

Relationships 1.5 – Trig equations and Graphs

Section A - Revision

This section will help you revise previous learning which is required in this topic.

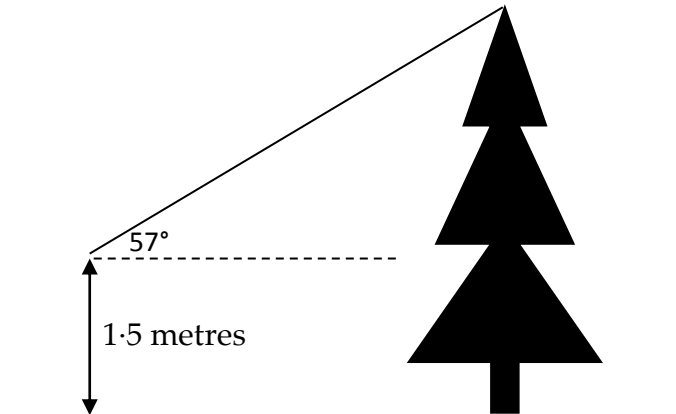
R1 I can use Trigonometry in a right angled triangle.

1. John stands 10 metres from the base of a tree.

He measures the angle of elevation from his eye level to the top of the tree as 57° .

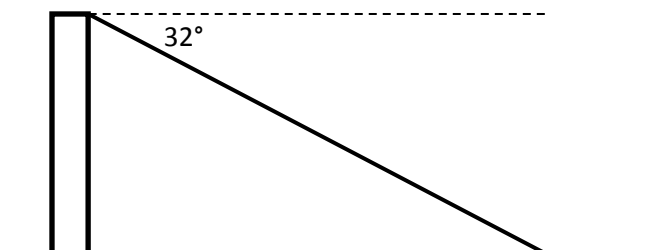
John's eye level is 1.5 metres above ground level.

Calculate the height of the tree.



2. The army are making a death slide. The rope making the slide is 50 metres long and runs from the top of a tower to the ground.

The angle of depression at the point which attaches the rope to the top of the tower is 32 degrees.



- (a) Calculate the height of the tower.
- (b) Calculate the distance from the base of the tower to the point at which the rope is fixed to the ground.

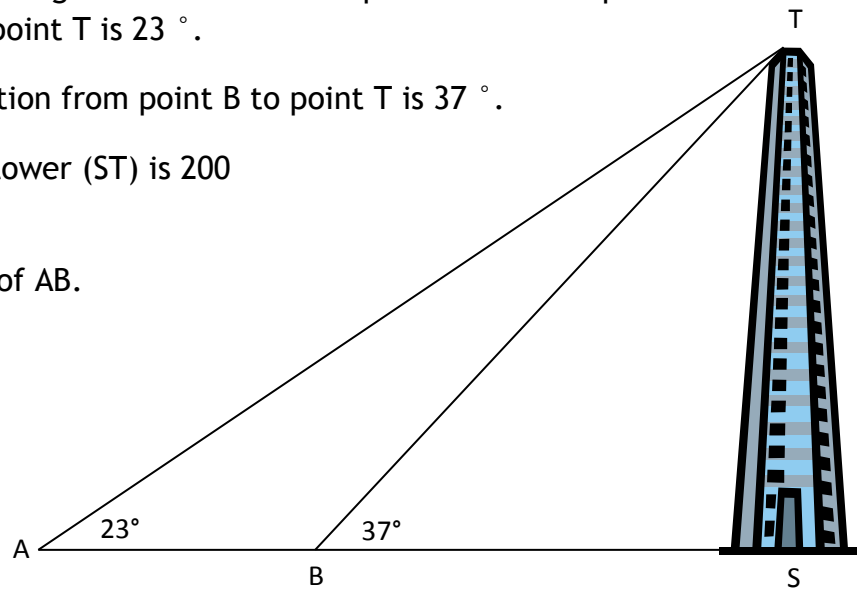
Trig Equations and Graphs

3. In the diagram, the angle of elevation from point A to the top of the building at point T is 23° .

The angle of elevation from point B to point T is 37° .

The height of the tower (ST) is 200 metres.

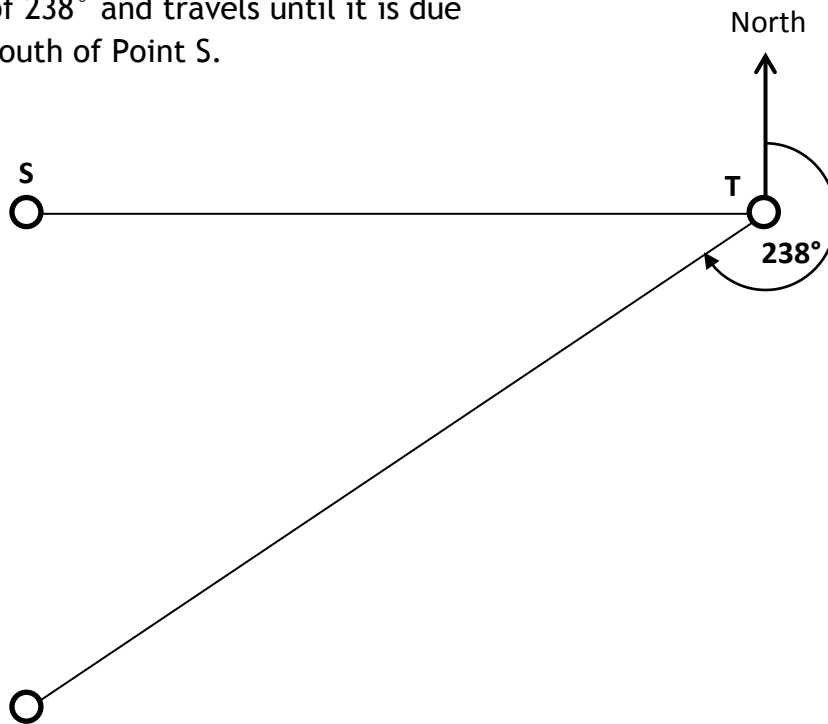
Calculate the size of AB.



4. A boat travels 50 km east from Point S to Point T.



It then changes course on a bearing of 238° and travels until it is due south of Point S.



How far has the boat travelled since leaving Point S?

Trig Equations and Graphs

Section B - Assessment Standard Section

This section will help you practise for your Assessment Standard Test for Trig Equations and Graphs. (Relationships 1.5)

Practice Assessment Standard Questions

1. Sketch the graph of $y = 5\sin x^\circ$ for $0 \leq x \leq 360$.
2. Sketch the graph of $y = 2\sin x^\circ$ for $0 \leq x \leq 360$.
3. Write down the period of the graph of the equation $y = \sin 9x^\circ$.
4. Write down the period of the graph of the equation $y = \sin 3x^\circ$.
5. Solve the equation
$$4\sin x^\circ + 1 = 1 \cdot 5, 0 \leq x \leq 360.$$
6. Solve the equation
$$10\cos x^\circ - 2 = 0, 0 \leq x \leq 360.$$

Trig Equations and Graphs

Section C - Operational Skills Section

This section provides problems with the operational skills associated with Trig Equations and Graphs.

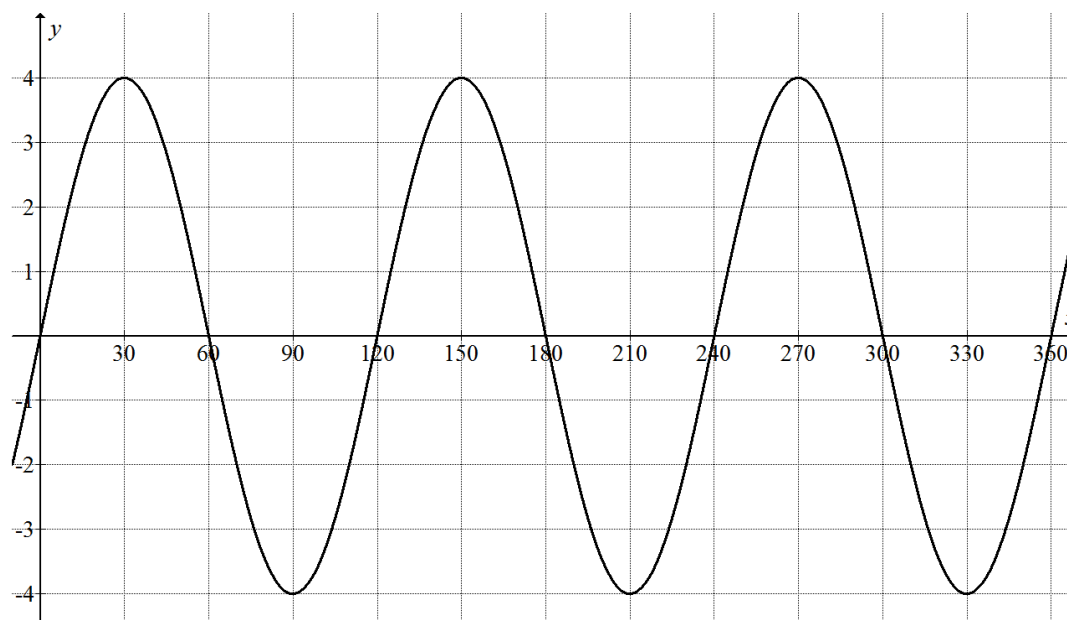
01 I can sketch Trig Graphs.

1. Sketch the graph of $y = -2 \sin x^\circ, 0 \leq x \leq 360$.
2. Sketch the graph of $y = 4 \cos 2x^\circ, 0 \leq x \leq 360$.
3. Sketch the graph of $y = \sin x^\circ + 2, 0 \leq x \leq 360$.
4. Sketch the graph of $y = 3 \cos x^\circ - 1, 0 \leq x \leq 360$.
5. Sketch the graph of $y = 2 - \cos x^\circ, 0 \leq x \leq 360$.
6. Sketch the graph of $y = 2 \sin 3x^\circ, 0 \leq x \leq 360$.
7. Sketch the graph of $y = \tan x^\circ, 0 \leq x \leq 360$.
8. Sketch the graph of $y = 5 \sin 2x^\circ, 0 \leq x \leq 360$.

Trig Equations and Graphs

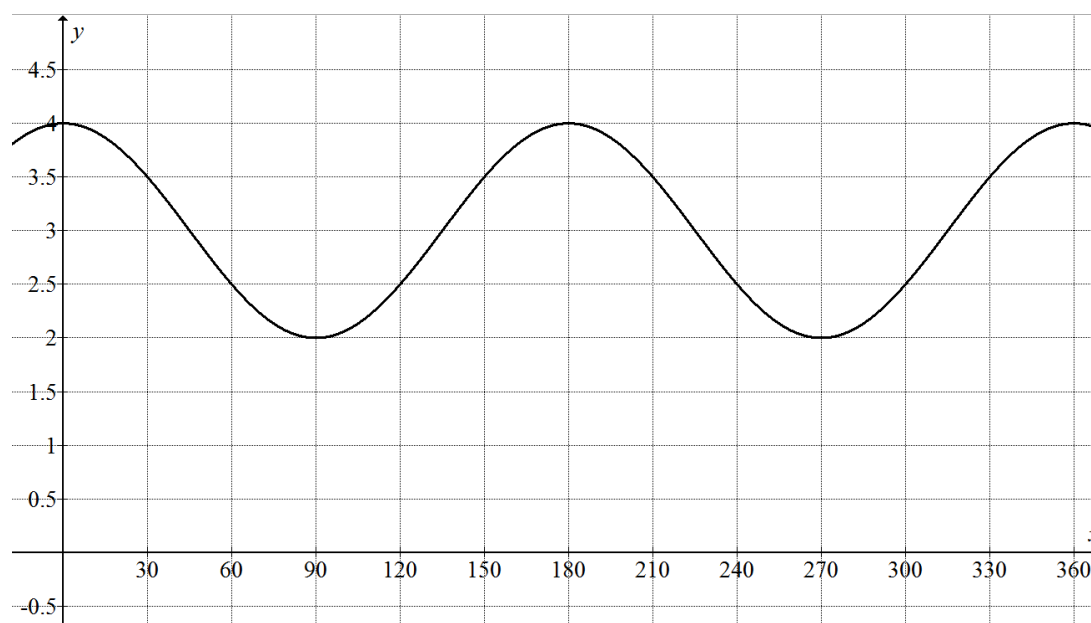
02 I can identify Trig Graphs.

1. Part of the graph of $y = a \sin bx^\circ$ is shown.



Write down the values of a and b .

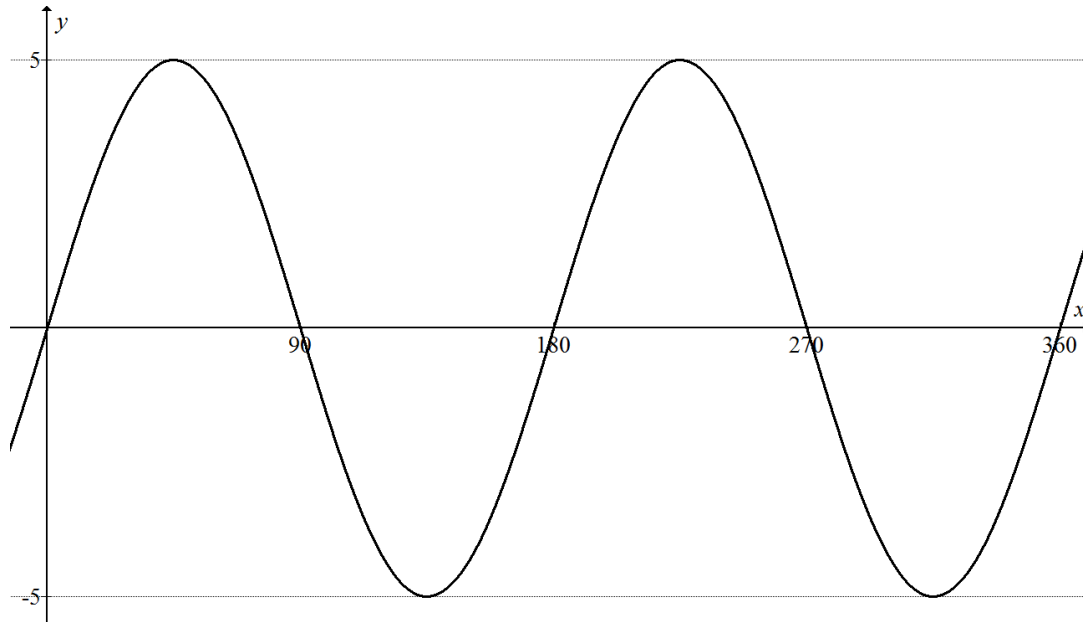
2. Part of the graph of $y = \cos bx^\circ + c$ is shown.



Write down the values of b and c .

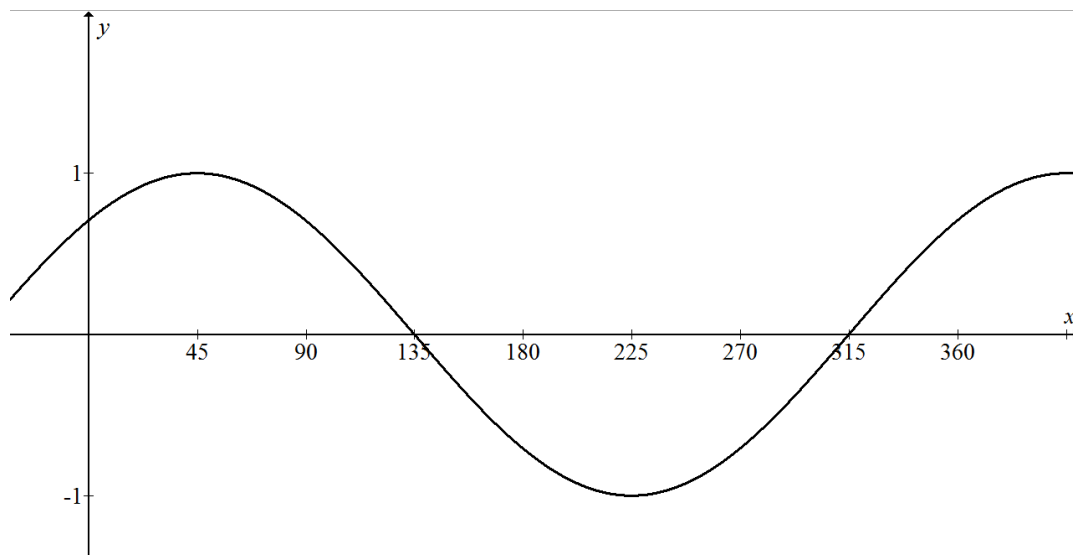
Trig Equations and Graphs

3. Part of the graph of $y = a \sin bx^\circ$ is shown.



Write down the values of a and b .

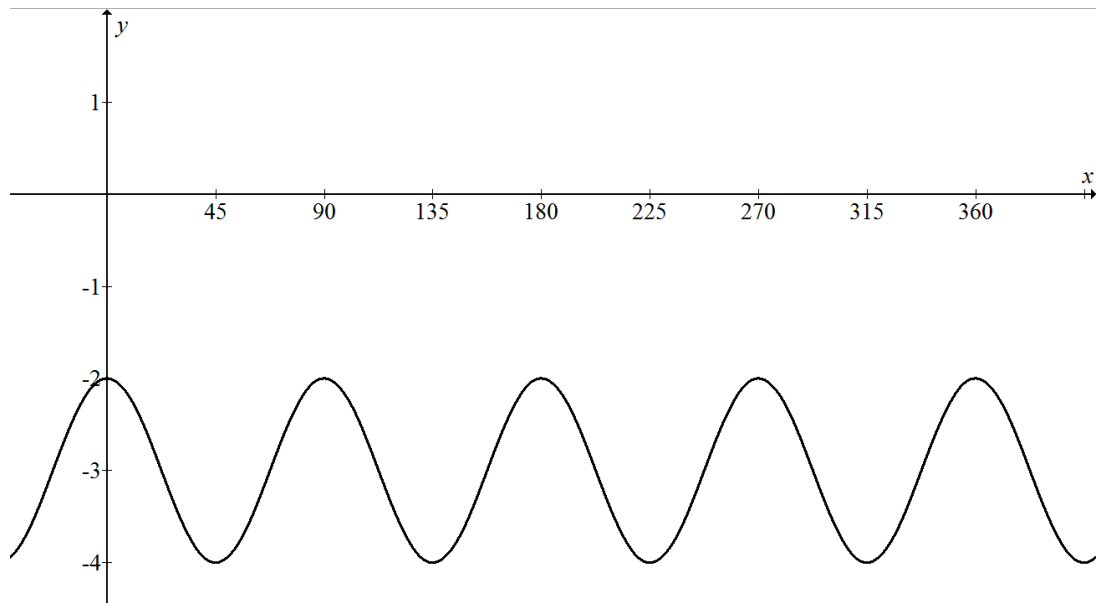
4. Part of the graph of $y = \cos(x - a)^\circ$ is shown.



Write down the value of a .

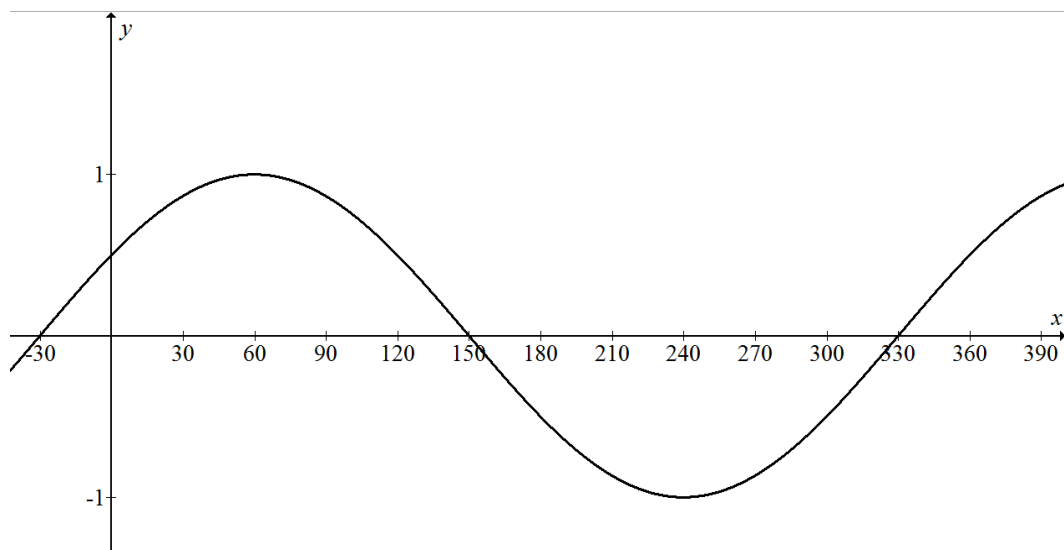
Trig Equations and Graphs

5. Part of the graph of $y = \cos bx^\circ + c$ is shown.



Write down the values of b and c .

6. Part of the graph of $y = \sin(x + a)^\circ$ is shown.



Write down the value of a .

Trig Equations and Graphs

03 I know the common exact values in the four quadrants.

1. Write down the exact value of:

- | | | |
|---------------------|---------------------|---------------------|
| (a) $\sin 30^\circ$ | (b) $\cos 30^\circ$ | (c) $\tan 30^\circ$ |
| (d) $\sin 60^\circ$ | (e) $\cos 60^\circ$ | (f) $\tan 60^\circ$ |
| (g) $\sin 45^\circ$ | (h) $\cos 45^\circ$ | (i) $\tan 45^\circ$ |
| (j) $\sin 0^\circ$ | (k) $\cos 0^\circ$ | (l) $\tan 0^\circ$ |
| (m) $\sin 90^\circ$ | (n) $\cos 90^\circ$ | (o) $\tan 90^\circ$ |

2. Write down the exact value of:

- | | | |
|----------------------|----------------------|----------------------|
| (a) $\sin 150^\circ$ | (b) $\cos 210^\circ$ | (c) $\tan 330^\circ$ |
| (d) $\sin 240^\circ$ | (e) $\cos 300^\circ$ | (f) $\tan 120^\circ$ |
| (g) $\sin 315^\circ$ | (h) $\cos 135^\circ$ | (i) $\tan 225^\circ$ |

04 I can solve Trig Equations.

1. Solve the equation

$$5 \tan x^\circ - 6 = 2, \quad 0 \leq x < 360.$$

2. Solve the equation

$$4 \cos x^\circ + 3 = 0, \quad 0 \leq x \leq 360.$$

3. Solve the equation

$$7 \sin x^\circ + 1 = -5, \quad 0 \leq x \leq 360.$$

Trig Equations and Graphs

4. Solve the equation

$$2 \tan x^\circ - 3 = 5, \quad 0 \leq x \leq 360.$$

5. Solve the equation

$$5 \cos x^\circ - 3 = 1, \quad 0 \leq x \leq 360.$$

6. Solve the equation

$$5 \cos x^\circ + 4 = 0, \quad 0 \leq x < 360.$$

05 I can manipulate Trig Identities.

1. If $\sin x^\circ = \frac{4}{5}$ and $\cos x^\circ = \frac{3}{5}$, calculate the value of $\tan x^\circ$.

2. Simplify $\frac{\cos x^\circ \tan x^\circ}{\sin x^\circ}$.

3. Simplify $\frac{\cos^3 x^\circ}{1 - \sin^2 x^\circ}$.

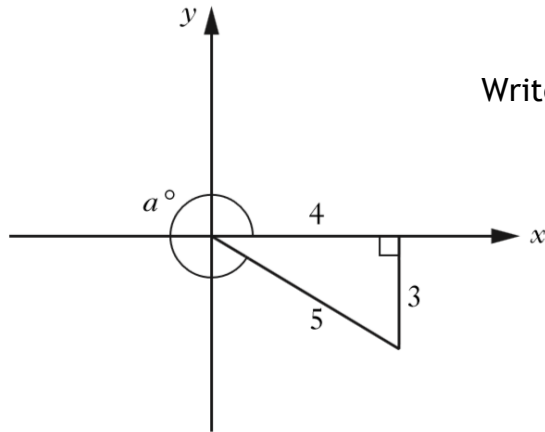
4. Prove that $\frac{\sin^2 A}{1 - \sin^2 A} = \tan^2 A$

Trig Equations and Graphs

Section D - Reasoning Skills Section

This section provides problems with Trig Equations and Graphs.

1.



Write down the exact value of $\cos a^\circ$.

2. If $f(x) = 3 \sin x^\circ$, $0 \leq x \leq 360$

(a) Find $f(270)$.

(b) $f(t) = 0 \cdot 6$.

Find two possible values of t .

3. An angle, a° , can be described by the following statements.

- a° is greater than 0 and less than 360
- $\sin a^\circ$ is negative
- $\cos a^\circ$ is positive
- $\tan a^\circ$ is negative

Write down a possible value for a .

4. The depth of water, D metres, in a harbour is given by the formula

$$D = 3 + 1 \cdot 75 \sin 30h^\circ$$

Where h is the number of hours after midnight.

(a) Calculate the depth of water at 5am.

(b) Calculate the maximum difference in depth of water in the harbour.

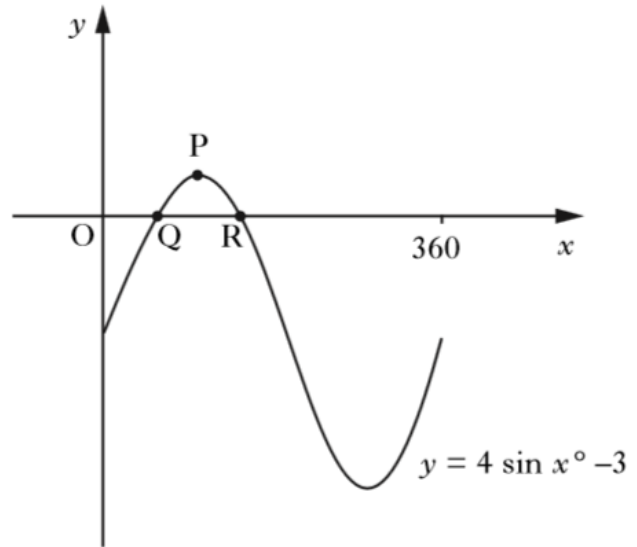
Trig Equations and Graphs

5. Part of a graph of $y = 4\sin x^\circ - 3$ is shown.

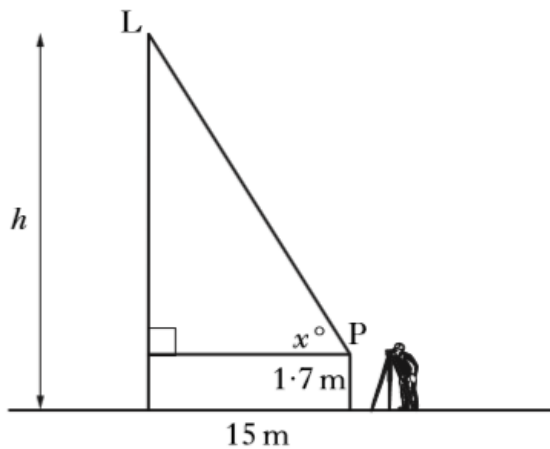
The graph cuts the x -axis at Q and R.

P is the maximum turning point.

- (a) Write down the coordinates of P.
 (b) Calculate the x -coordinates of Q and R.



6. In the diagram below, the point L represents the lift.



The height, h metres, of the lift above the ground is given by the formula

$$h = 15\tan x^\circ + 1.7$$

Where x° is the angle of elevation from the surveyor at point P.

- (a) What is the height of the lift above the ground when the angle of elevation from P is 25° ?
 (b) What is the angle of elevation at the point P when the height of the lift above the ground is 18.4 metres?

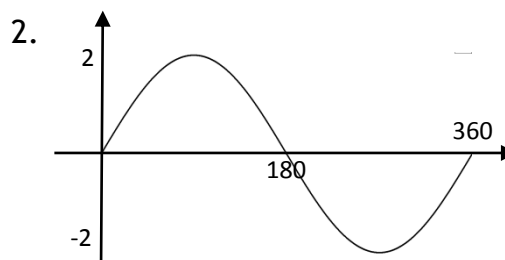
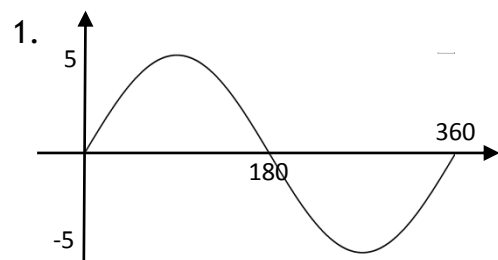
Trig Equations and Graphs

Answers

Section A - Revision

1. 16.9 m 2.(a) 26.5 m (b) 42.4 m 3. AB = 205.76 m
 4. 108.962 km

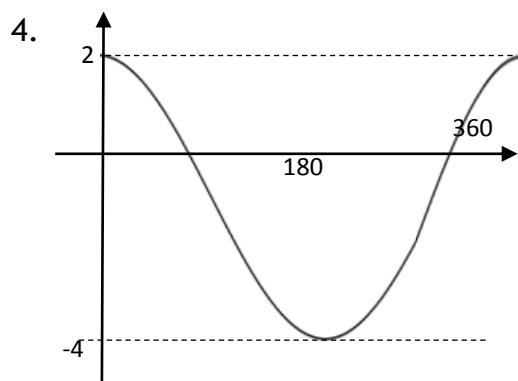
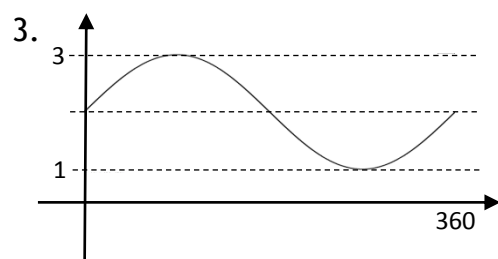
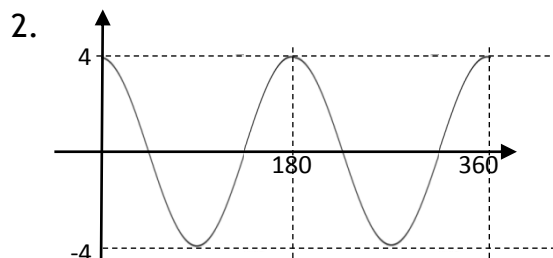
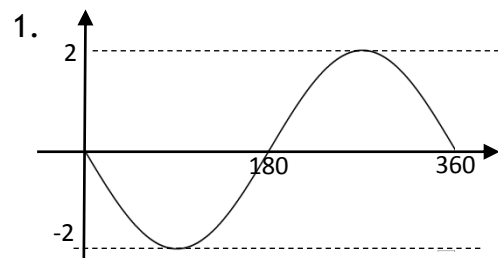
Section B - Practice Assessment Standard Questions



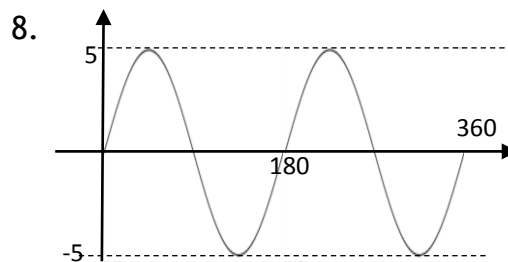
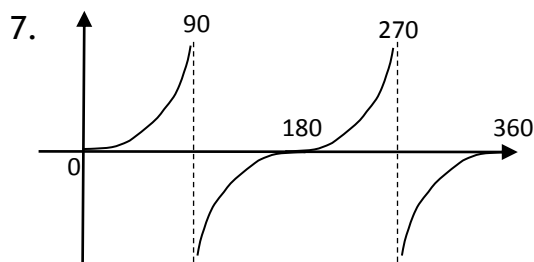
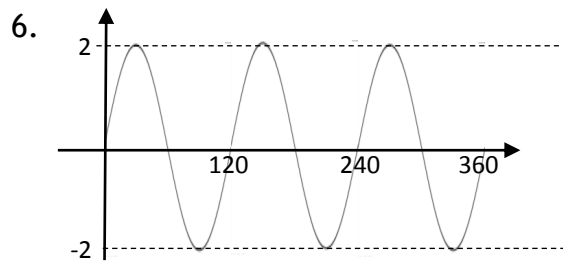
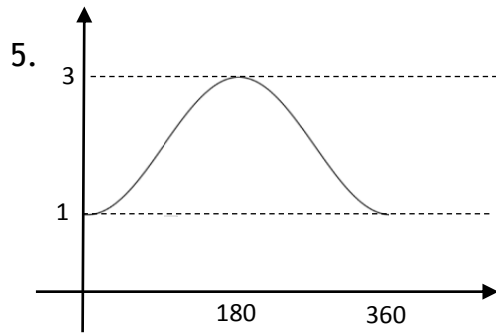
3. Period = 40° 4. Period = 120° 5. $x = 7 \cdot 2^\circ$, $x = 172 \cdot 8^\circ$
 6. $x = 78 \cdot 5^\circ$, $x = 281 \cdot 5^\circ$

Section C - Operational Skills

O1



Trig Equations and Graphs



O2

1. $y = 4 \sin 3x^\circ$ 2. $y = \cos 2x^\circ + 3$ 3. $y = 5 \sin 2x^\circ$
 4. $y = \cos(x - 45)^\circ$ 5. $y = \cos 4x^\circ - 3$ 6. $y = \sin(x + 30)^\circ$

O3

- 1(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{\sqrt{3}}{2}$ (e) $\frac{1}{2}$ (f) $\sqrt{3}$ (g) $\frac{1}{\sqrt{2}}$ (h) $\frac{1}{\sqrt{2}}$
 (i) 1 (j) 0 (k) 1 (l) 0 (m) 1 (n) 0 (o) Undefined
 2(a) $\frac{1}{2}$ (b) $-\frac{\sqrt{3}}{2}$ (c) $-\frac{1}{\sqrt{3}}$ (d) $-\frac{\sqrt{3}}{2}$ (e) $\frac{1}{2}$ (f) $-\sqrt{3}$ (g) $-\frac{1}{\sqrt{2}}$ (h) $-\frac{1}{\sqrt{2}}$
 (i) 1

O4

1. $x^\circ = 58 \cdot 0^\circ, x^\circ = 238 \cdot 0^\circ$ 2. $x^\circ = 138 \cdot 6^\circ, x^\circ = 221 \cdot 4^\circ$
 3. $x^\circ = 239 \cdot 0^\circ, x^\circ = 301 \cdot 0^\circ$ 4. $x^\circ = 76 \cdot 0^\circ, x^\circ = 256 \cdot 0^\circ$
 5. $x^\circ = 36 \cdot 9^\circ, x^\circ = 323 \cdot 1^\circ$ 6. $x^\circ = 143 \cdot 1^\circ, x^\circ = 216 \cdot 9^\circ$

O5

1. $\frac{4}{3}$ 2. 1 3. $\cos x^\circ$ 4. $\tan^2 A$

Trig Equations and Graphs

Section D - Reasoning Skills Section

1. $\frac{4}{5}$
2. (a) -3 (b) $t = 11 \cdot 5$ and $168 \cdot 5$
3. Any answer $270 < a < 360$
4. (a) $3 \cdot 875$ m (b) $3 \cdot 50$ m
5. (a) $P(90, 1)$ (b) $Q(48 \cdot 6, 0)$ $R(131 \cdot 4, 0)$
6. (a) $8 \cdot 69$ m (b) $48 \cdot 1^\circ$