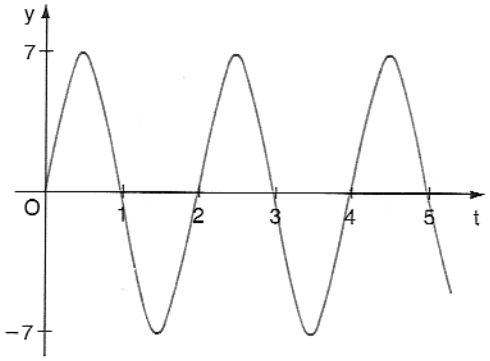
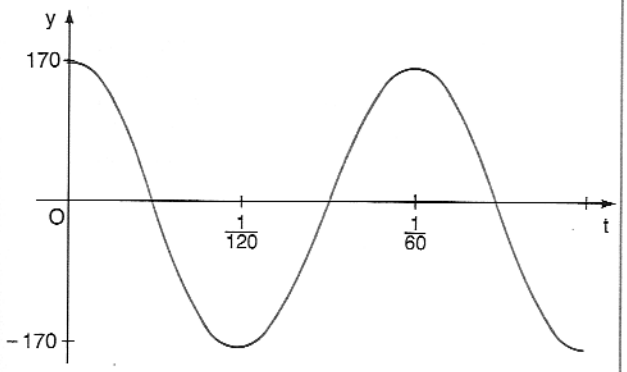
# APPLICATIONS OF SINUSOIDAL FUNCTIONS
## SUPPLEMENTARY PROBLEMS

1. State a defining equation for each of the following graphs.

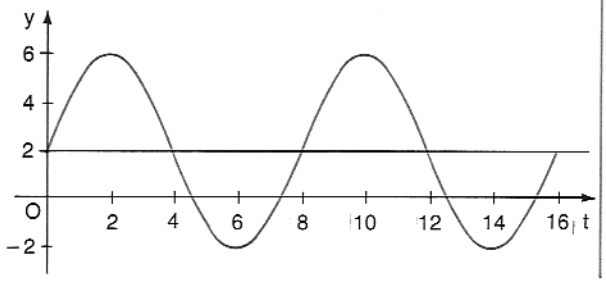
(a)



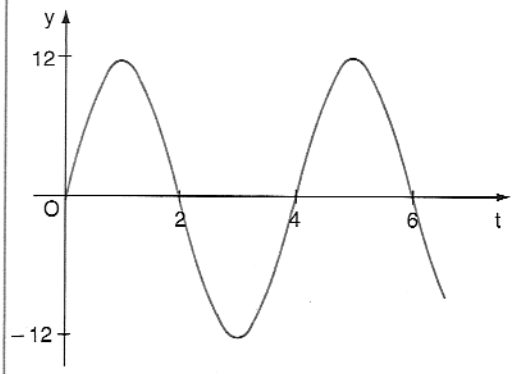

(b)



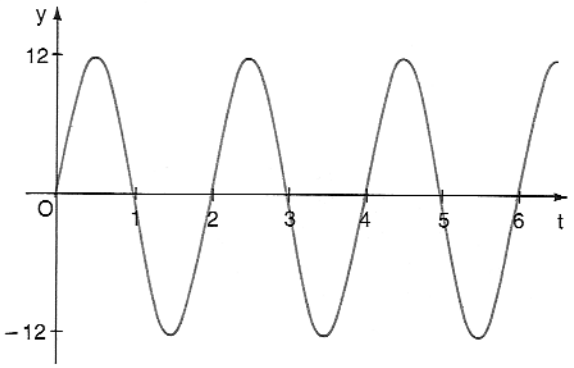

(c)



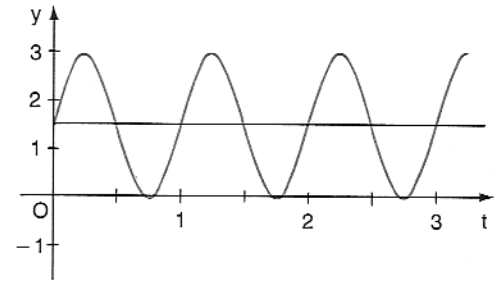

(d)




(e)




(f)



2. Temperature readings were recorded every 2 h over a 24 h period on an early summer day as in the following table.

| Time | Temperature (°C) |
|---|---|
| 13:00 | 27.3 |
| 15:00 | 28.9 |
| 17:00 | 27.8 |
| 19:00 | 26.0 |
| 21:00 | 22.0 |
| 23:00 | 18.1 |
| 01:00 | 16.0 |
| 03:00 | 15.1 |
| 05:00 | 16.1 |
| 07:00 | 18.2 |
| 09:00 | 22.1 |
| 11:00 | 25.5 |
| 13:00 | 27.4 |

(a) Plot the data on a graph and draw a smooth curve through the points.
(b) Relate the graph to the general sine function

$$y = a \sin k(\theta + c) + d$$

(c) Write the equation of the graph.
(d) Use the equation to find the temperature at
(i) 04:00.
(ii) 16:00.
(iii) 20:30.

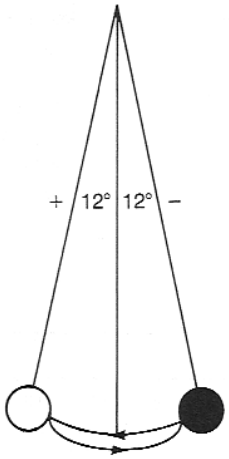
3. A ferris wheel has a diameter of 40 m and rotates once every 24 s.
(a) Draw a graph to show a person's height above or below the centre of rotation starting at the lowest position.
(b) Find an equation of the graph in (a).

4. During a spring tide on the Petitcodiac River, readings were taken and a range of 15 m was reported. Assuming the height of water with respect to mean sea level is a sine function,
(a) draw a graph of the height of water over a 24 h period.
(b) find an equation of the graph in (a).

**5.** A mass is suspended from a spring and allowed to bounce up and down. The distance from the high point to the low point is 20 cm and it takes 4 s to complete 5 cycles. The distance from the position of rest with respect to time is modelled by a sine function for the first few cycles.
(a) Draw a graph of this sine function.
(b) Write the equation that describes distance from the position of rest with respect to time.

**6.** A water wheel with radius 2 m has 0.2 m submerged and rotates at 5 rev/min.
(a) Draw a graph showing two complete rotations taking the surface of the water at the horizontal axis.
(b) Write the equation of the sine function describing the height above the water taking the point at which the wheel touches the water at $t = 0$.

**7.** A grandfather clock pendulum swings making one period every 2 s and an angle of 12° from the position of rest.
(a) Express the angle between the arm and the position of rest as a function of time, assuming the relationship is a sine function.
(b) Draw the graph of the above function for $0 \leq t \leq 6$, starting from the middle position.




## Answers

1. (a) $y = 7 \sin \pi t$ (b) $y = 170 \cos 120 \pi t$ (c) $y = 4 \sin \frac{\pi}{2} t + 2$
(d) $y = 12 \sin \frac{\pi}{2} t$ (e) $y = 12 \sin \pi t$ (f) $y = \frac{3}{2} \sin 2\pi t + \frac{3}{2}$
2. (c) $y = 6.9 \sin \frac{\pi}{12} (t + 4) + 22$ (d) (i) 15.3°C (ii) 28.7°C (iii) 22.4°C
3. (b) $y = -20 \cos \frac{\pi}{12} t$ or $y = 20 \sin \frac{\pi}{12} (t - 6)$
4. (b) $y = 7.5 \sin \frac{\pi}{6} t$ (assuming a 12 h cycle)
5. (b) $y = 10 \sin \frac{5\pi}{2} t$
6. (b) $y = -2 \sin (10\pi t + 1.12) + 1.8$ (taking $t = 0$ at the point at which the wheel enters the water)
7. (a) $\theta = 12 \sin \pi t$