

Homework 7.10: Applications of Trig Functions

Name: Key!

Math 3

1. A water wheel on a paddleboat has a radius of 1 m. The wheel rotates once every 1.46 seconds and the bottom 0.3 m of the wheel is submerged in water. (Consider the water surface to be the x-axis.)

- a) Determine the cosine equation of the graph, starting from a point at the top of the wheel.

$$a = 1$$

$$\text{period} = 1.46 \text{ s}$$

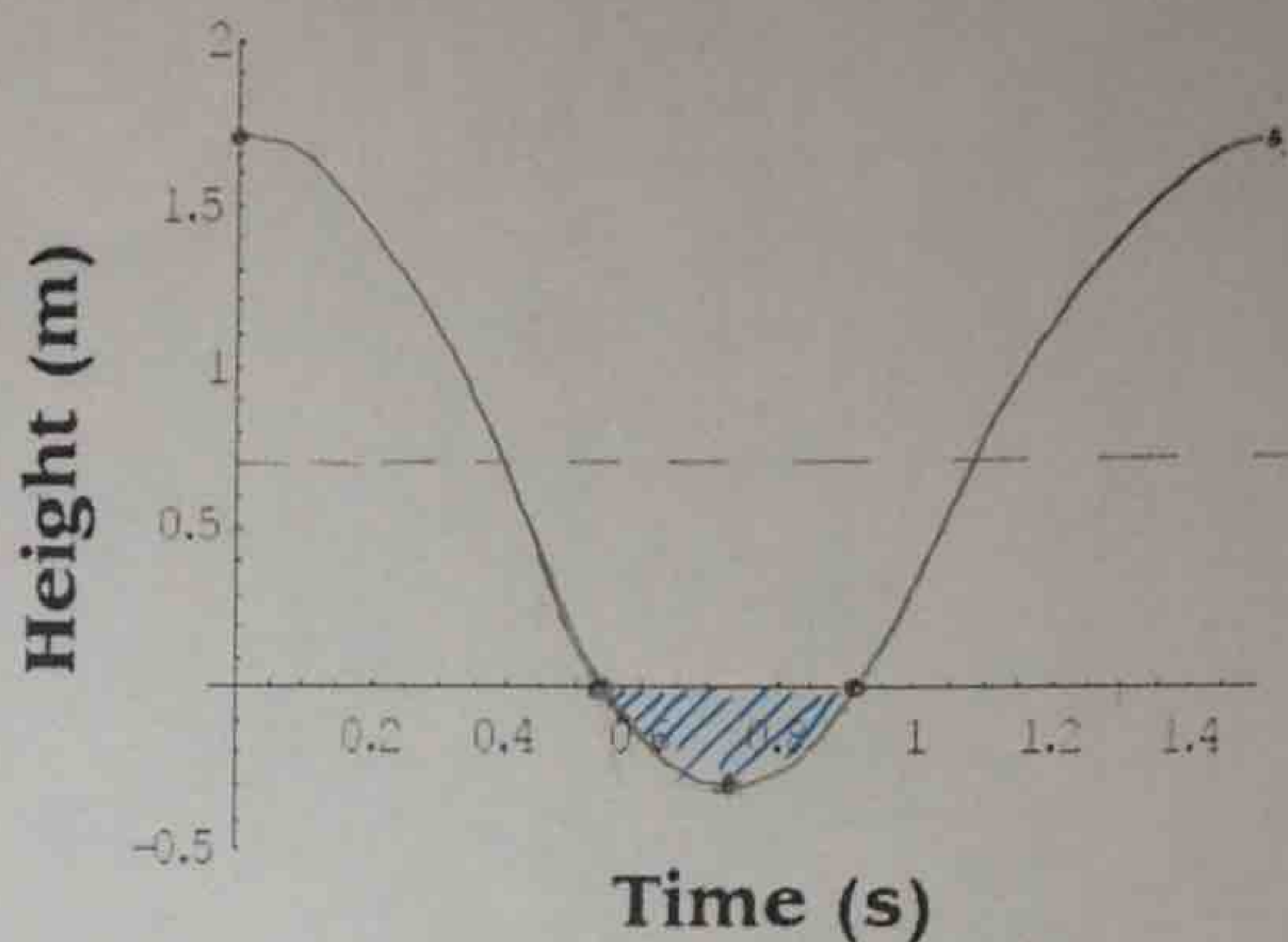
$$b = \frac{2\pi}{1.46}$$

$$y = 1 \cos \frac{2\pi}{1.46} \theta + 0.7$$

$$\text{midline} = -0.3 + 1 = 0.7$$

$$\frac{1.46}{2} = 0.73$$

$$\text{max} = -0.3 + 2 = 1.7$$



- b) Graph the height of a point on the wheel relative to the surface of the water, starting from the highest point.
 c) How long is the point on the wheel underwater?

$$0.55 \text{ to } 0.91 \text{ or } 0.36 \text{ sec}$$

2. The bottom of a windmill is 8m above the ground, and the top is 22m above the ground. The wheel rotates once every five seconds.

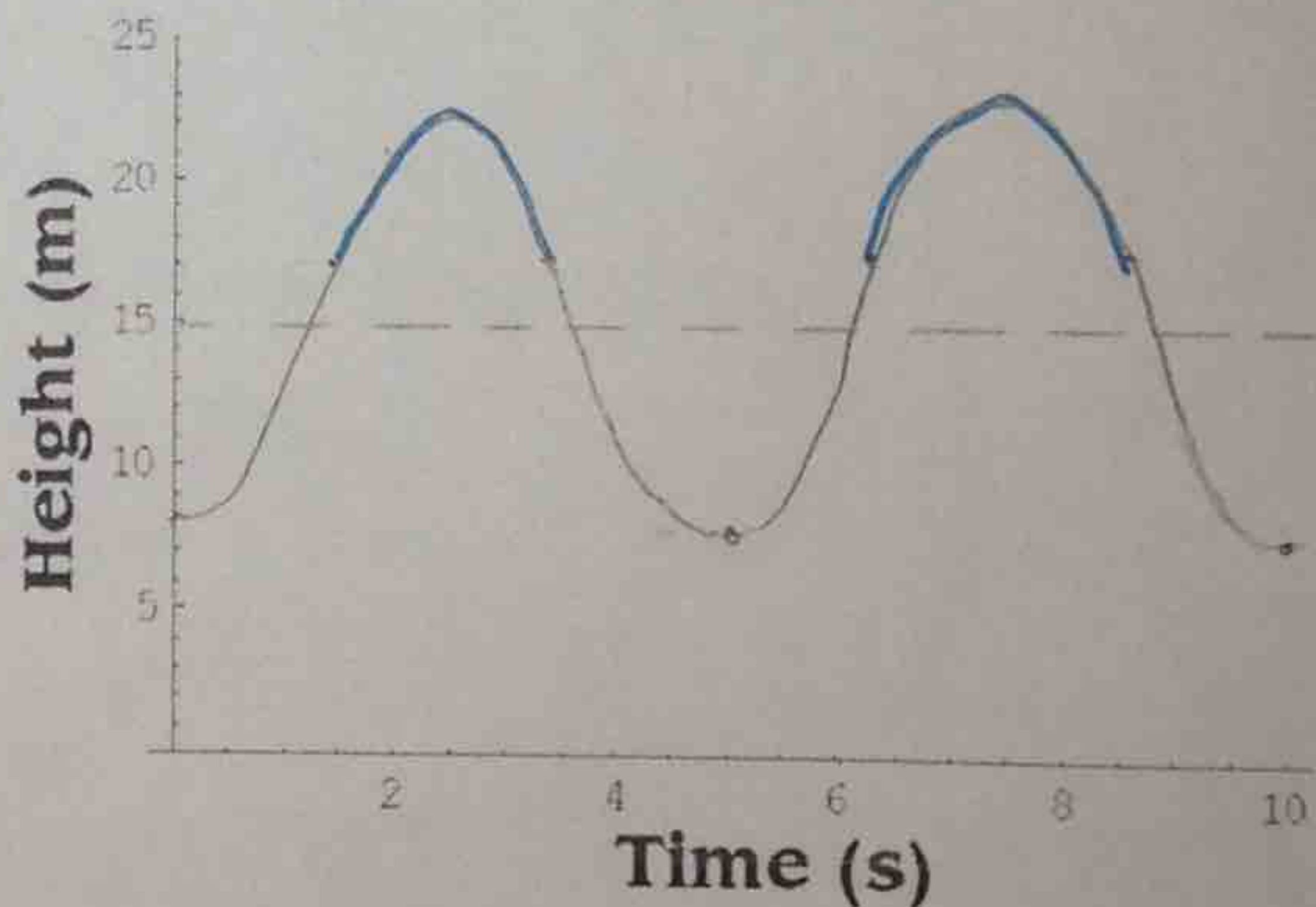
- a) Determine the cosine equation of the graph, starting from a point at the bottom of the windmill.

$$\text{amp} = \frac{22 - 8}{2} = 7$$

$$\text{mid} = \frac{22 + 8}{2} = 15$$

$$b = \frac{2\pi}{5}$$

$$y = -7 \cos \frac{2\pi}{5} \theta + 15$$



- b) Draw the graph of two complete cycles.
 c) What is the height of the point after 4 seconds?

$$12.8 \text{ m}$$

- d) What is the height of the point after 4 seconds?

$$12.8 \text{ m}$$

- e) For how long (over the course of both cycles) is the wheel above 17 m?

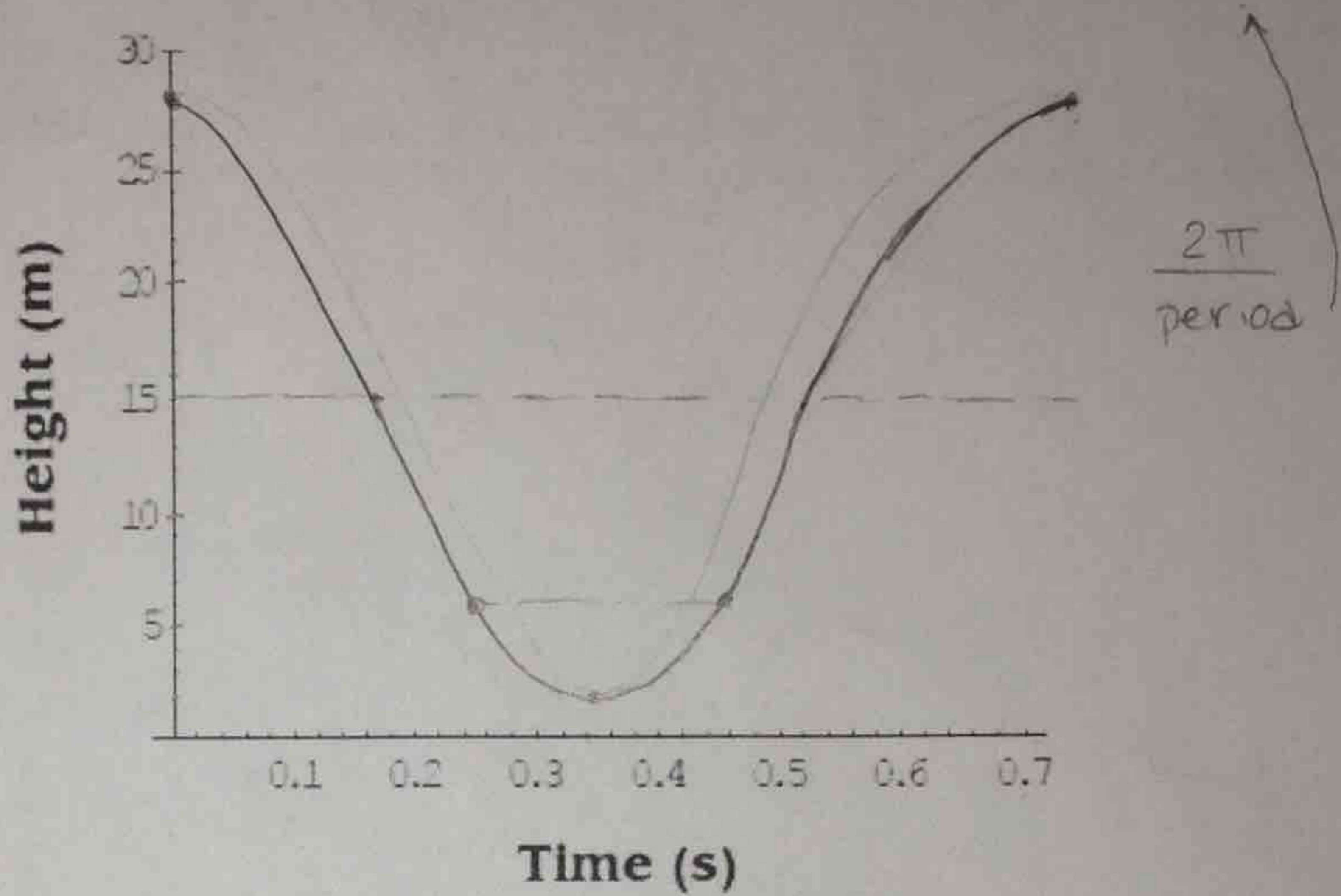
$$1.5 \quad 3.5$$

$$\underbrace{\quad\quad}_{2 \text{ sec}}$$

about 4 sec

3. A point on an industrial flywheel experiences a motion described by the formula: $h(t) = 13\cos\frac{2\pi}{0.7}t + 15$

max = 28
min = 2



a) What is the maximum height of the point?

$15 + 13 = 28 \text{ m}$

$\varphi = 0.7$

b) At what time is the maximum height reached?

0.7 sec

c) What is the minimum height of the point?

$15 - 13 = 2 \text{ m}$

d) At what time is the minimum height reached?

0.35 sec

e) How long, within one cycle, is the point lower than 6 m above the ground?

$0.44 - 0.26$

0.18 seconds

f) What is the height of the point if the wheel turns for 2 hours and 20 minutes?

20 min = 1200 sec

$2(60)(60) = 7200 \text{ sec}$

8400 sec

$\frac{8400}{0.7} = 12000 \text{ cycles}$

height = 28 m