

Trigonometric Formulae

1. Copy and complete the table below.

Formula	Maximum value	Minimum value
$8 + 5\cos(15t)^0$		
$5.2 + 3.1\sin(x - 30)^0$		
$13.4 + 4.5\cos(h + 20)^0$		
$8.5\sin(45t)^0 + 3.5$		
$7.25 - 2.27\sin(60n)^0$		
$4.8\cos(p - 135)^0 - 3.2$		

2. A formula is given as $H = 22.5 + 13.3\cos(30t)^0$.

- Write down the minimum value of H.
- Calculate the value of H when t is replaced by 10.
- If H is replaced by 23.4, calculate t correct to one decimal place given $0 \leq t \leq 360$.

3. A formula is $P = 2.2 + 1.4\sin(x - 30)^0$.

- Write down the maximum value of P.
- Calculate the value of P when $x = 75$.
- If $P = 2.9$, find two values of x in the range $0 \leq x \leq 360$.

4. A formula is $T = 5.5 - 2.3\sin(x + 10)^0$.

- Write down the maximum and minimum values of T.
- Calculate T when x is 200.
- Find the values of x in the range $0 \leq x \leq 360$ when T is replaced by 3.5.

5. The height of a fairground ride, in metres, above the ground can be found using the formula

$$H = 14.5 + 12.5\cos(30t)^0$$

where t is the number of seconds after the ride starts.

- Write down the maximum and minimum heights above the ground that the ride reaches.
- Calculate the height of the ride after 10 seconds.
- After how many seconds will the ride **first** be at a height of 8.25 metres.

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

$$V = 1.8 + 0.45\cos(20t)^0$$

Where t is the number of the month. (January = 1, February = 2, etc.)

- Find the volume of water in the reservoir in June.
- The local council would need to consider water rationing during any month in which the volume of water in the reservoir falls below 1.3 million gallons. Will the council need to consider rationing? **Explain.**

7. The depth of water, D metres, in a harbour, t hours after midnight, is given by the formula

$$D = 9 + 3.5\sin(15t)^0$$

- (a) A fishing boat wants to dock in the harbour. To do so the boat needs a minimum depth of 5 metres. Can the fishing boat dock? **Explain your answer.**
- (b) What is the depth in the harbour at 3.30p.m.?
- (c) At what two times between noon and midnight is the depth 7.25 metres?



8. The amount of gas, in thousands of cubic metres, held in a storage tank can be estimated using the formula

$$G = 8.7 + 3.6\cos(60t)^0$$

where t is the number of hours after midnight.

- (a) How much can the storage tank hold when full?
- (b) Calculate the volume of the tank at 2.30 p.m.



9. A child's toy is hanging by a spring from the ceiling. As the toy is set moving, its height, in metres, above the floor is given by the formula

$$H = 2.3 + 0.5\cos(30t)^0$$

where t is the number of seconds the toy has been moving.

- (a) Write down the maximum value of H .
- (b) Calculate the height of the toy above the floor after 5 seconds.
- (c) After how many seconds is the toy first at a height of 2.55 metres?

10. A satellite is programmed to orbit the Earth. The height of the satellite above the Earth, in kilometres, is given by the formula

$$H = 120 + 25\sin(40t)^0$$

where t is the number of hours after midnight.

- (a) What is the greatest distance from the Earth that the satellite will reach?
- (b) Calculate the height of the satellite at 10.30 p.m.
- (c) How many minutes after midnight will the satellite first be at a height of 132.5 kilometres?

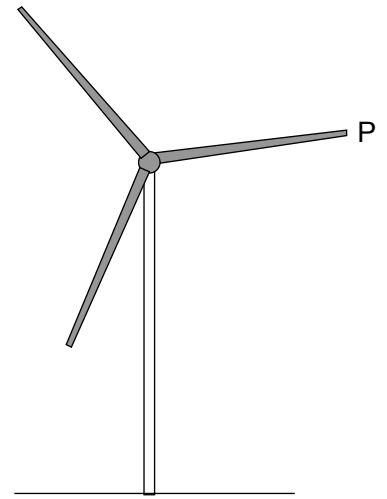


11. The arms on a wind turbine move at a steady pace.

The height, h metres, of a point P above the ground at time t seconds is given by the formula

$$h = 9.5 + 4.5\sin(10t)^{\circ}.$$

- (a) Calculate the height of point P at time 15 seconds.
- (b) Find the two times during the first turn of the turbine when the point P is at a height of 7.25 metres.



12. The height, H , metres of a carriage on the big wheel above the ground is given by the formula

$$H = 12 + 4\sin(5t)^{\circ}$$

- (a) Find the height of the carriage after 20 seconds.
- (b) Find the two times during the first turn of the wheel when the carriage is 14 metres above the ground.

