Triangle and periodic-model applications

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

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

Read D=4, amplitude 2 and B=π/6; evaluate cos 0.

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

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

$\cos(\pi t/6) = 0$; argumentsπ/2 and 3π/2 give the times.

Answer: t=3,9 h.

3. Paths 8 km and 11 km leave a camp 60° apart. Find endpoint separation exactly. [3 marks]

$d^2 = 64 + 121 - 176(1/2) = 97$.

Answer: $\sqrt{97}$ km

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

$b = 20\sin 70^\circ/\sin 40^\circ \approx 29.2380$.

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.

$B = 2\pi/40 = \pi/20$.

Answer: $h(t) = 12 - 10\cos(\pi t/20)$ 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.