# Triangle and periodic-model applications

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

**1.** For tide $d = 4 + 2\cos(\frac{\pi t}{6})$, $t$ in hours, state range, period and starting depth. [3 marks]

Read $D = 4$, amplitude 2 and $B = \frac{\pi}{6}$; evaluate $\cos 0$.

**Answer:** Range $[2, 6]$ m; period 12 h; start 6 m.

**2.** For $d = 4 + 2\cos(\frac{\pi t}{6})$, find $d = 4$ on $0 \le t < 12$. [3 marks]

$\cos(\frac{\pi t}{6}) = 0$; arguments $\frac{\pi}{2}$ and $\frac{3\pi}{2}$ give the times.

**Answer:** $t = 3, 9$ h.

**3.** Paths 8 km and 11 km leave a camp $60^\circ$ apart. Find endpoint separation exactly. [3 marks]

$d^2 = 64 + 121 - 176(\frac{1}{2}) = 97.$

**Answer:** $\sqrt{97}$ km

**4.** A triangle has $a = 20$ m opposite $A = 40^\circ$, and $B = 70^\circ$. Find $b$ to one decimal place. [3 marks]

$b = \frac{20\sin 70^\circ}{\sin 40^\circ} \approx 29.2380.$

**Answer:** 29.2 m.

**5.** A wheel has centre height 12 m, radius 10 m and period 40 s. It starts at its lowest point. Give a model. [3 marks]

Midline 12, amplitude 10, and negative cosine starts low.

$B = \frac{2\pi}{40} = \frac{\pi}{20}.$

**Answer:** $h(t) = 12 - 10\cos(\frac{\pi t}{20})$ metres.

**6.** Why might today's fitted sine temperature model fail to predict next month's temperatures? [3 marks]

A fixed-period model assumes stable parameters; seasonal and weather changes may violate them.

**Answer:** The mean, amplitude and timing can change.