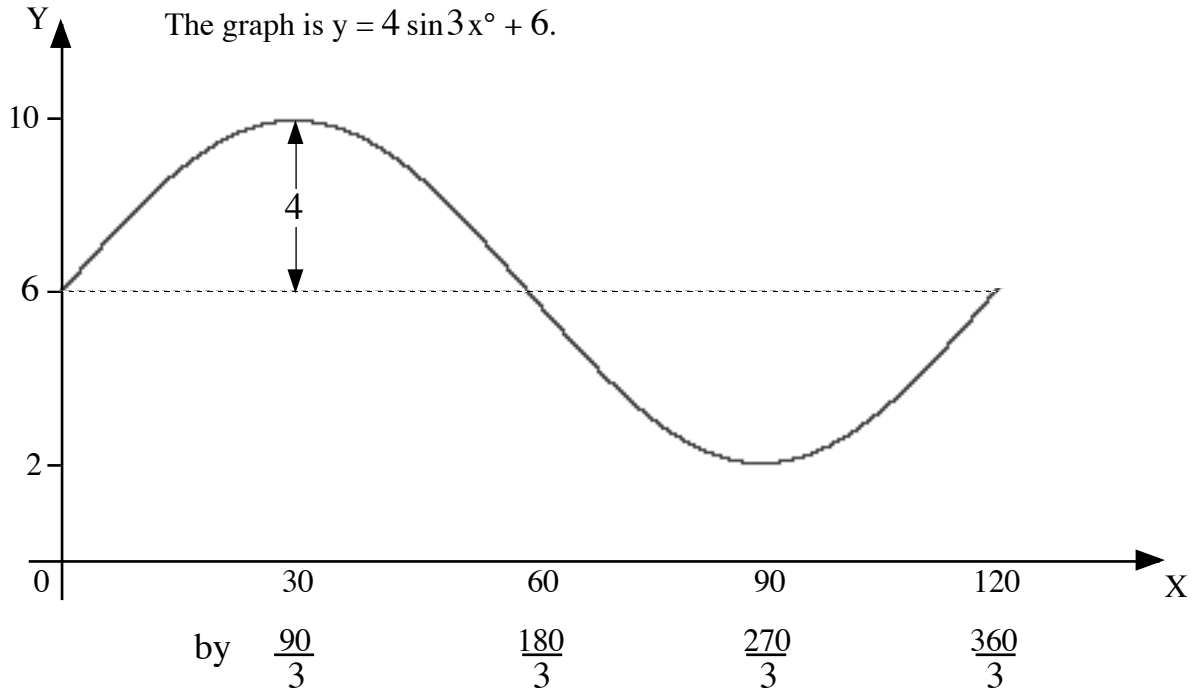
TRIGONOMETRIC GRAPHS

www.duggie.weebly.com



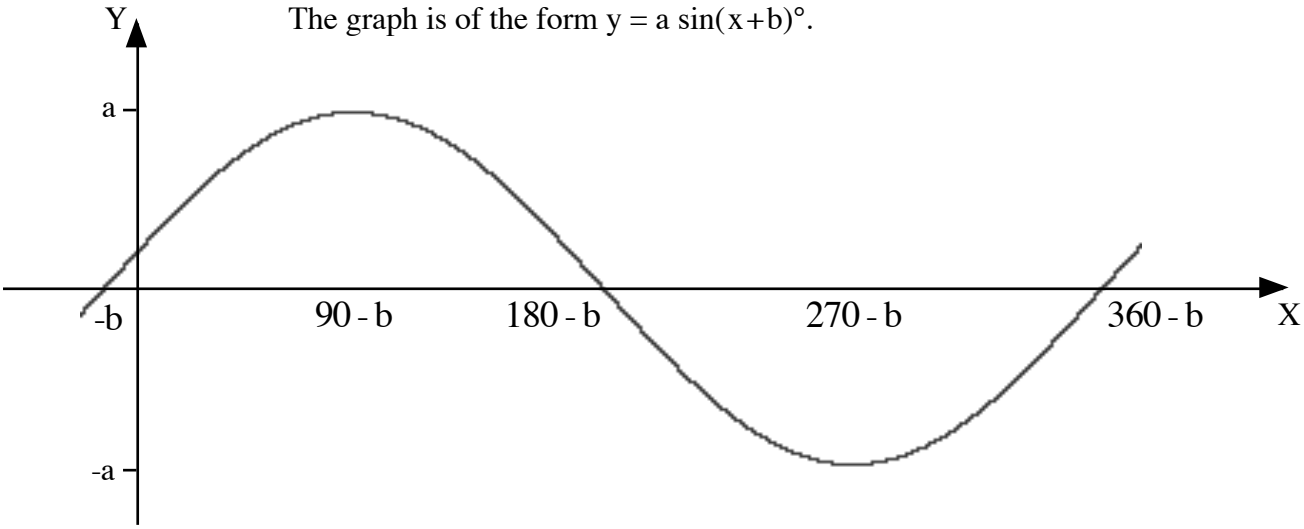


MAXIMUM 4 x 1 + 6 = 10 when 3x = 90
x = 30

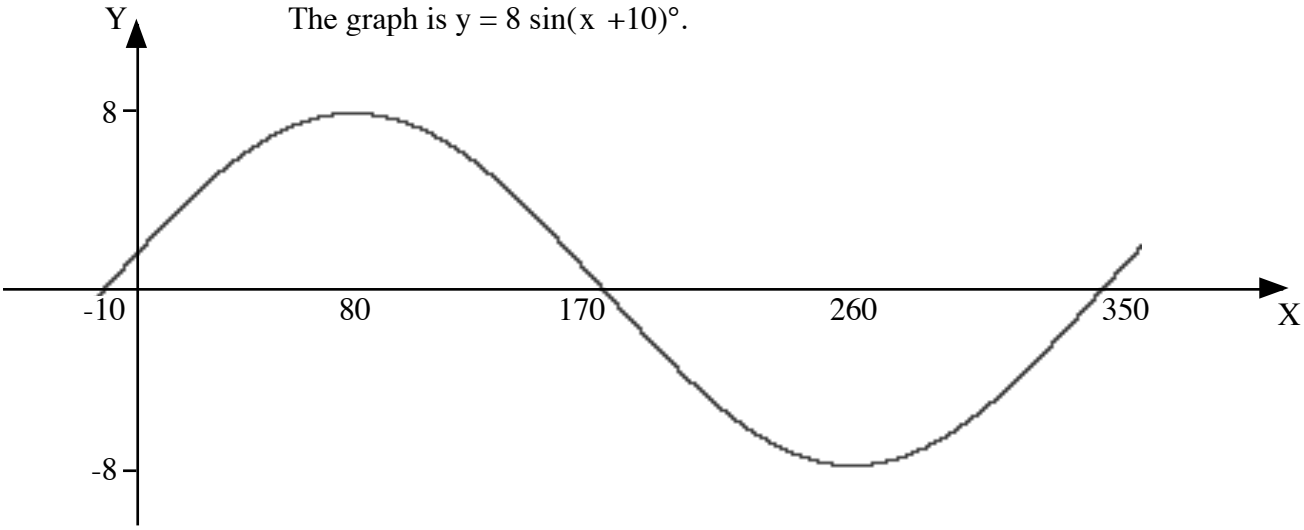
MINIMUM 4 x (-1) + 6 = 2 when 3x = 270
x = 90

maximum value 10 when x = 30 or maximum turning point (30,10)
minimum value 2 when x = 90 or minimum turning point (90, 2)

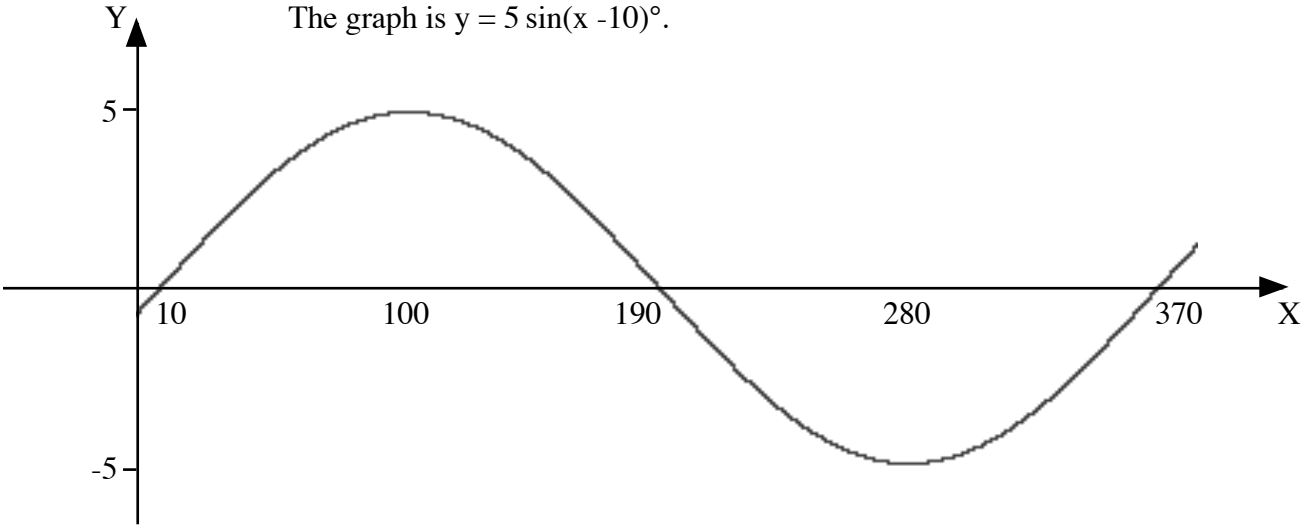
The graph is of the form $y = a \sin(x+b)°$.



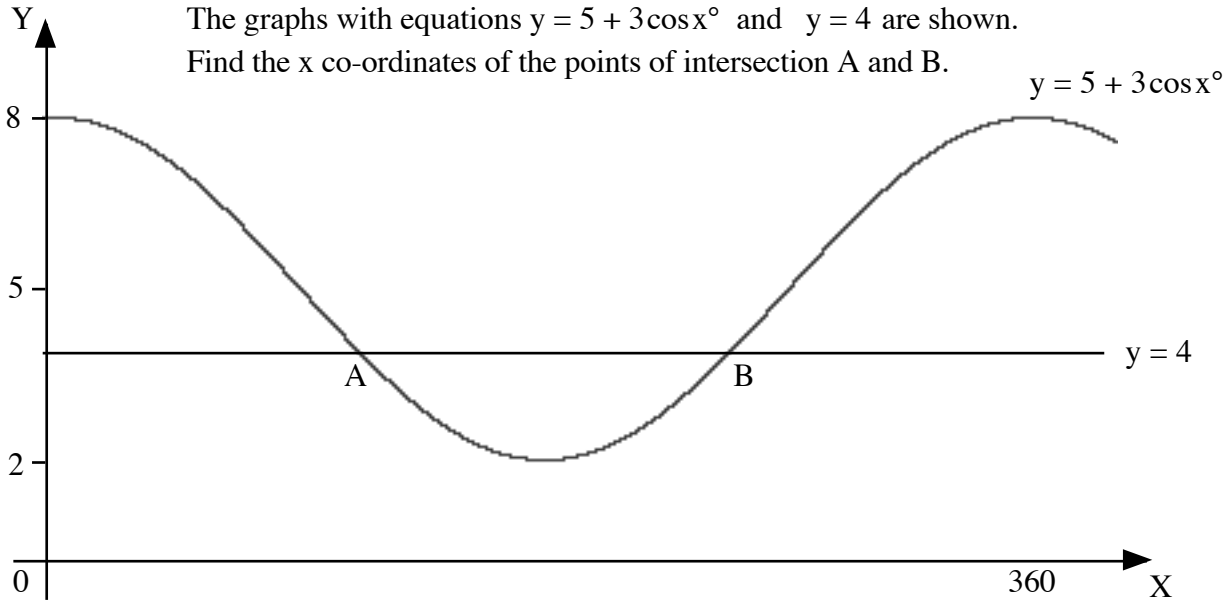
The graph is $y = 8 \sin(x +10)°$.



The graph is $y = 5 \sin(x -10)°$.



The graphs with equations $y = 5 + 3\cos x°$ and $y = 4$ are shown.
Find the x co-ordinates of the points of intersection A and B.



$5 + 3\cos x° = 4$

$3\cos x° = -1$

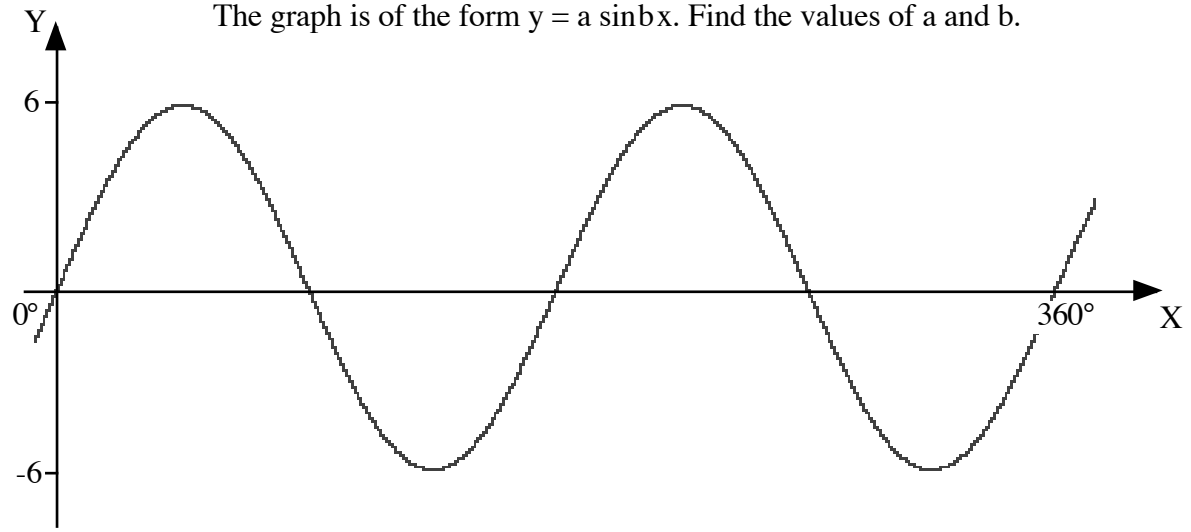
$\cos x° = -1/3$

$x = 109{\cdot}5$ or $x = 250{\cdot}5$

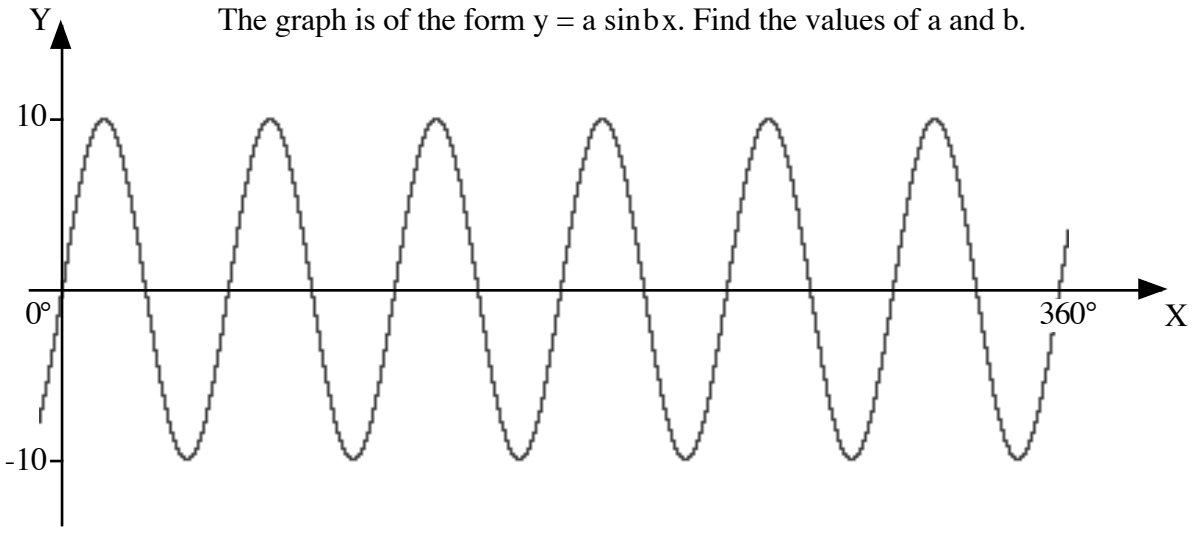
A, S, T, C where functions positive:

S	A
cos -	cos +
$180 - a = 109{\cdot}5°$	$a = \cos^{-1} 1/3 = 70{\cdot}528...°$
$180 + a = 250{\cdot}5°$	$360 - a = 289{\cdot}5°$
cos -	cos +
T	C

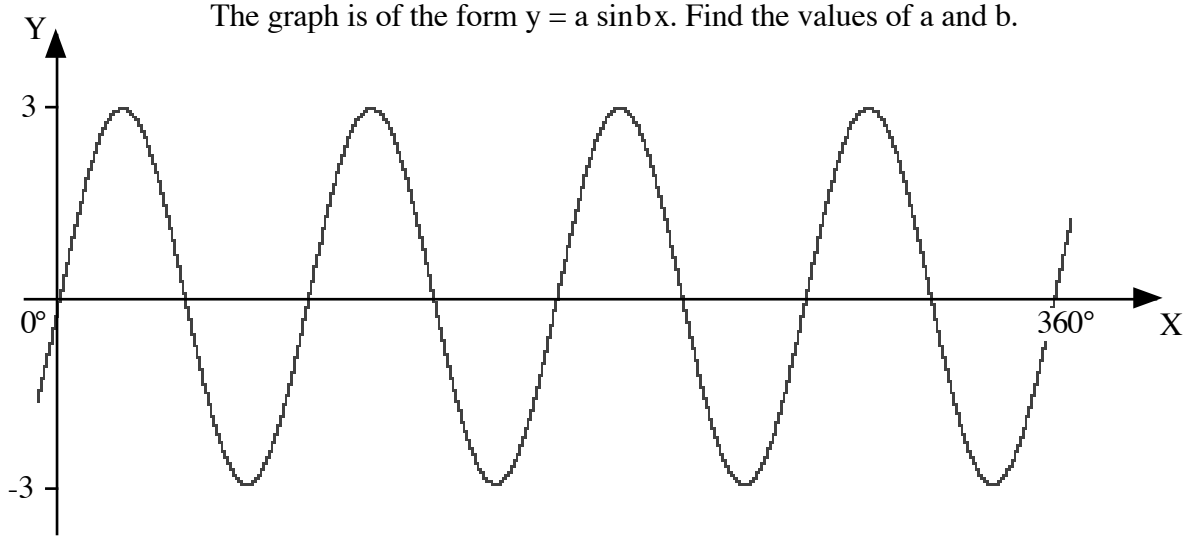
1. The graph is of the form y = a sinbx. Find the values of a and b.



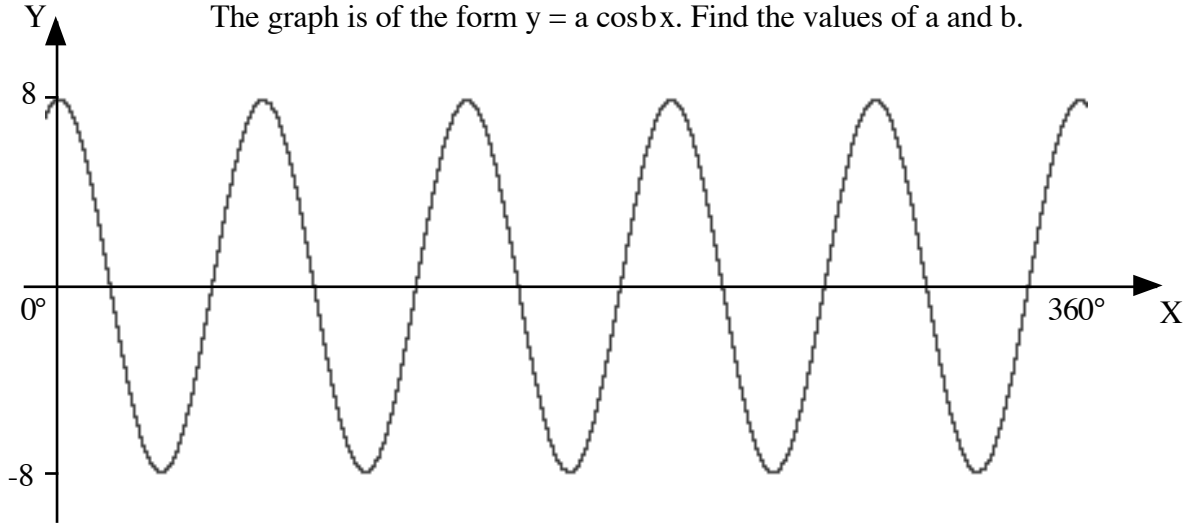
2. The graph is of the form y = a sinbx. Find the values of a and b.



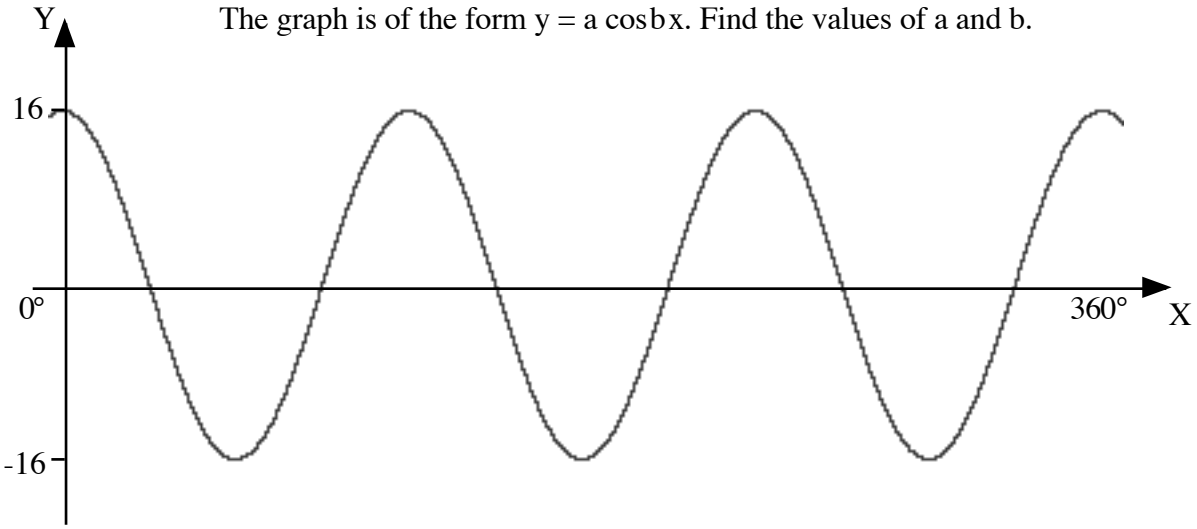
3. The graph is of the form y = a sinbx. Find the values of a and b.



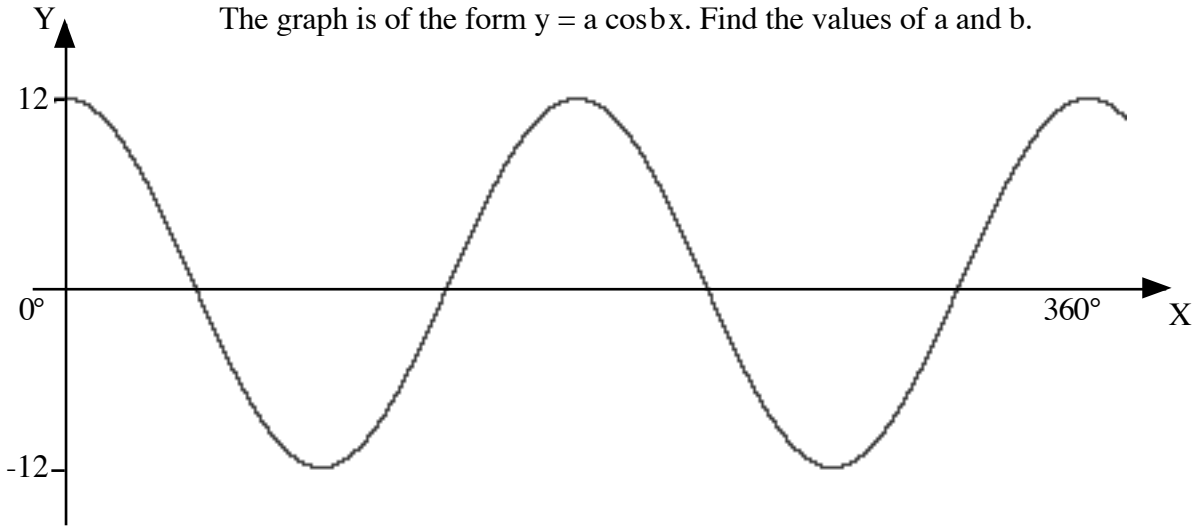
4. The graph is of the form $y = a\cos bx$. Find the values of a and b.



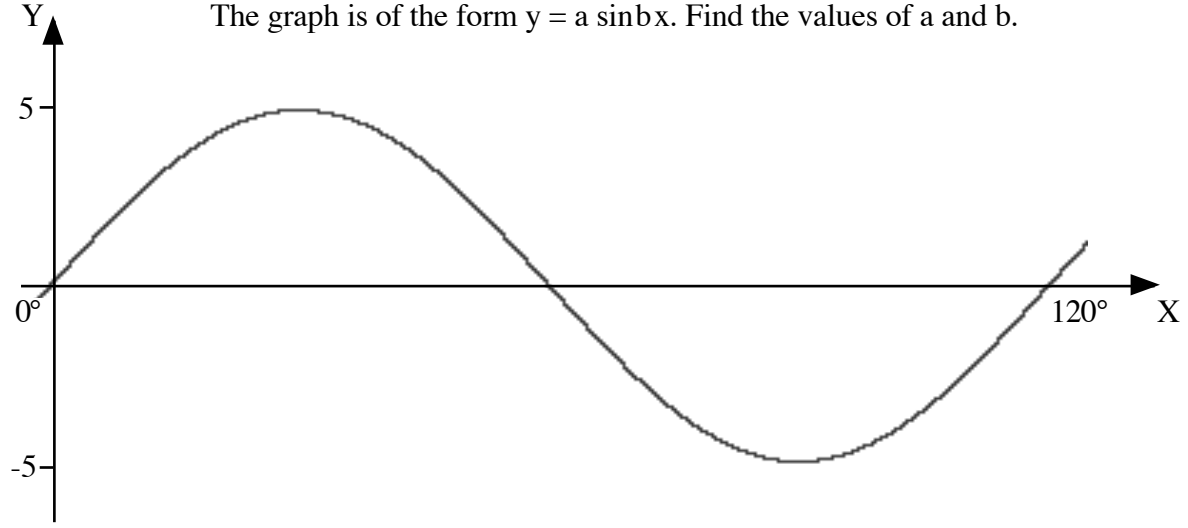
5. The graph is of the form $y = a\cos bx$. Find the values of a and b.



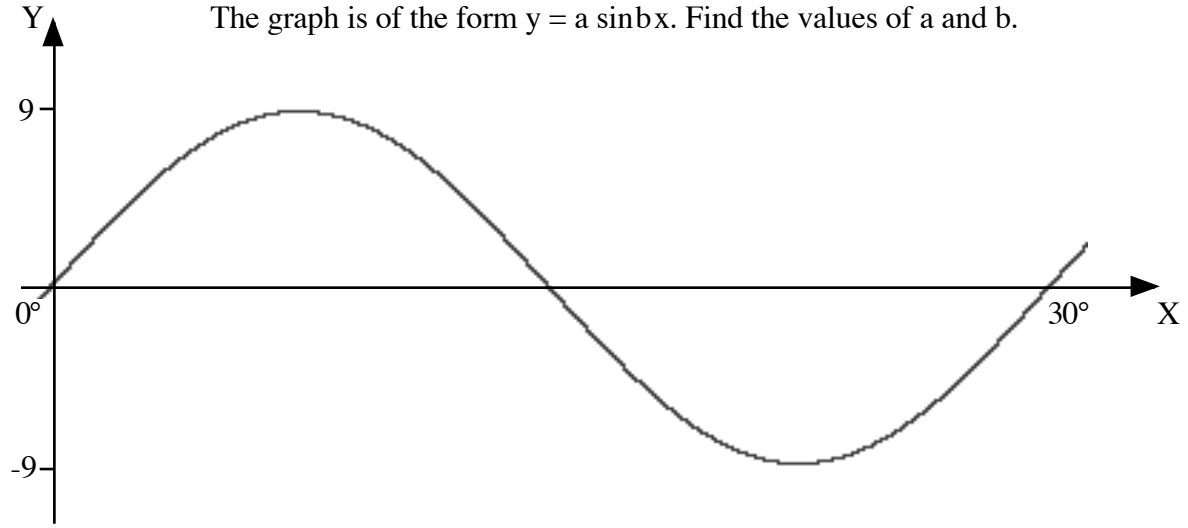
6. The graph is of the form $y = a\cos bx$. Find the values of a and b.



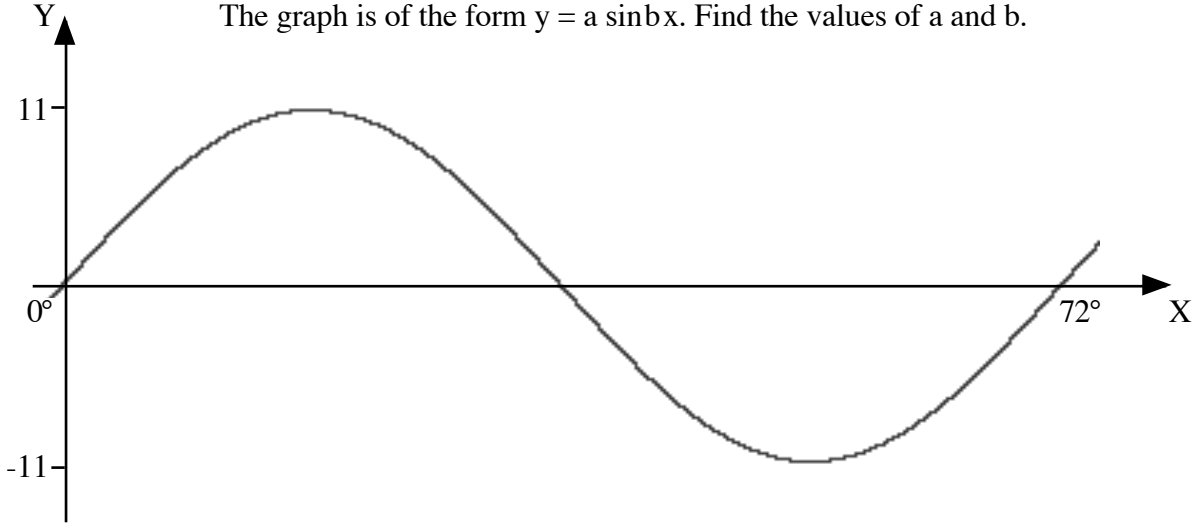
7. The graph is of the form y = a sin bx. Find the values of a and b.



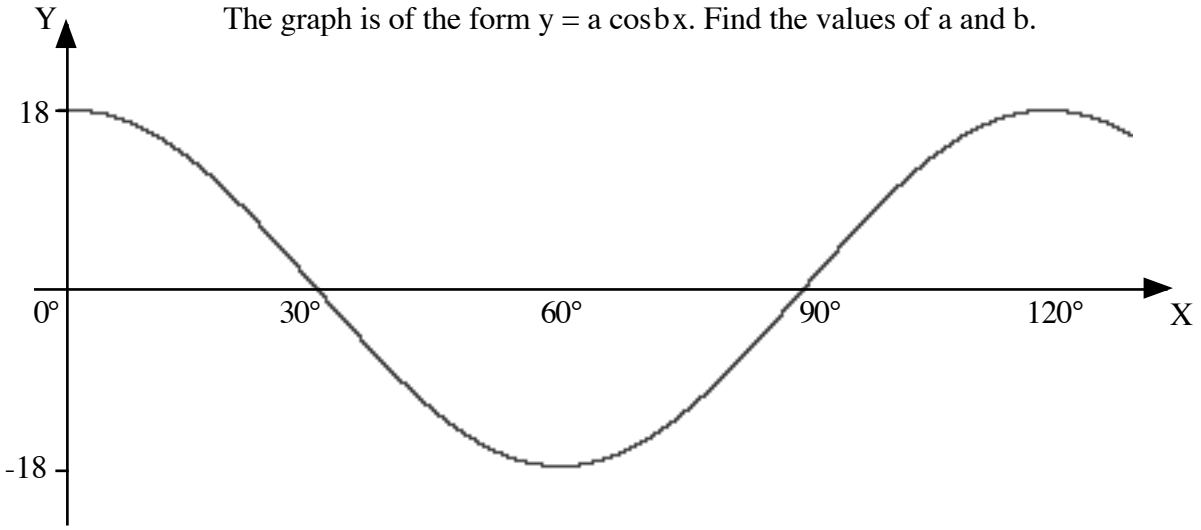
8. The graph is of the form y = a sin bx. Find the values of a and b.



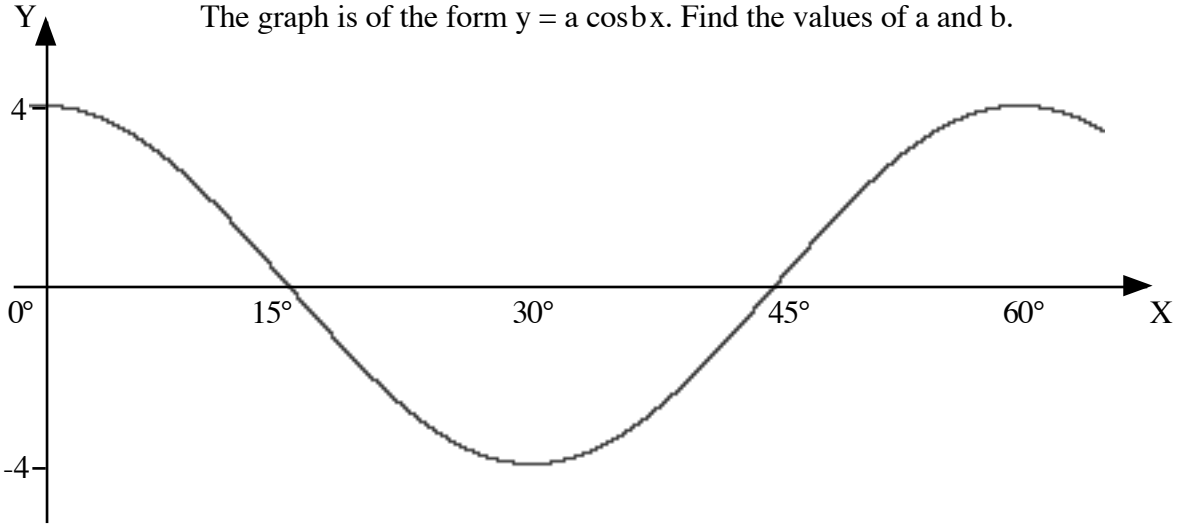
9. The graph is of the form y = a sin bx. Find the values of a and b.



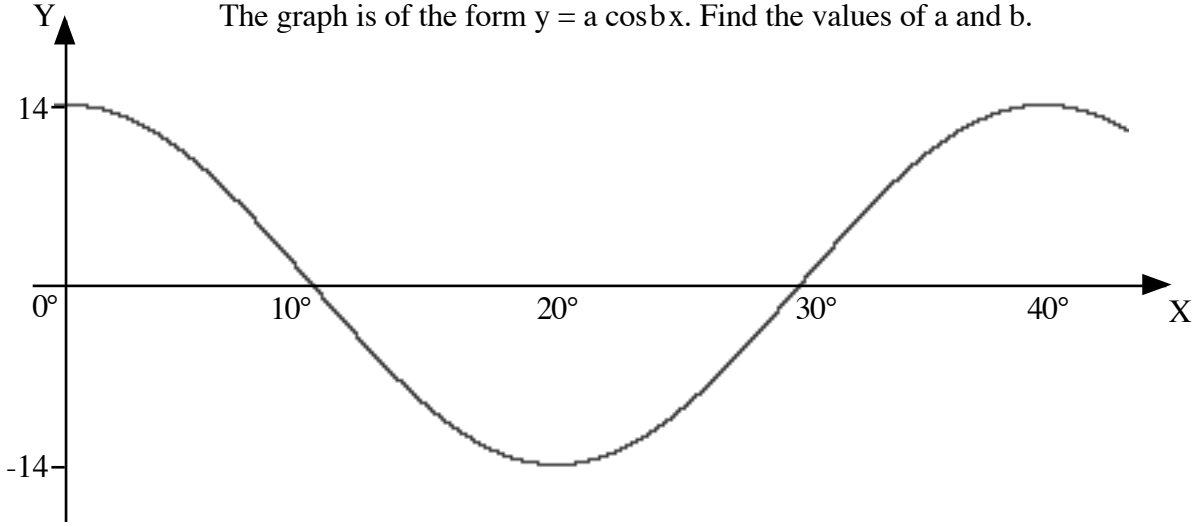
10. The graph is of the form y = a cos bx. Find the values of a and b.



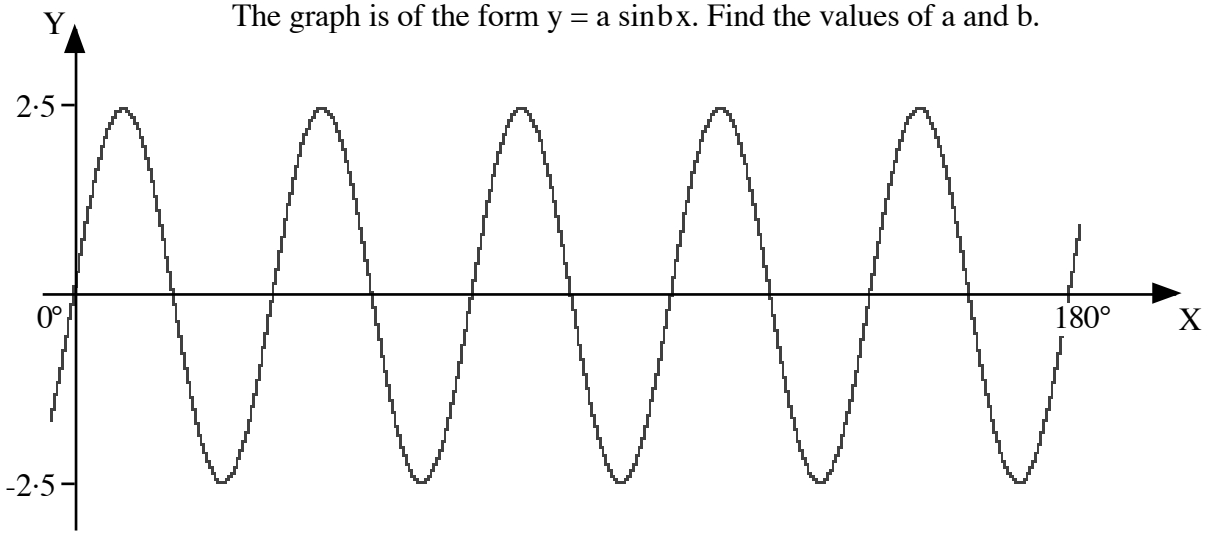
11. The graph is of the form y = a cos bx. Find the values of a and b.



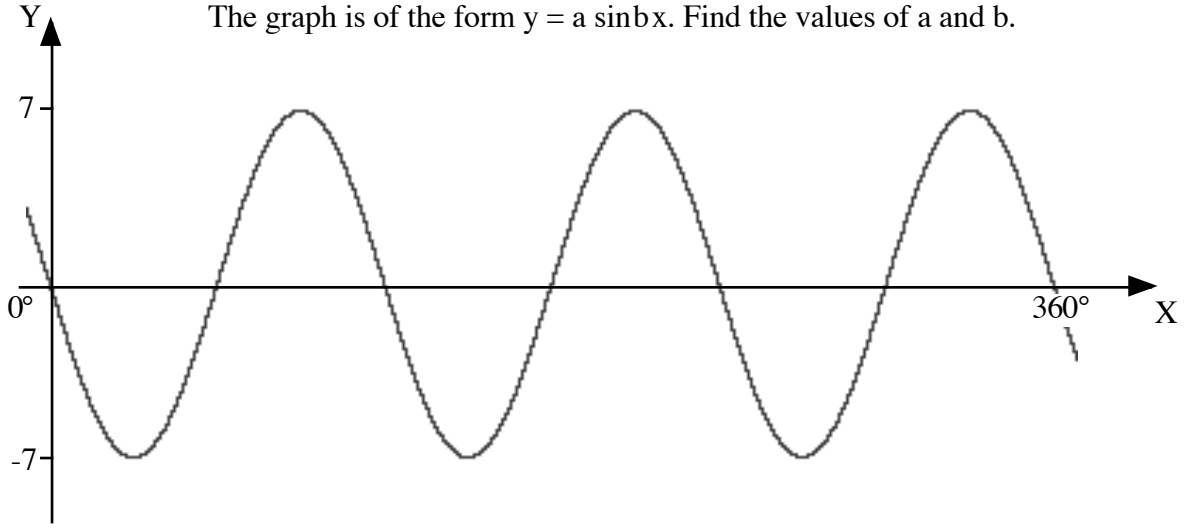
12. The graph is of the form y = a cos bx. Find the values of a and b.



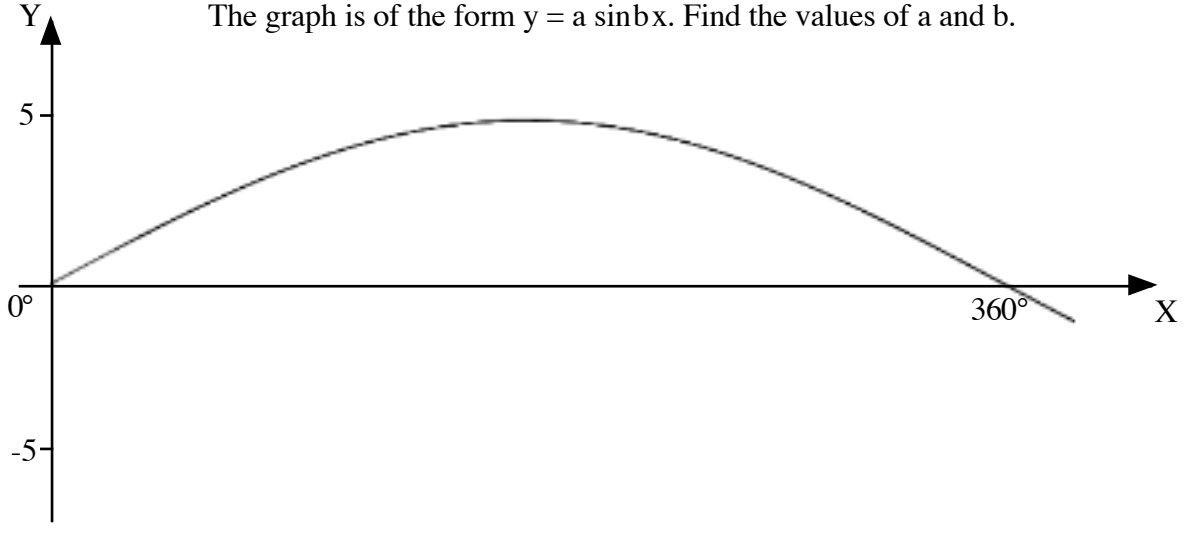
13. The graph is of the form y = a sinbx. Find the values of a and b.



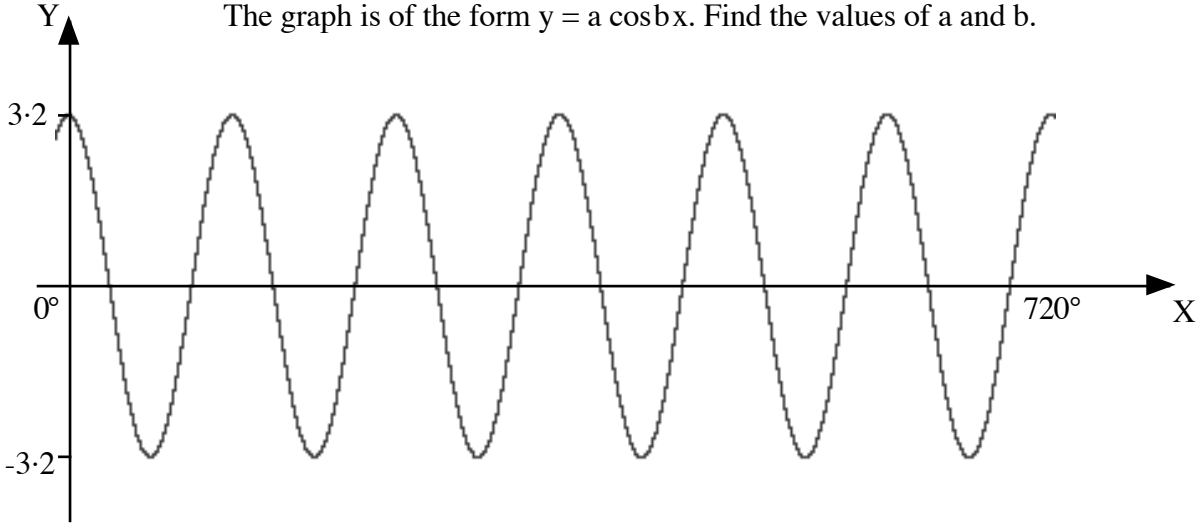
14. The graph is of the form y = a sinbx. Find the values of a and b.



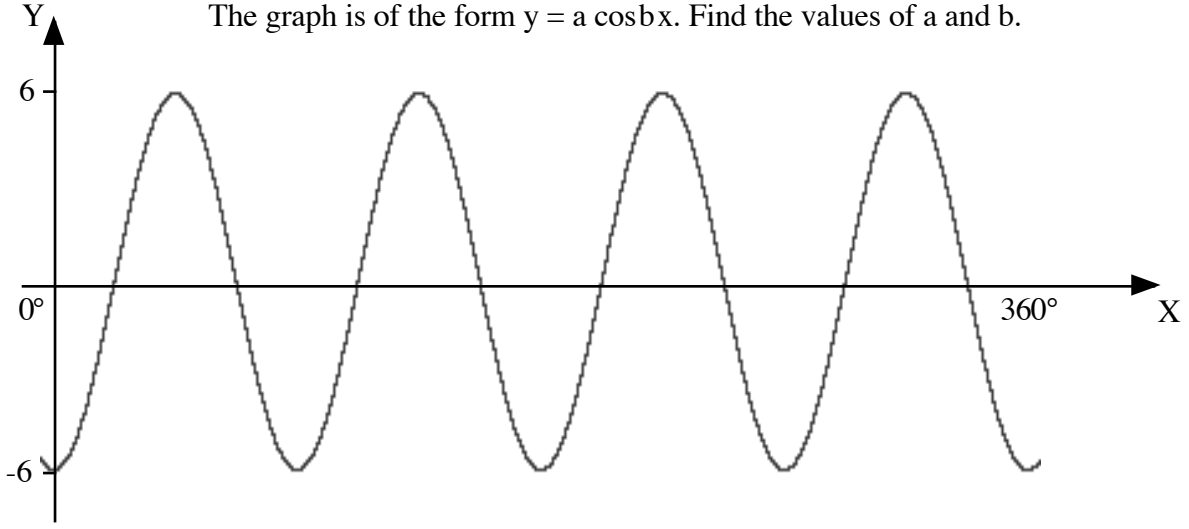
15. The graph is of the form y = a sinbx. Find the values of a and b.



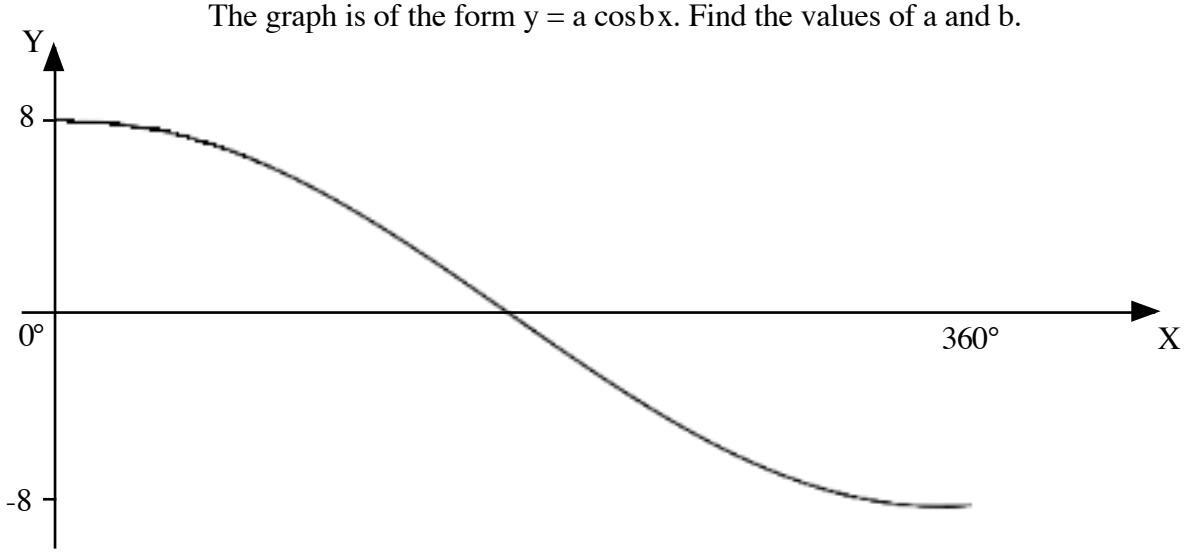
16. The graph is of the form y = a cos bx. Find the values of a and b.



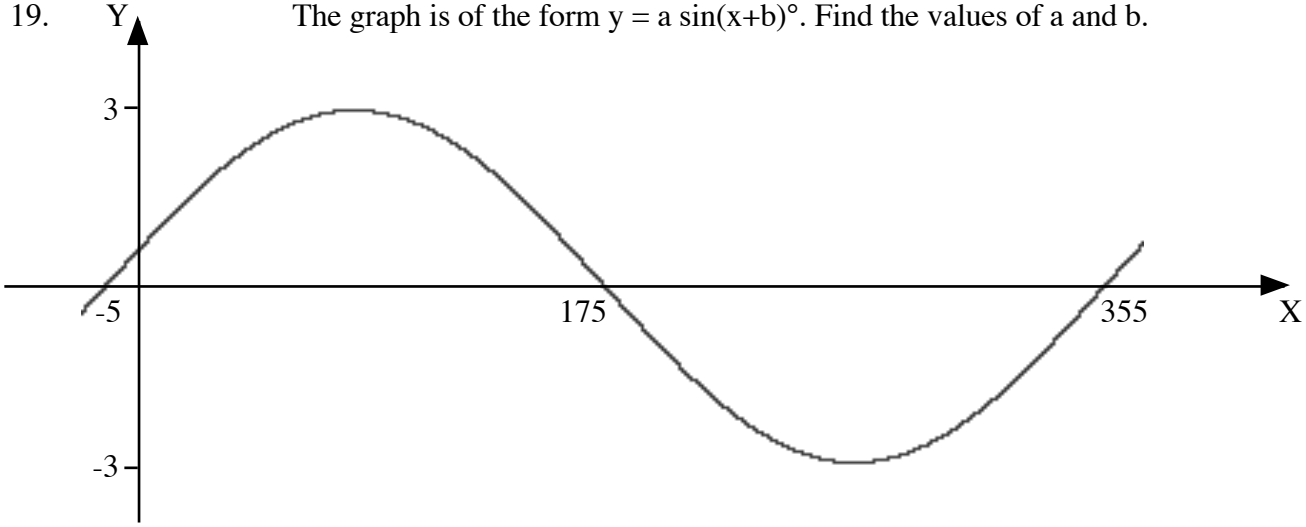
17. The graph is of the form y = a cos bx. Find the values of a and b.



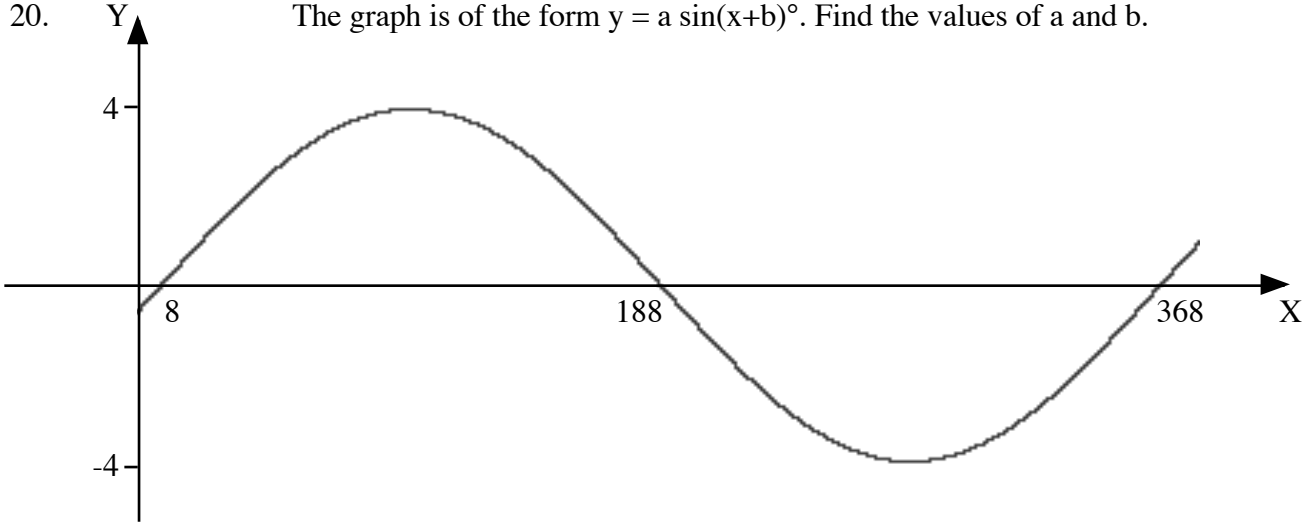
18. The graph is of the form y = a cos bx. Find the values of a and b.



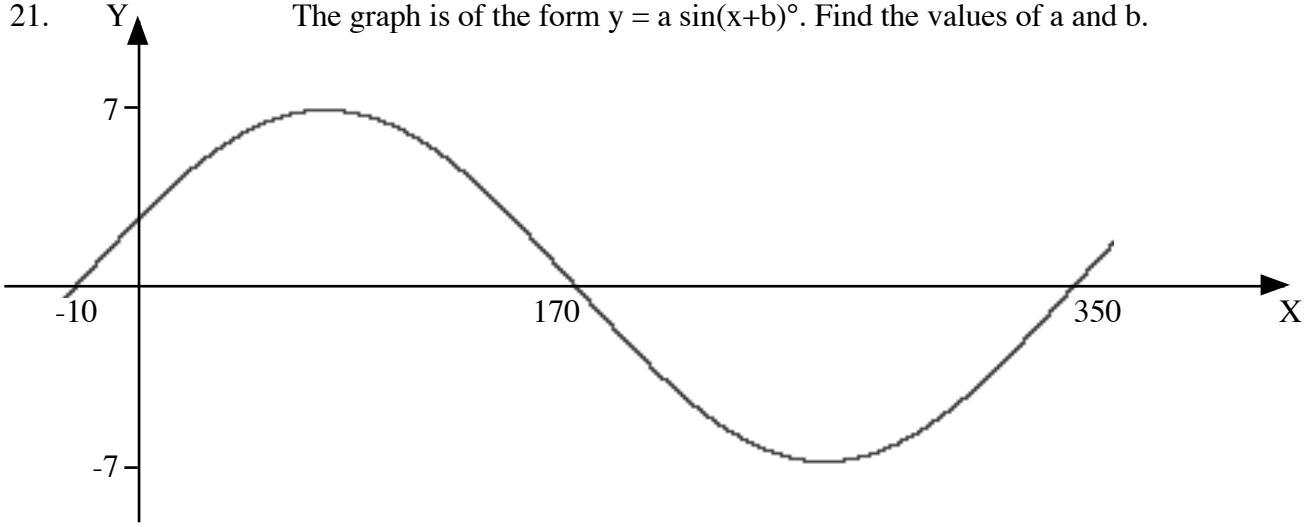
19. The graph is of the form y = a sin(x+b)°. Find the values of a and b.



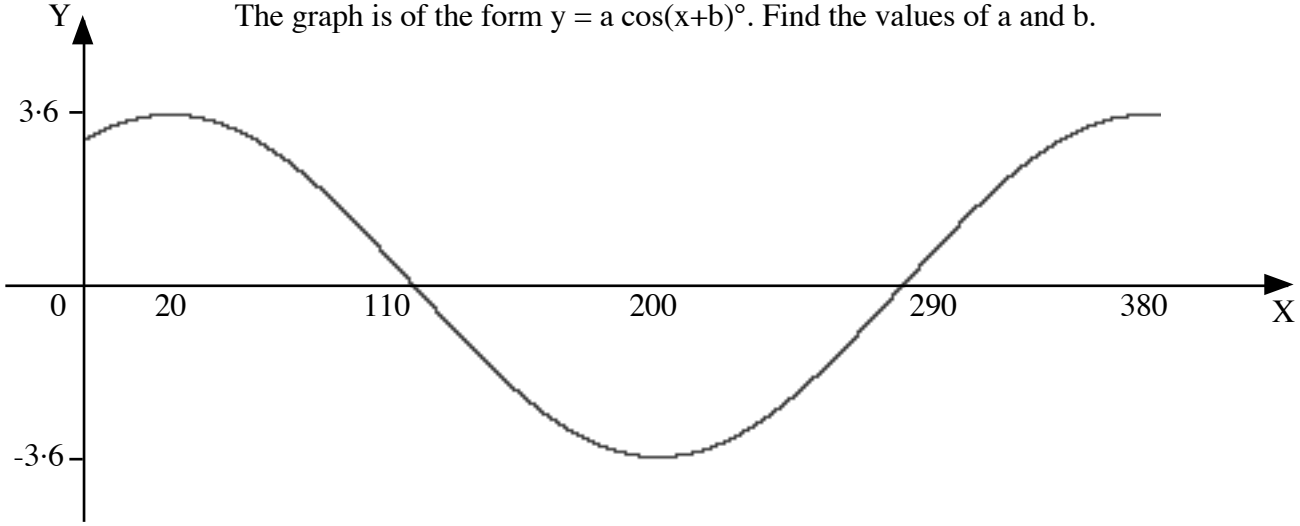
20. The graph is of the form y = a sin(x+b)°. Find the values of a and b.



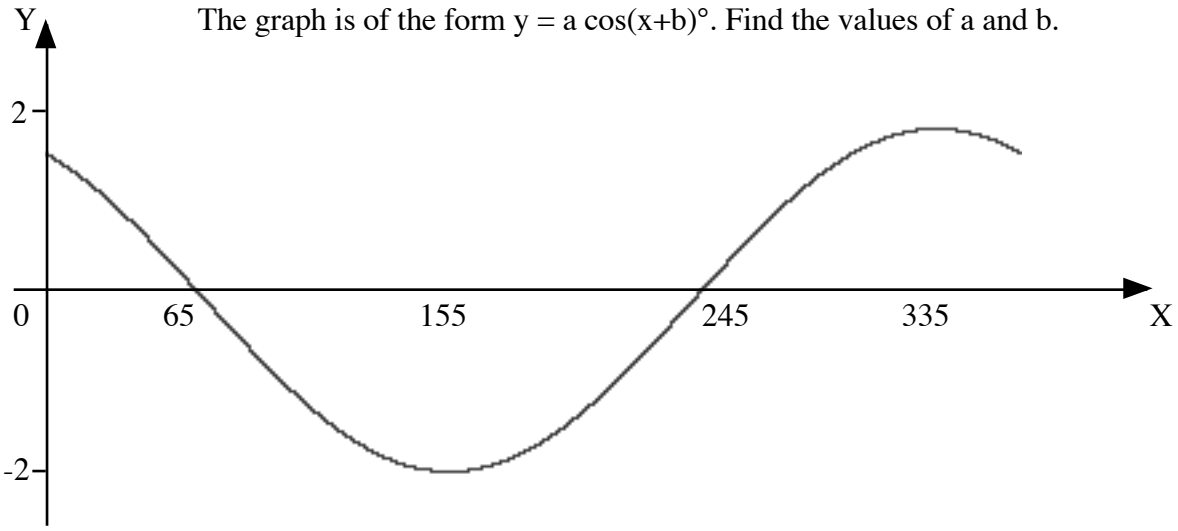
21. The graph is of the form y = a sin(x+b)°. Find the values of a and b.



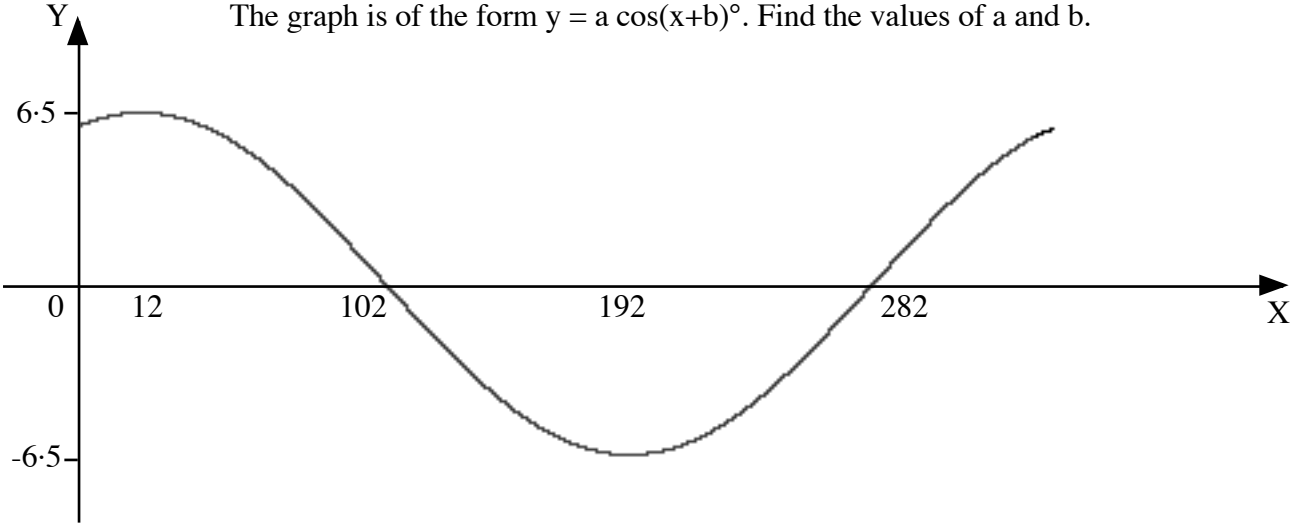
22. The graph is of the form y = a cos(x+b)°. Find the values of a and b.



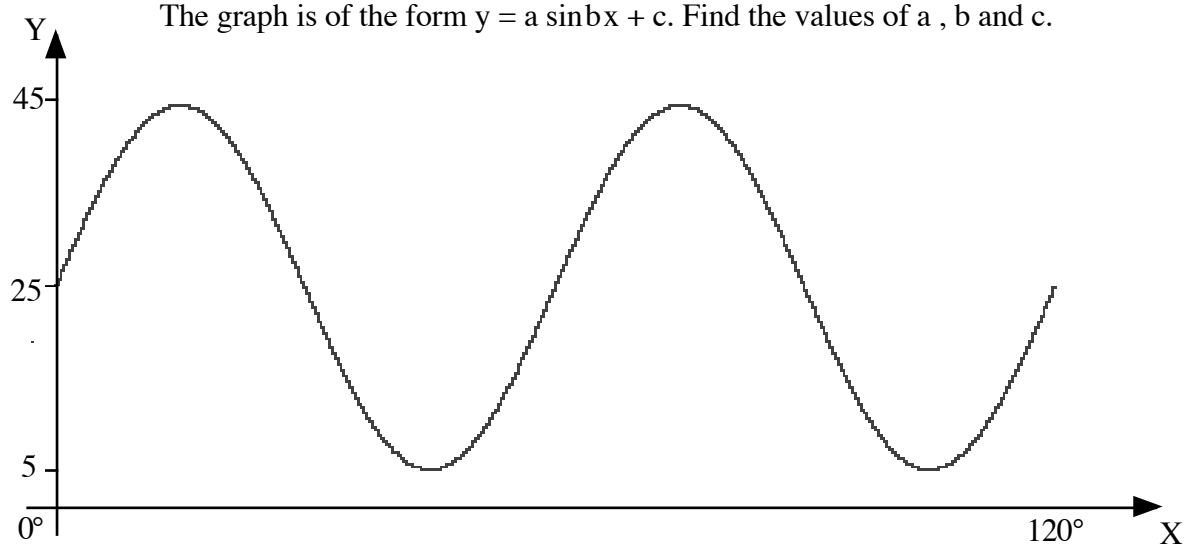
23. The graph is of the form y = a cos(x+b)°. Find the values of a and b.



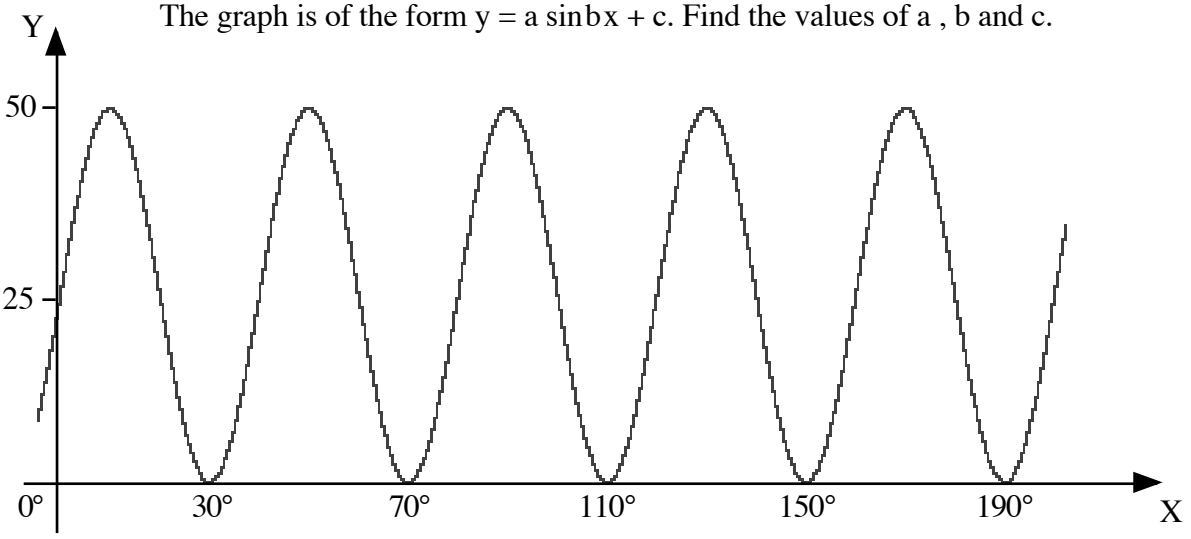
24. The graph is of the form y = a cos(x+b)°. Find the values of a and b.



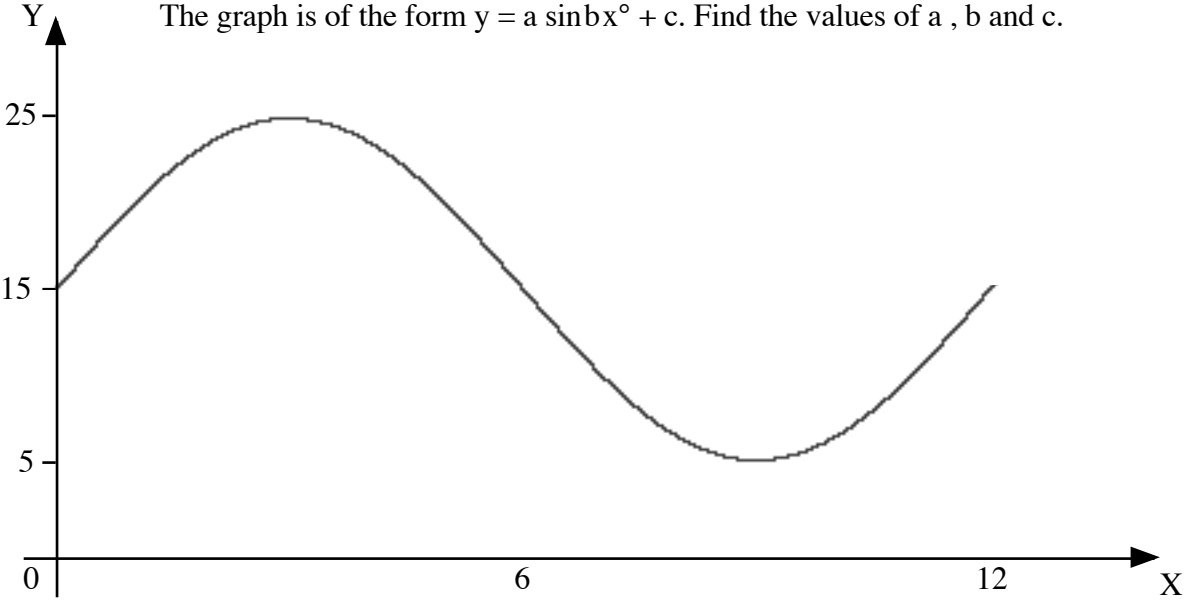
25. The graph is of the form y = a sin bx + c. Find the values of a , b and c.



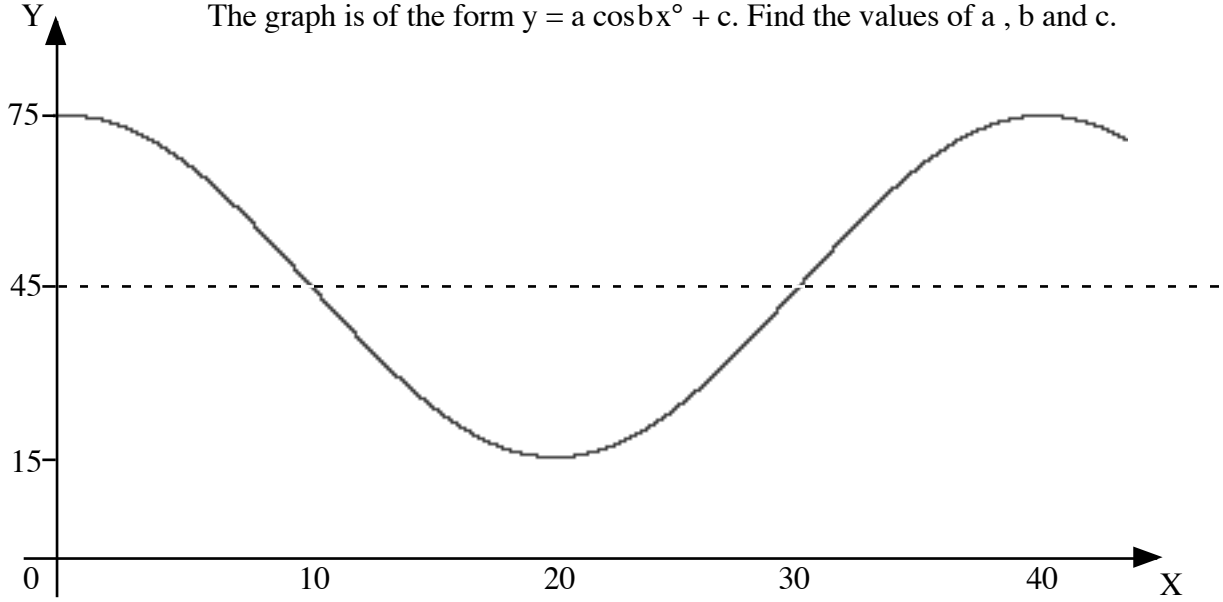
26. The graph is of the form y = a sin bx + c. Find the values of a , b and c.



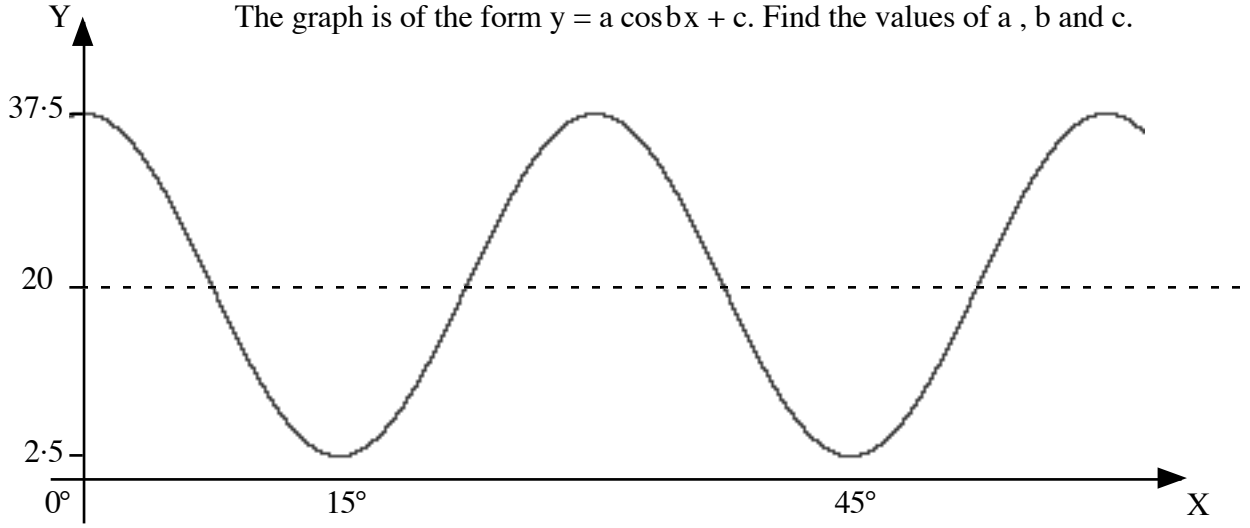
27. The graph is of the form y = a sin bx° + c. Find the values of a , b and c.



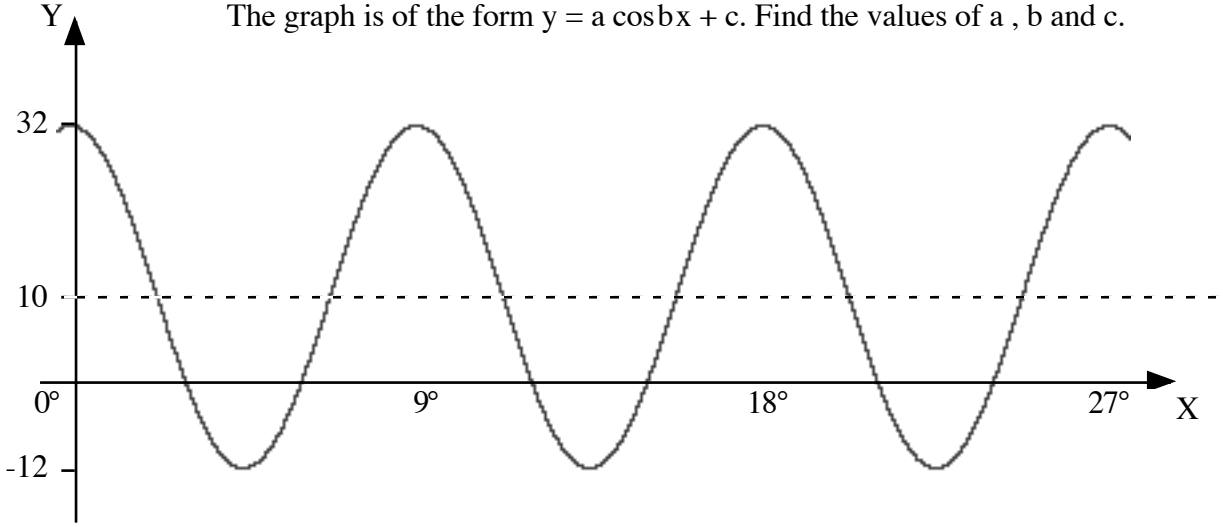
28. The graph is of the form y = a cos bx° + c. Find the values of a , b and c.



29. The graph is of the form y = a cos bx + c. Find the values of a , b and c.

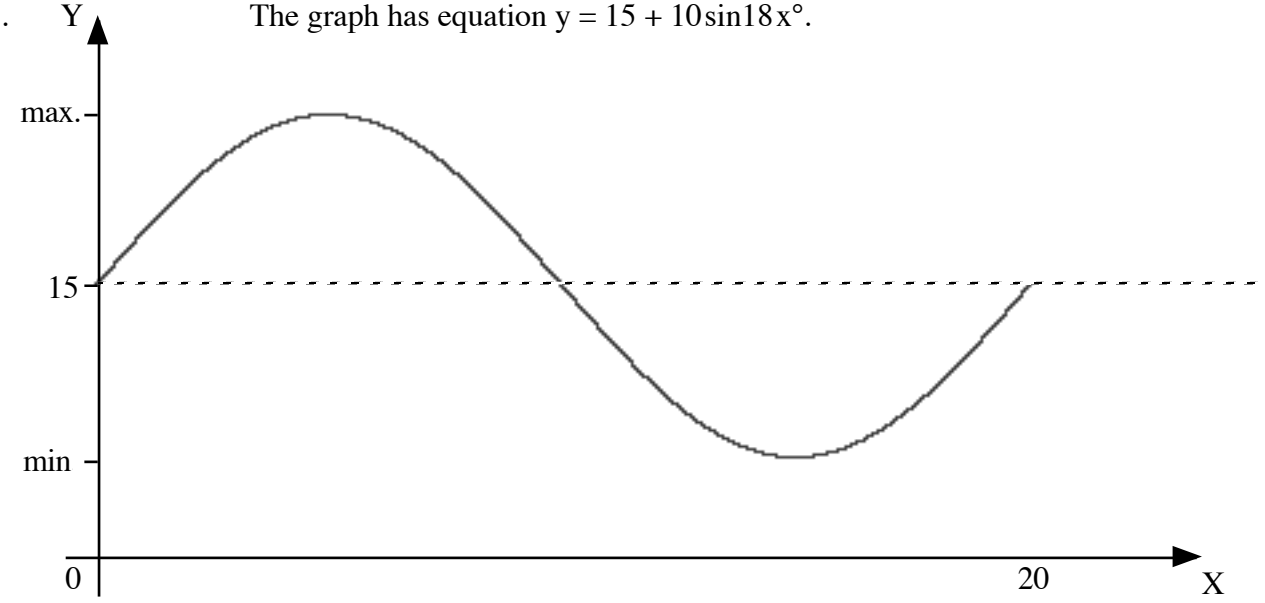


30. The graph is of the form y = a cos bx + c. Find the values of a , b and c.

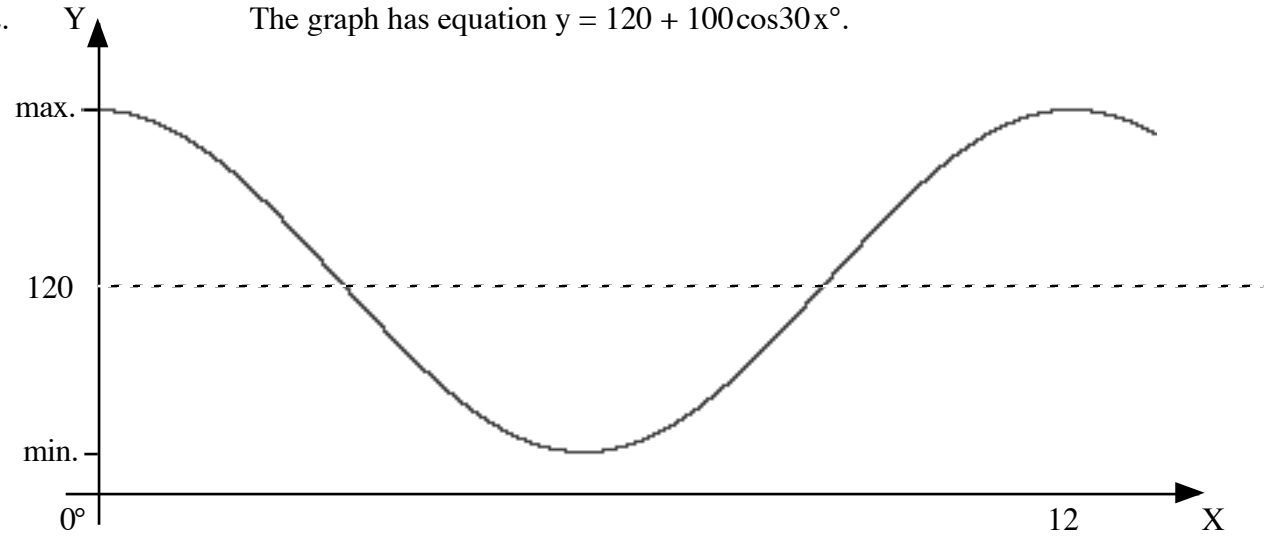


For questions 31 to 36 find the co-ordinates of the maximum and minimum turning points of the graph.

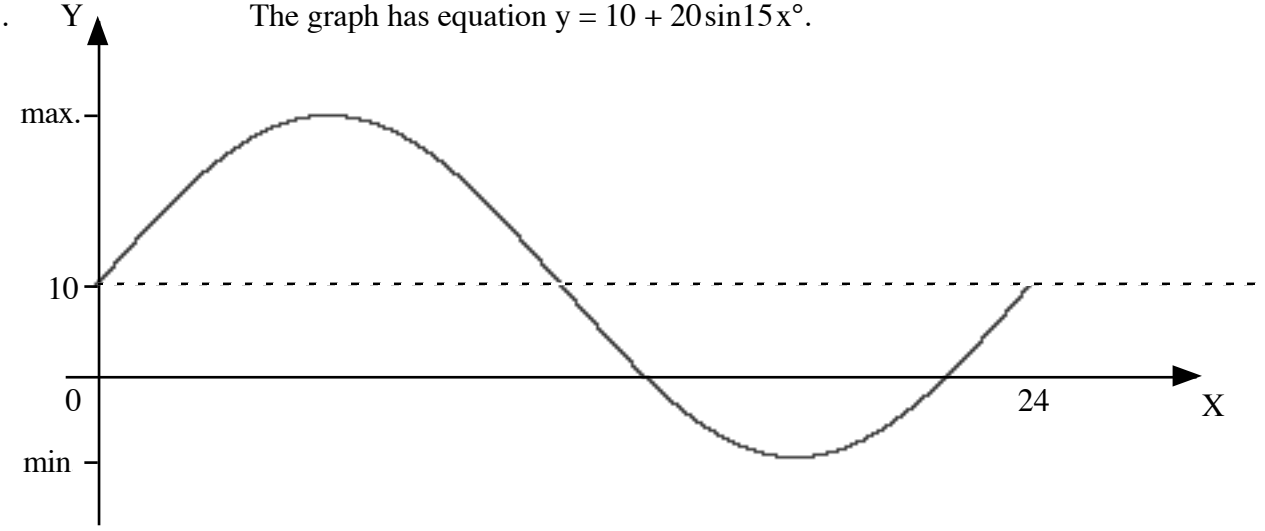
31. The graph has equation $y = 15 + 10\sin 18x°$.



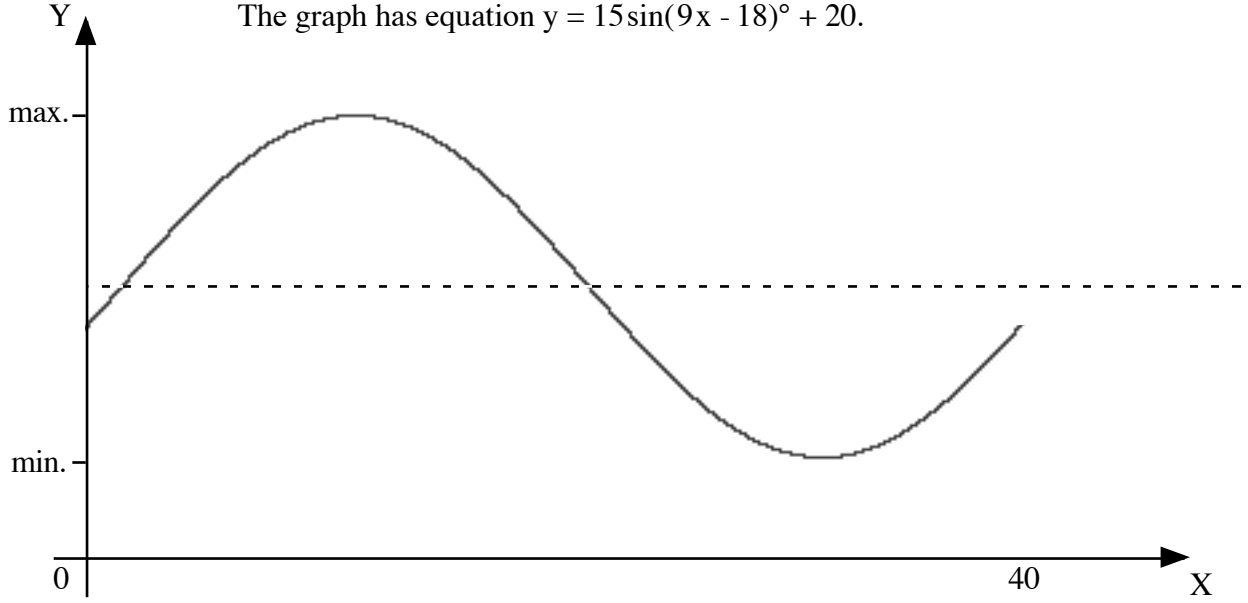
32. The graph has equation $y = 120 + 100\cos 30x°$.



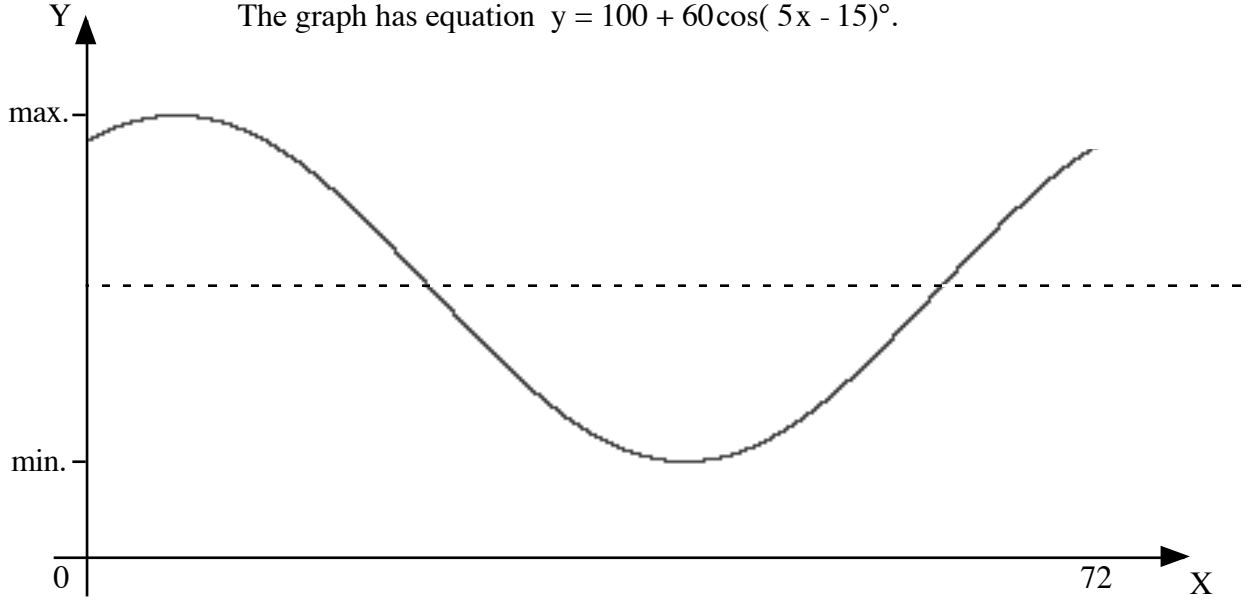
33. The graph has equation $y = 10 + 20\sin 15x°$.



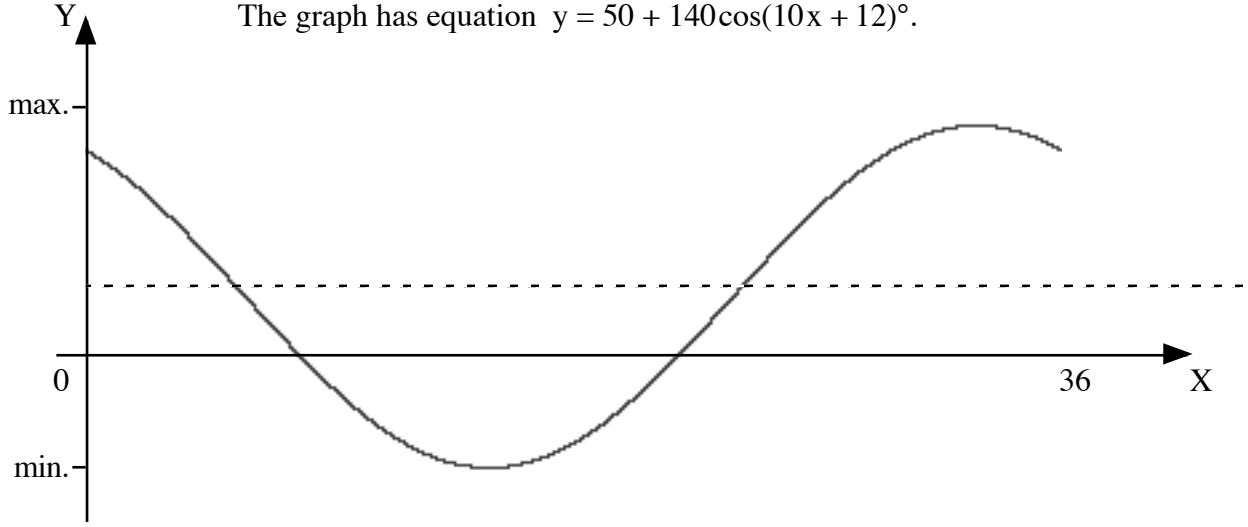
34. The graph has equation $y = 15\sin(9x - 18)° + 20$.



35. The graph has equation $y = 100 + 60\cos(5x - 15)°$.

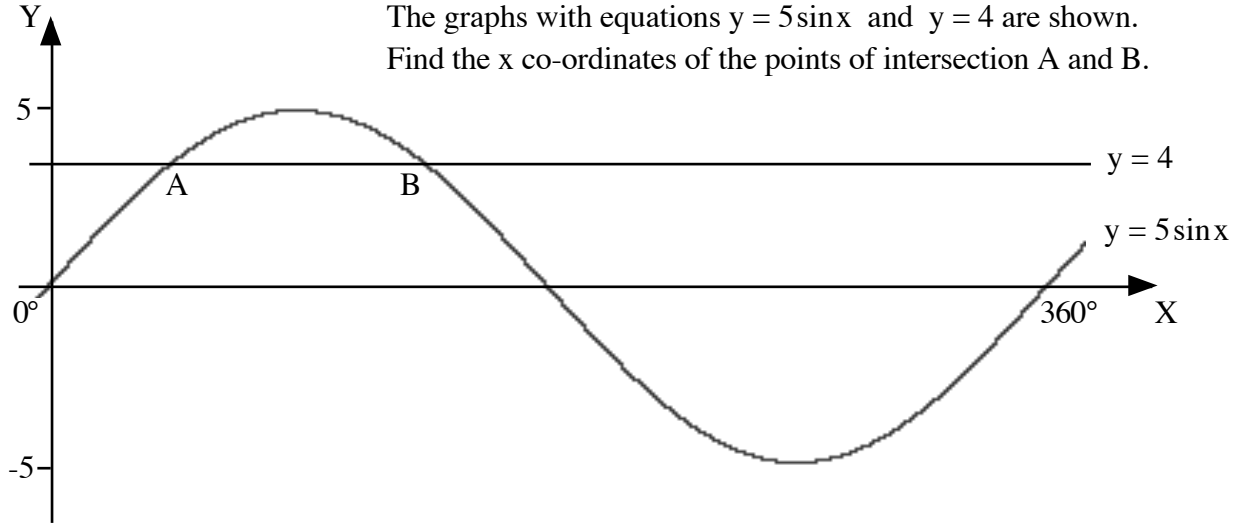


36. The graph has equation $y = 50 + 140\cos(10x + 12)°$.

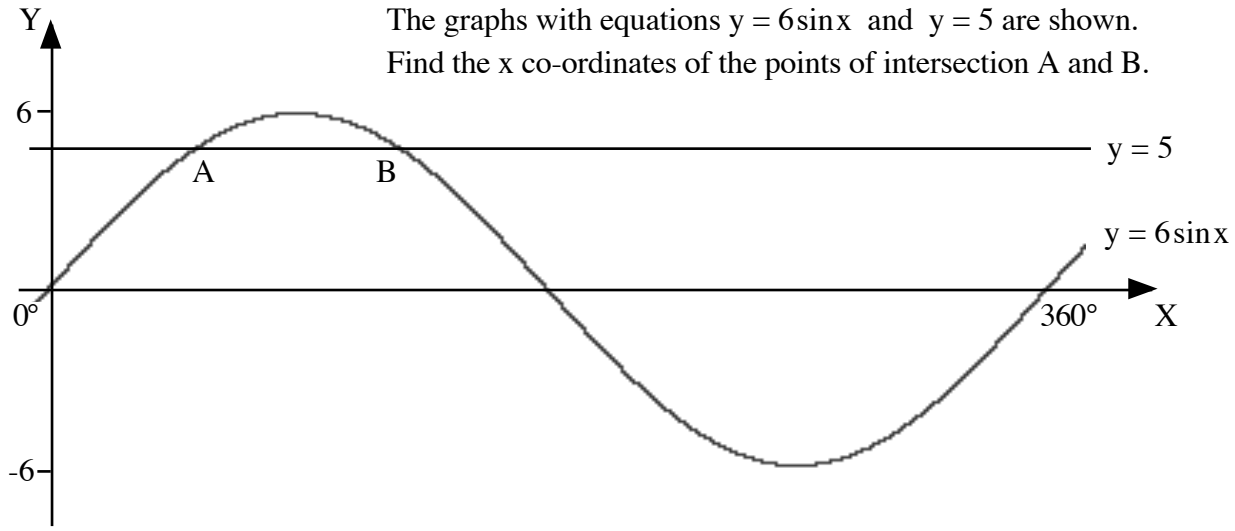


For questions 37 to 51 give your answers correct to one decimal place.

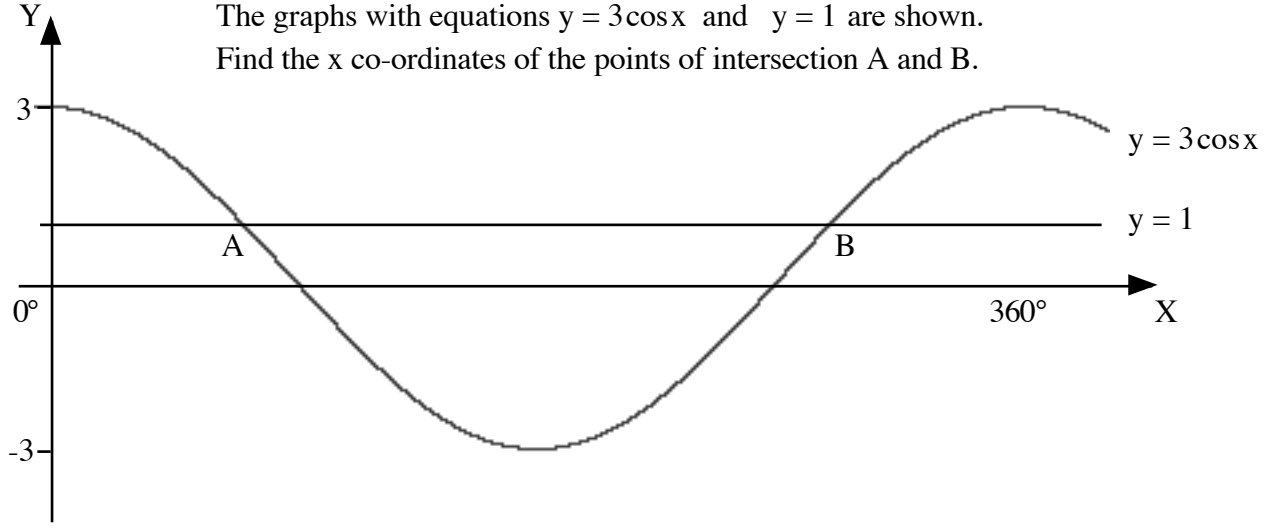
37. The graphs with equations $y = 5\sin x$ and $y = 4$ are shown.
Find the x co-ordinates of the points of intersection A and B.



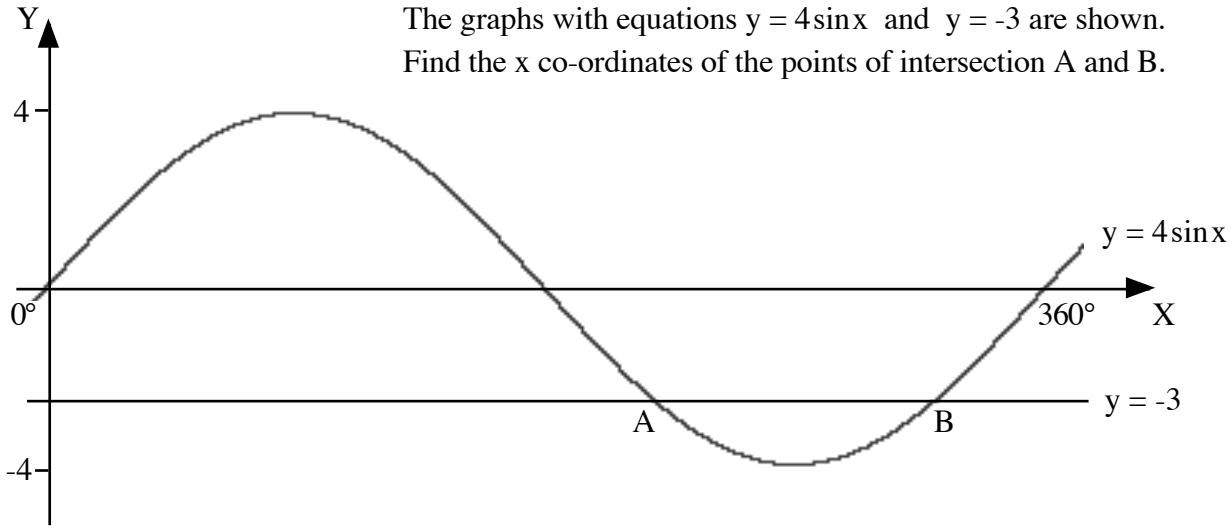
38. The graphs with equations $y = 6\sin x$ and $y = 5$ are shown.
Find the x co-ordinates of the points of intersection A and B.



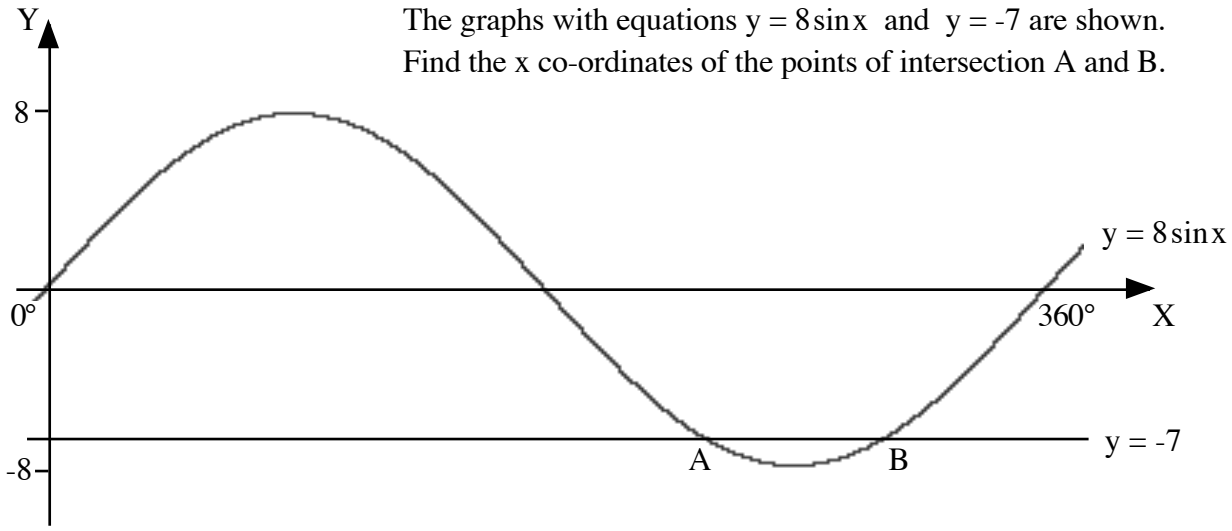
39. The graphs with equations $y = 3\cos x$ and $y = 1$ are shown.
Find the x co-ordinates of the points of intersection A and B.



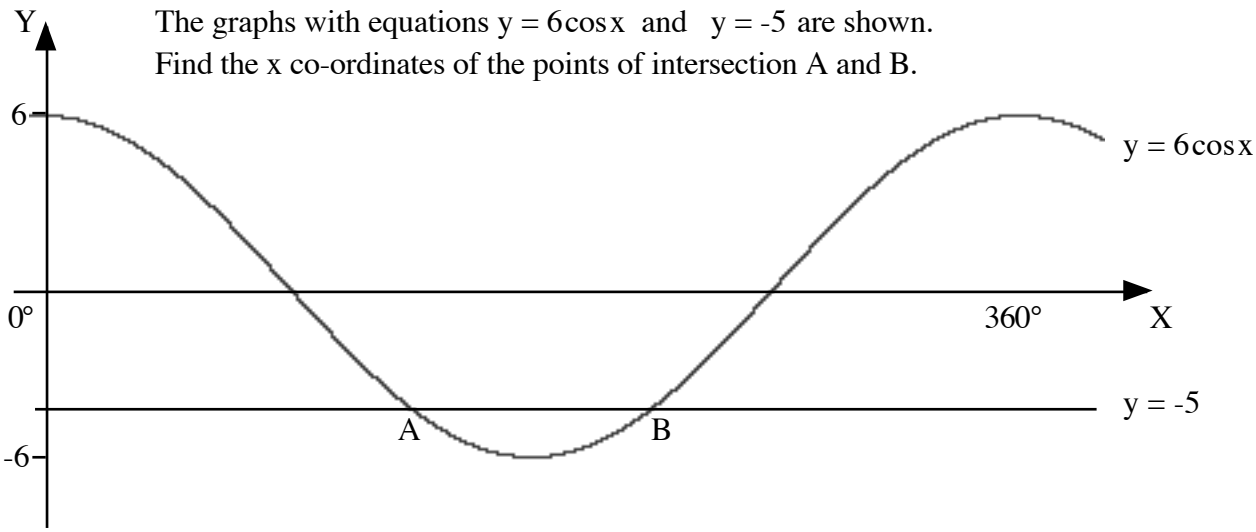
40. The graphs with equations $y = 4\sin x$ and $y = -3$ are shown.
Find the x co-ordinates of the points of intersection A and B.



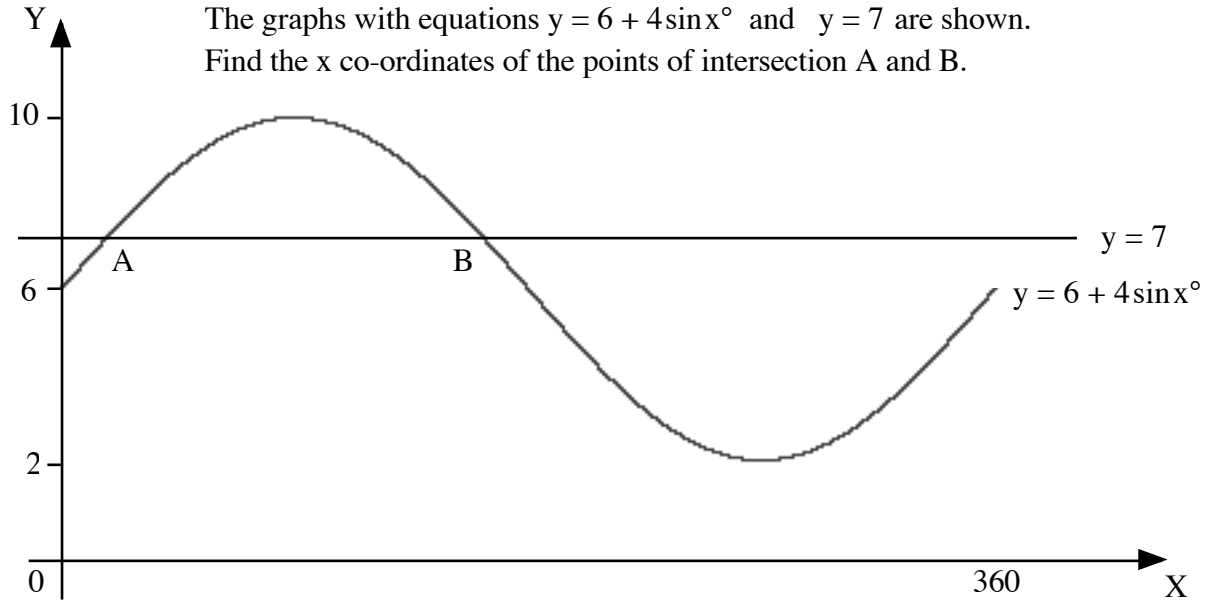
41. The graphs with equations $y = 8\sin x$ and $y = -7$ are shown.
Find the x co-ordinates of the points of intersection A and B.



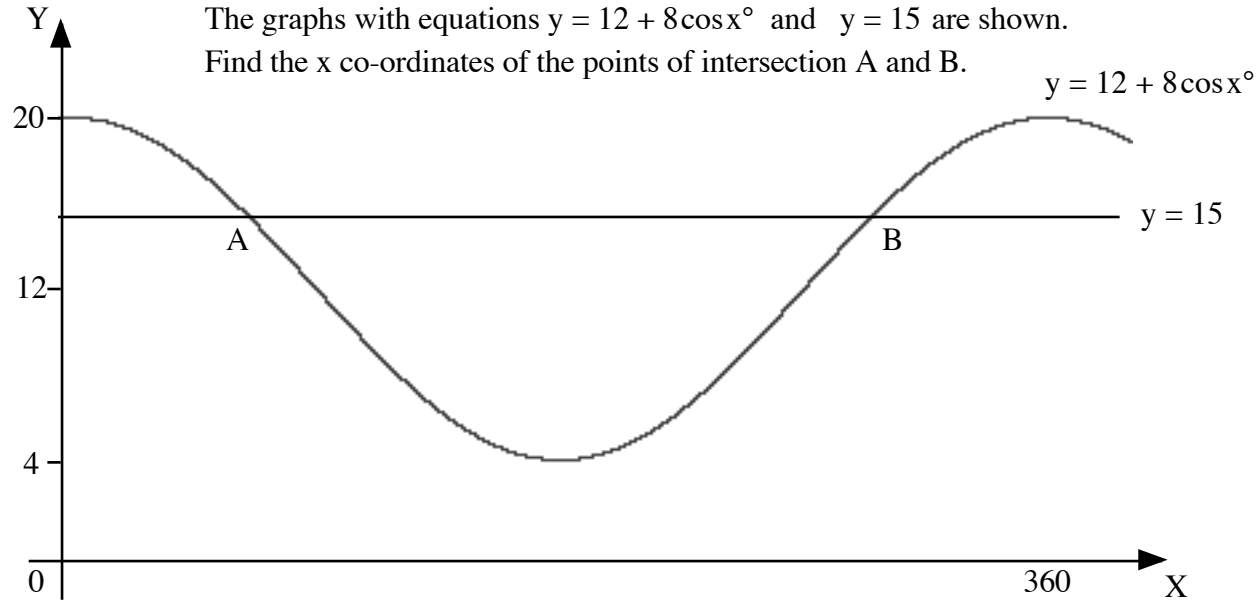
42. The graphs with equations $y = 6\cos x$ and $y = -5$ are shown.
Find the x co-ordinates of the points of intersection A and B.



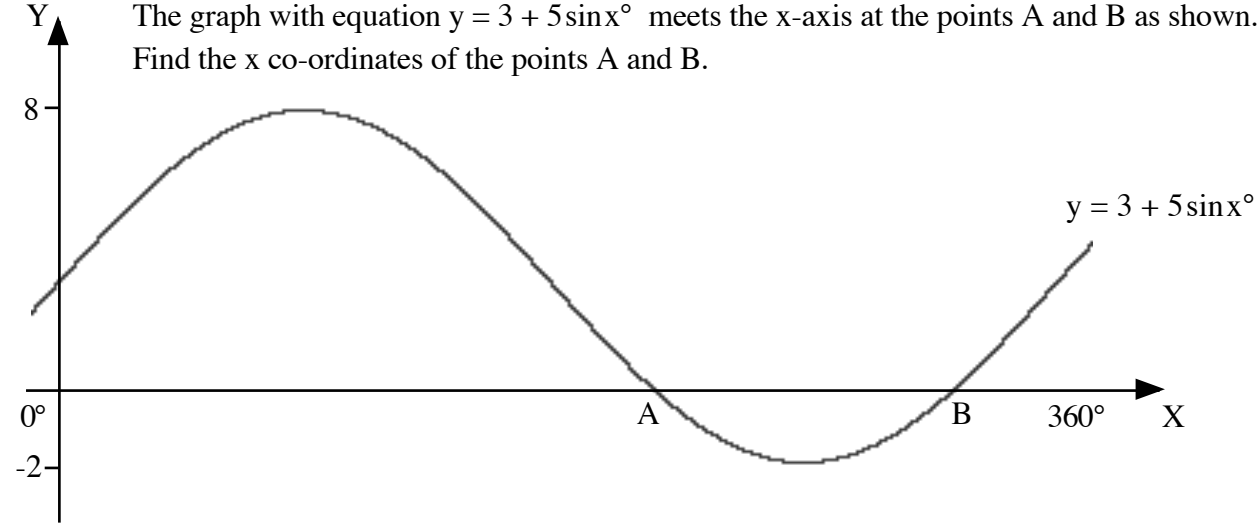
43. The graphs with equations $y = 6 + 4\sin x°$ and $y = 7$ are shown.
Find the x co-ordinates of the points of intersection A and B.



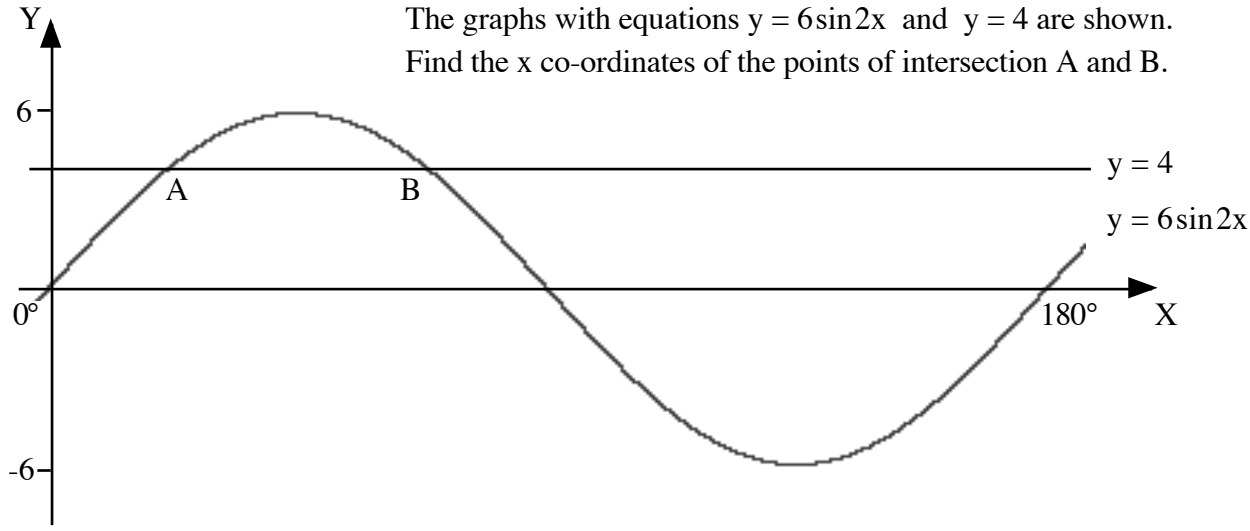
44. The graphs with equations $y = 12 + 8\cos x°$ and $y = 15$ are shown.
Find the x co-ordinates of the points of intersection A and B.



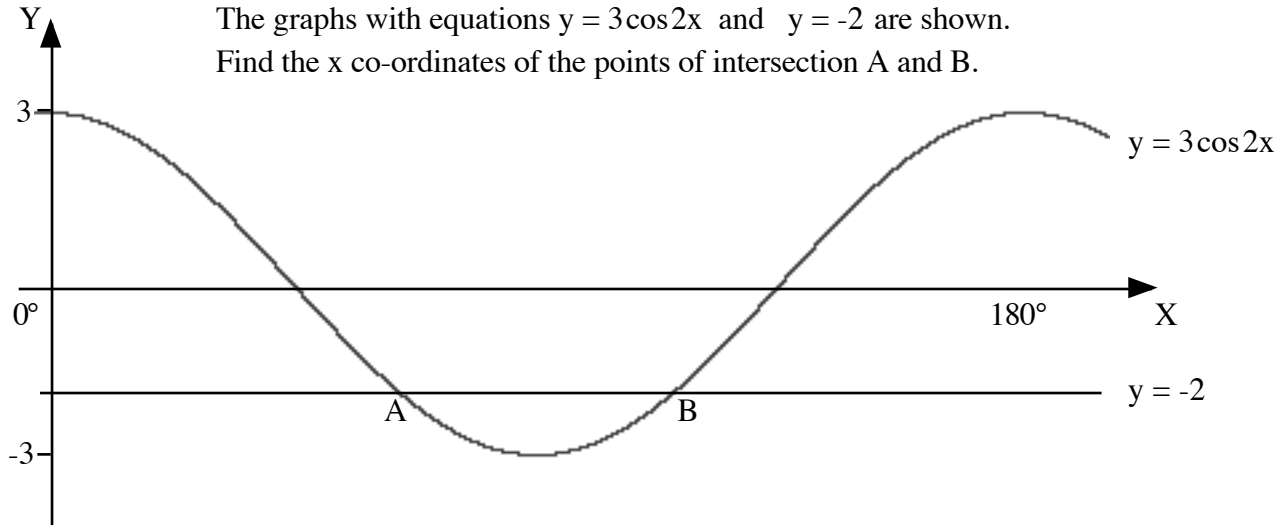
45. The graph with equation $y = 3 + 5\sin x°$ meets the x-axis at the points A and B as shown.
Find the x co-ordinates of the points A and B.



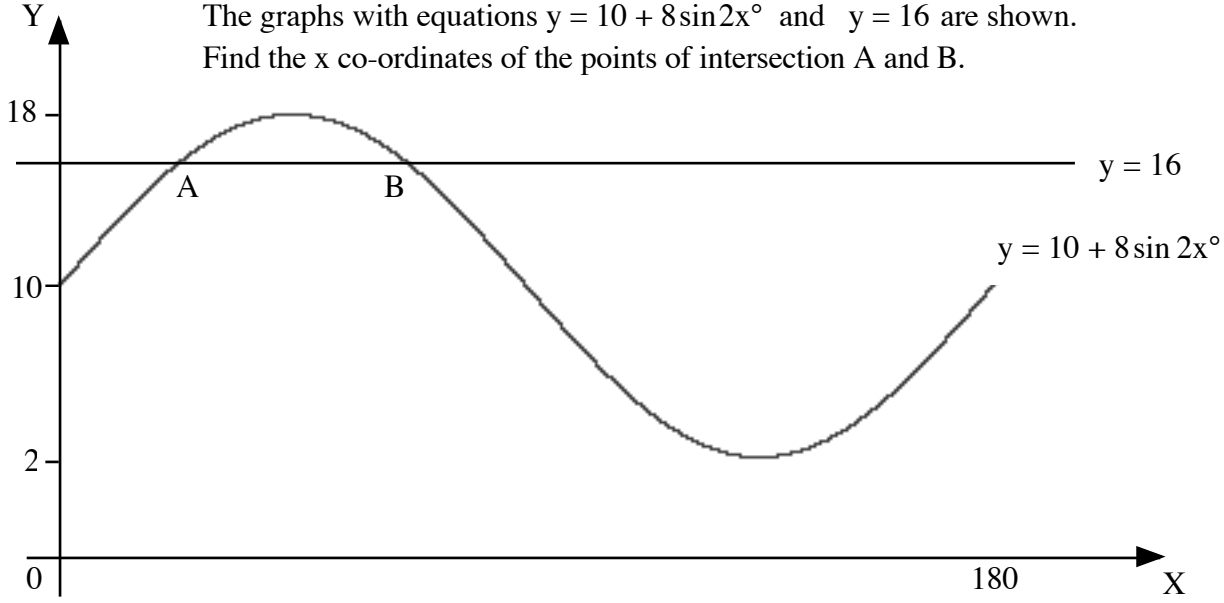
46. The graphs with equations $y = 6\sin 2x$ and $y = 4$ are shown.
Find the x co-ordinates of the points of intersection A and B.



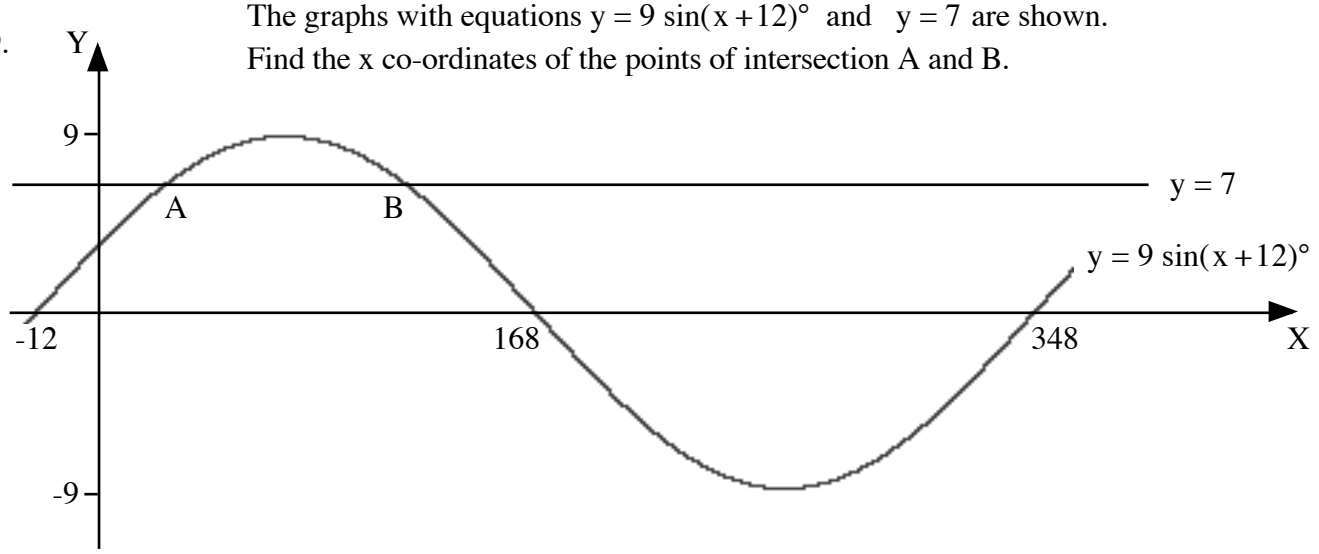
47. The graphs with equations $y = 3\cos 2x$ and $y = -2$ are shown.
Find the x co-ordinates of the points of intersection A and B.



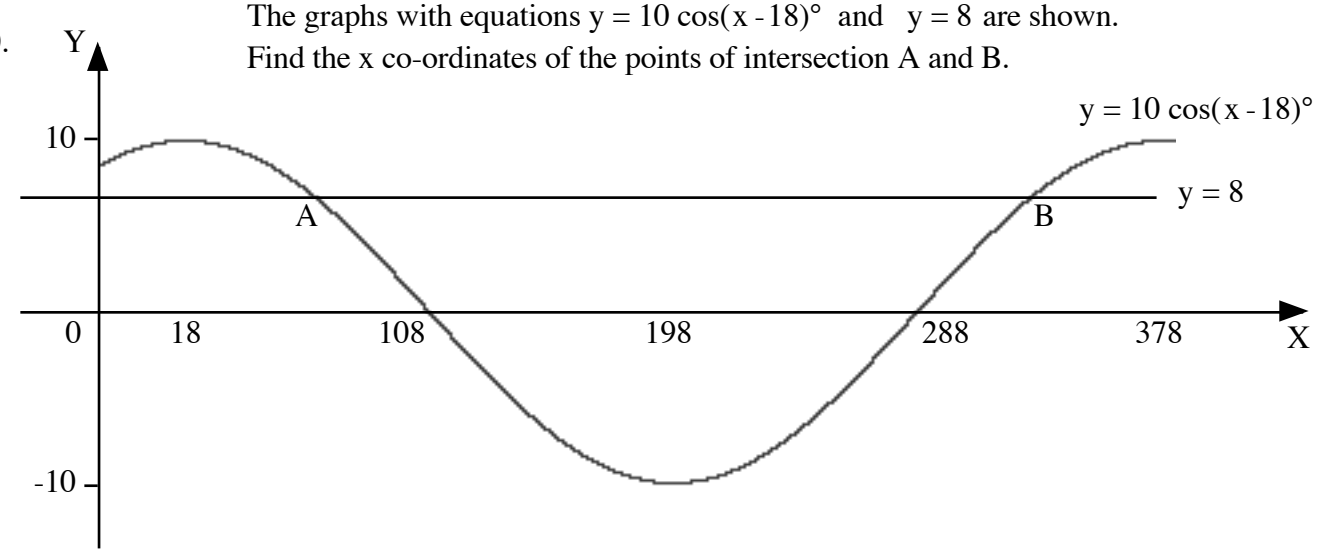
48. The graphs with equations $y = 10 + 8\sin 2x°$ and $y = 16$ are shown.
Find the x co-ordinates of the points of intersection A and B.



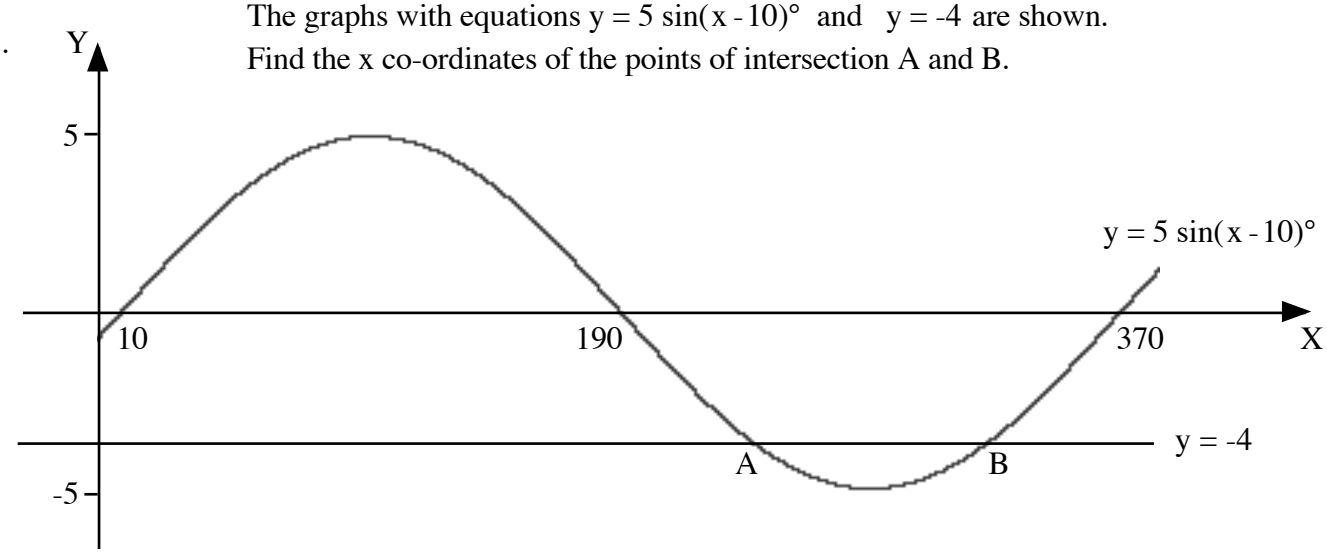
49. The graphs with equations $y = 9\sin(x+12)°$ and $y = 7$ are shown.
Find the x co-ordinates of the points of intersection A and B.



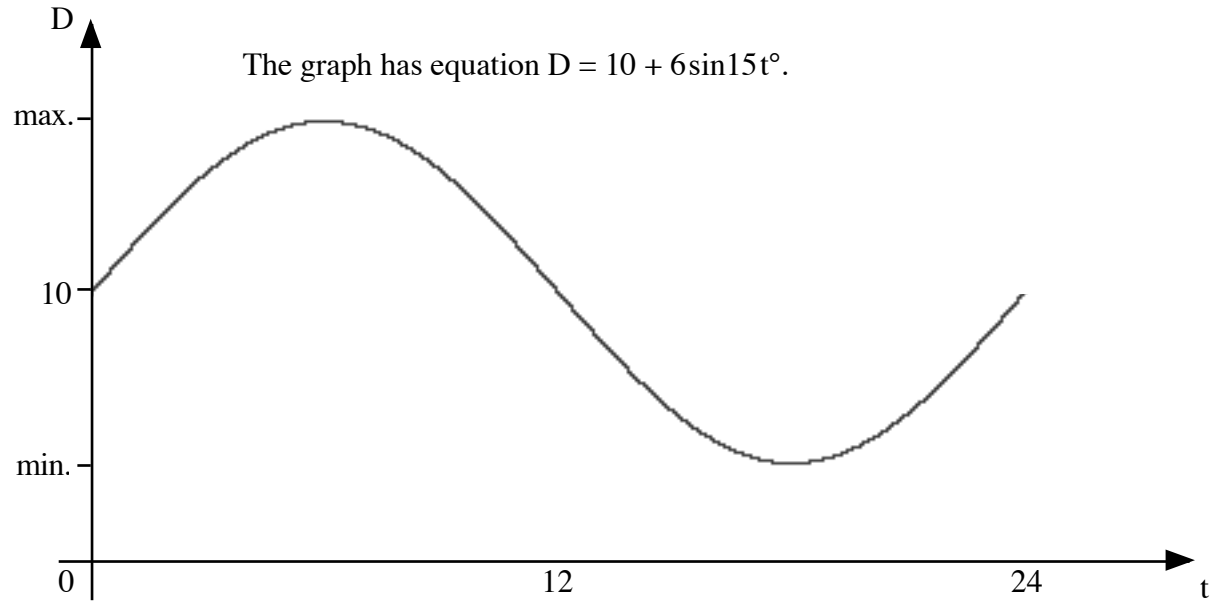
50. The graphs with equations $y = 10\cos(x-18)°$ and $y = 8$ are shown.
Find the x co-ordinates of the points of intersection A and B.



51. The graphs with equations $y = 5\sin(x-10)°$ and $y = -4$ are shown.
Find the x co-ordinates of the points of intersection A and B.



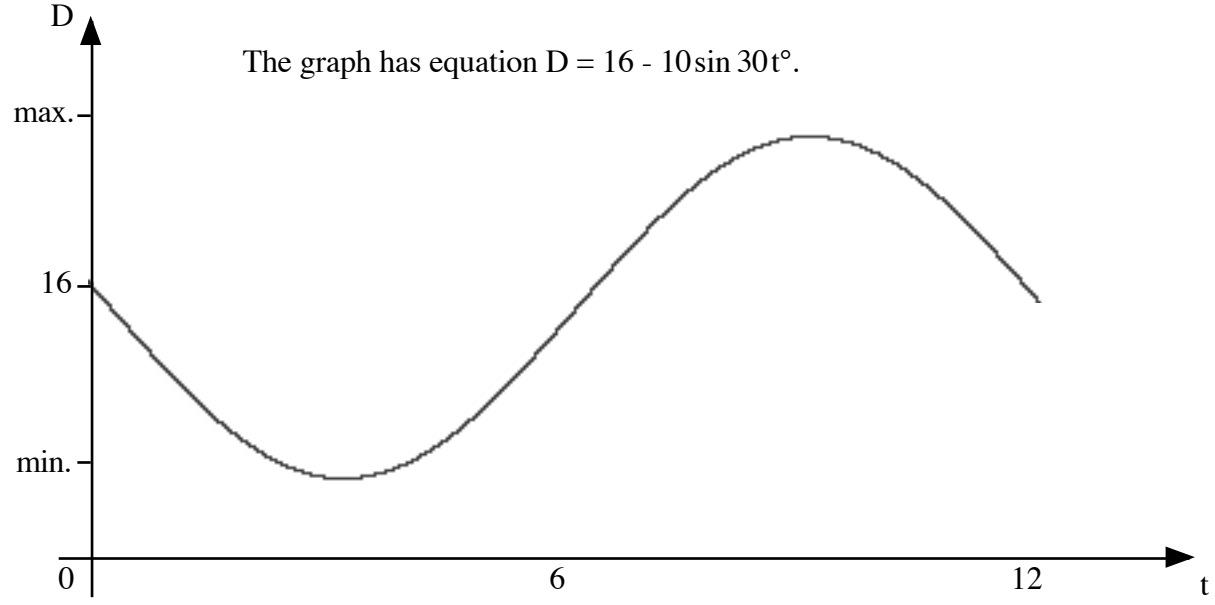
52.



The graph shows the depth of water in a harbour over a 24 hour period.
The depth, D metres, at time t hours after midnight, is given by the formula D = 10 + 6sin15t°.

(a) Find the maximum and minimum depths of water in the harbour and the times of day they occur.
(b) Find the depth of water in the harbour at 2pm.
(c) To safely leave the harbour a ship needs to have a depth of at least 13 metres of water.
Between which two times of day can the ship safely leave the harbour?

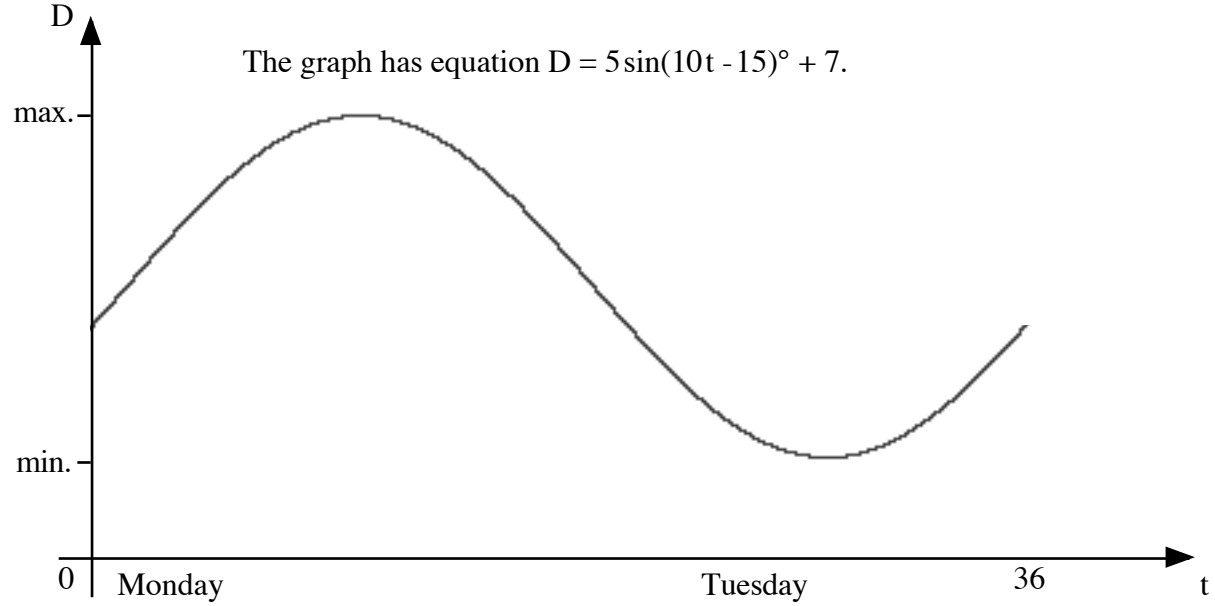
53.



The graph shows the depth of water in a harbour over a 12 hour period.
The depth, D metres, at time t hours after midnight, is given by the formula D = 16 - 10sin 30t°.

(a) Find the maximum and minimum depths of water in the harbour and the times of day they occur.
(b) Find the depth of water in the harbour at 1am.
(c) To safely leave the harbour a ship needs to have a depth of at least 21 metres of water.
Between which two times of day can the ship safely leave the harbour?

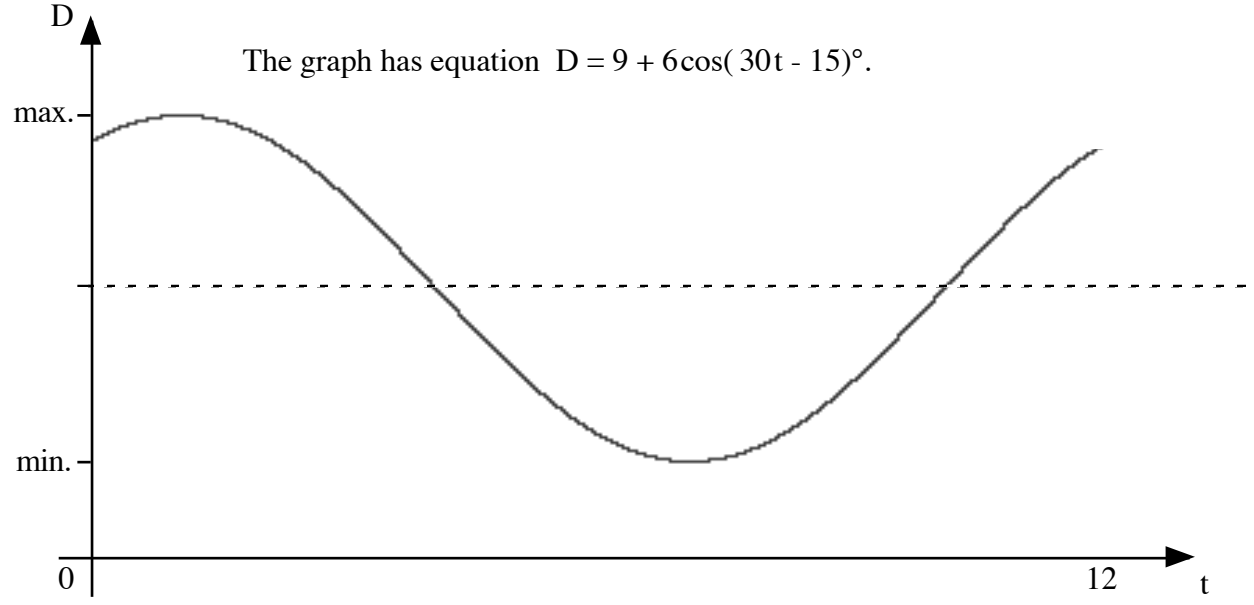
54.



The graph shows the depth of water in a harbour over a 36 hour period.
The depth, D metres, at time t hours after midnight on Sunday, is given by the formula D = 5sin(10t - 15)° + 7.

(a) Find the maximum and minimum depths of water in the harbour and the times they occur.
(b) Find the depth of water in the harbour at midnight on Sunday.
(c) Find the depth of water in the harbour at 4 30 am on **Monday**.
(d) To safely leave the harbour a boat needs to have a depth of at least 4·5 metres of water.
Between which two times can the boat **not** safely leave the harbour?

55.



The graph shows the depth of water in a harbour over a 12 hour period.
The depth, D metres, at time t hours after midnight, is given by the formula D = 9 + 6cos(30t - 15)°.

(a) Find the maximum and minimum depths of water in the harbour and the times they occur.
(b) Find the depth of water in the harbour at midnight.
(c) Find the depth of water in the harbour at 6 45 am.
(d) To safely leave the harbour a boat needs to have a depth of at least 3·2 metres of water.
Between which two times of the morning can the boat **not** safely leave the harbour?

Answers

1. a = 6 b = 2
2. a = 10 b = 6
3. a = 3 b = 4
4. a = 8 b = 5
5. a = 16 b = 3
6. a = 12 b = 2
7. a = 5 b = 3
8. a = 9 b = 12
9. a = 11 b = 5
10. a = 18 b = 3
11. a = 4 b = 6
12. a = 14 b = 9
13. a = 2·5 b = 10
14. a = -7 b = 3
15. a = 5 b = 0·5
16. a = 3·2 b = 3
17. a = -6 b = 4
18. a = 8 b = 0·5
19. a = 3 b = 5
20. a = 4 b = -8
21. a = 7 b = 10
22. a = 3·6 b = -20
23. a = 2 b = 25
24. a = 6·5 b = -12
25. a = 20 b = 6 c = 25
26. a = 25 b = 9 c = 25
27. a = 10 b = 30 c = 15
28. a = 30 b = 9 c = 45
29. a = 17·5 b = 12 c = 20
30. a = 22 b = 40 c = 10

31. max (5 , 25) min (15 , 5)
32. max (0 , 220) , (12 , 220) min (6 , 20)
33. max (6 , 30) min (18 , -10)
34. max (12 , 35) min (32 , 5)
35. max (3 , 160) min (39 , 40)
36. max (34·8 , 190) min (16·8 , -90)

37. 53·1 and 126·9
38. 56·4 and 123·6
39. 70·5 and 289·5
40. 228·6 and 311·4
41. 241·0 and 299·0
42. 146·4 and 213·6
43. 14·5 and 165·5
44. 68·0 and 292·0
45. 216·9 and 323·1
46. 20·9 and 69·1
47. 65·9 and 114·1
48. 24·3 and 65·7
49. 39·1 and 116·9
50. 54·9 and 341·1
51. 243·1 and 316·9

52. (a) max 6am ; 16m min 6pm ; 4m (b) 7m (c) 2am and 10am
53. (a) max 9am ; 26m min 3am ; 6m (b) 11m (c) 7am and 11am
54. (a) max Mon 10.30am ; 12m min Tues 4.30am ; 2m
    (b) 5·7m (c) 9·5m (d) Mon 10.30pm and Tues 10.30am
55. (a) max 12.30am ; 15m min 6.30am ; 3m
    (b) 14·8m (c) 3·1m (d) 6am and 7am