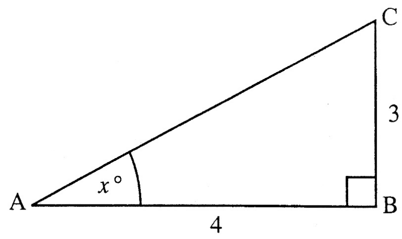
Graphs, Triangles, Maxima &Minima

1. ABC is a right angled triangle with AB = 4 units and BC = 3 units

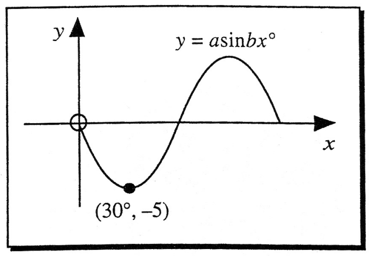
Prove that for the angle marked $x°$

$$\sin^2 x + \cos^2 x = 1$$



2 KU

2. Shown is the graph of $y = a \sin bx°$



Write down the values of a and b. 2 KU

3. On a certain day the depth, D metres, of water at a fishing port, t hours after midnight, is given by the formula

$$D = 12.5 + 9.5\sin(30t)°$$

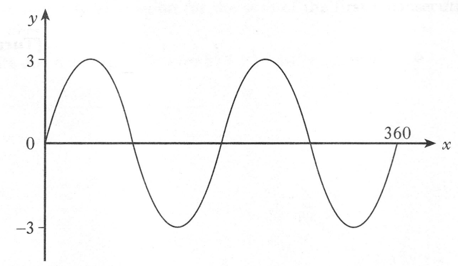
a) Find the depth of water at 1.30 pm 3 RE

b) The depth of water in the harbour is recorded each hour.
What is the maximum difference in the depths of water in the harbour, over the 24 hour period ?

Show clearly all your working. 3 RE

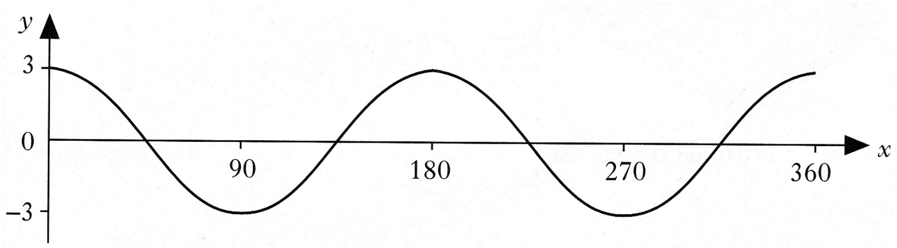
4. The diagram shows the graph of

$$y = k\sin ax°,\ \ 0 \le x \le 360$$



Find the values of a and k. 2 RE

5.



The diagram shows the graph of $y = a\cos bx°$, $\quad 0 \le x \le 360$
Find the values of a and b. 2 KU

Solving Equations

1. Solve the equation $3\tan x^o + 5 = 0$, for $0 \le x \le 360$. 4 KU

2. Solve **algebraically** the equation $2 + 3\sin x° = 0$ for $0 \le x \le 360$ 3 KU

3. Solve **algebraically**, the equation $7\cos x° - 2 = 0$ for $0 \le x \le 360$ 3 KU

4. Solve **algebraically**, the equation $5\tan x - 9 = 0$, for $0 \le x \le 360$ 3 KU

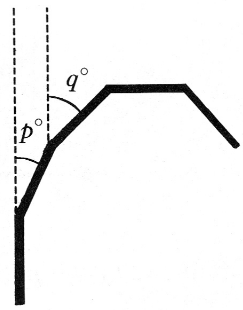
5. Solve the equation $5\sin x° + 2 = 0$, *for* $0 \le x \le 360$ 3 KU

6. Solve algebraically the equation: $\tan 40° = 2\sin x° + 1$ $0 \le x \le 360$ 3 KU

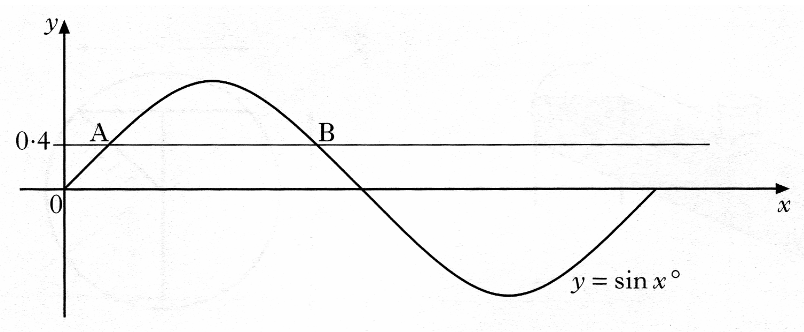
7. The diagram opposite shows part of a natural crystal of topaz.
   The relationship between the angles marked $p°$ and $q°$ is

   $$2\tan p° = \tan q°$$

   Find the value of q when p = 24. 3 KU



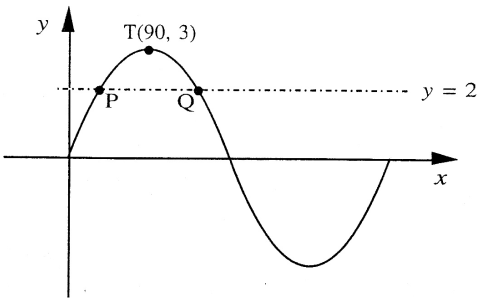
8. The diagram shows part of the graph of $y = \sin x$.



The line $y = 0.4$ is drawn and cuts the graph of $y = \sin x$ at A and B.

Find the x-coordinates of A and B. 3 RE

9. The graph shown has equation $y = a\sin bx°$.



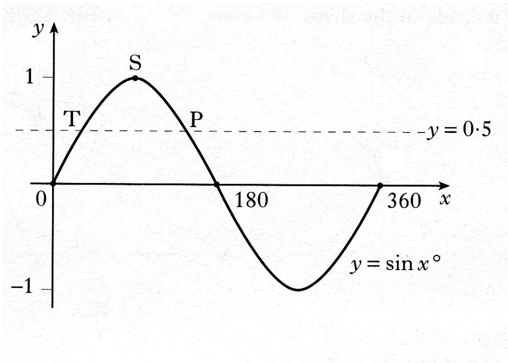
It has a maximum at the point T(90, 3).

a) Write down the values of a and b. 1 KU

Also shown in the figure is the line with equation y = 2, which meets the curve at the points P and Q.

b) Find the x-coordinate of the point Q. 3 RE

10. The diagram shows the graph of $y = \sin x°$, $0 \le x \le 360$

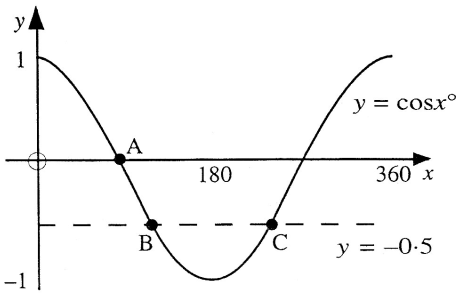


a) Write down the coordinates of point S. 1 KU

The straight line y = 0.5 cuts the graph at T and P.

b) Find the coordinates of T and P. 2 KU

11. The diagram shows the graph of $y = \cos x°$, $0 \le x \le 360$.



a) Write down the coordinates of point A. 1 KU

The straight line $y = -0.5$ cuts the graph at B and C.

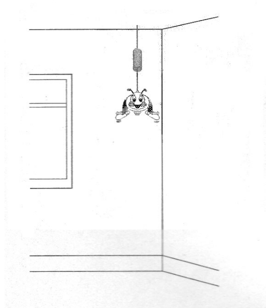
b) Find the coordinates of B and C. 3 KU

12. A toy is hanging by a spring from the ceiling.

Once the toy is set moving, the height, H metres, of the toy above the floor is given by the formula

$$h = 1.9 + 0.3\cos(30t)°$$

t seconds after starting to move.



a) State the maximum value of H. 1 KU

b) Calculate the height of the toy above the floor after 8 seconds. 3 RE

c) When is the height of the toy first 2.05 metres above the floor? 3 RE

13. The volume of water, V millions of gallons, stored in a reservoir during any month is to be predicted by using the formula

$$V = 1 + 0.5\cos(30t)°$$

where t is the number of the month. (For January $t = 1$, February $t = 2$ …)

a) Find the volume of water in the reservoir in October. 3 RE

b) The local council would need to consider water rationing during any month in which the volume of water stored is likely to be less than 0.55 million gallons.

Will the local council need to consider water rationing?

Justify your answer. 4 RE