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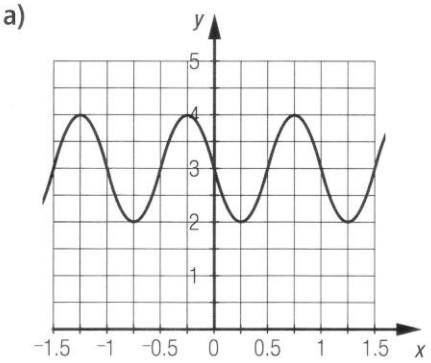
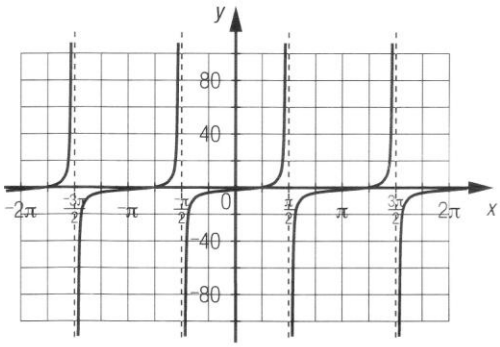
3.

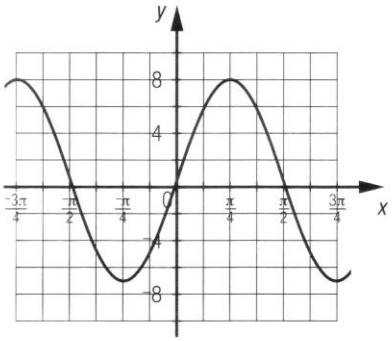
a)



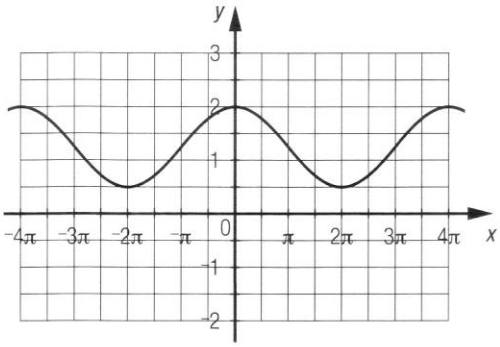
b)



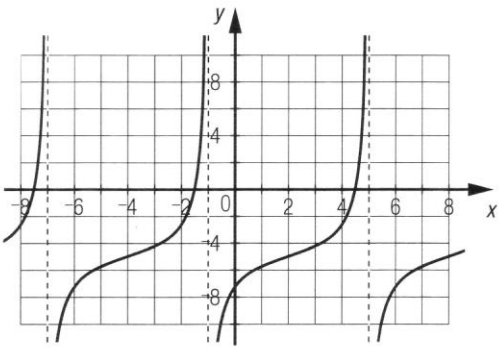
c)



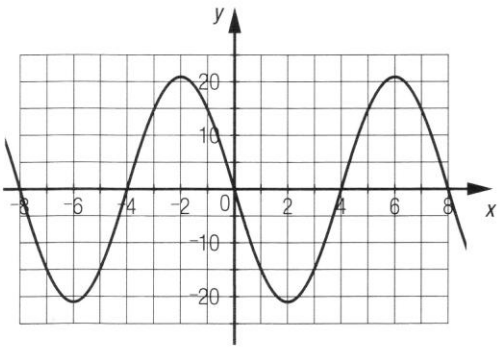
d)



e)



f)



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5. A – 2

B – 4

C – 3

D – 5

E – 1

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6.

a) **1)** $f(x) = \sin 2\left(x - \frac{\pi}{8}\right) + 0.5$ **2)** $f(x) = \cos 2\left(x - \frac{3\pi}{8}\right) + 0.5$

b) **1)** $f(x) = -3\sin \pi x - 1$ **2)** $f(x) = 3\cos \pi(x + 0.5) - 1$

c) **1)** $f(x) = 6\sin \pi\left(x + \frac{1}{4}\right)$ **2)** $f(x) = 6\cos \pi\left(x - \frac{1}{4}\right)$

d) **1)** $f(x) = -0.75\sin \frac{\pi}{2}x + 0.05$ **2)** $f(x) = -0.75\cos \frac{\pi}{2}(x - 1) + 0.05$

e) **1)** $f(x) = -2\sin 4x - 1$ **2)** $f(x) = 2\cos 4\left(x + \frac{\pi}{8}\right) - 1$

f) **1)** $f(x) = 7\sin \frac{\pi}{6}(x - 1) - 7$ **2)** $f(x) = 7\cos \frac{\pi}{6}(x - 4) - 7$

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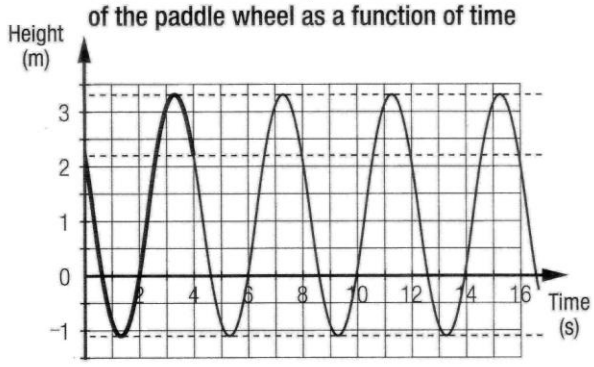
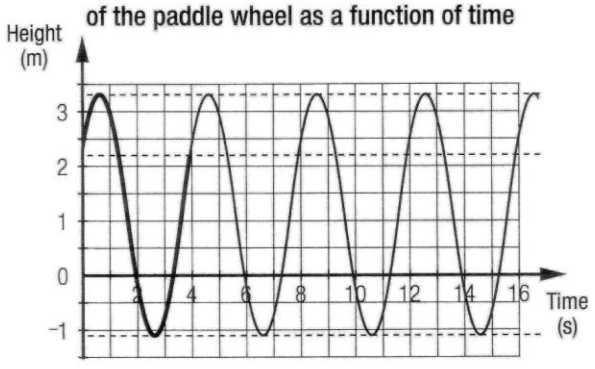
13. *Several answers possible. Example:*
$y = -45\cos \frac{2\pi}{11}x + 45$ where x represents time (in years) and y represents the number of sunspots observed in one day.

14. There are two possible answers based on the initial position of the extremity of the broken blade. In both cases, the following can be noted:

- Since the paddle wheel completes 10 turns/min, equal to 1 turn for each 6 s, you can deduce that the period is 6 s.
- Since the radius of the wheel is 2.2 m and its centre is located at 1.1 m above the surface of the water, the maximum and minimum heights reached by the extremity of the broken blade are 3.3 m and −1.1 m.
- The initial value of the function is 2.2.

Initial position of the extremity of the broken blade

a)	The extremity of the broken blade is located on the right side of the centre of the wheel.	The extremity of the broken paddle wheel is located on the left side of the centre of the wheel.
	Height of the extremity of the broken blade of the paddle wheel as a function of time 	**Height of the extremity of the broken blade of the paddle wheel as a function of time** 
b)	*Several answers possible. Example:* $h(t) = 2.2\sin \frac{\pi}{3}(t + 0.5) + 1.1$ where h represents the height (in m) and t, the time (in s).	*Several answers possible. Example:* $h(t) = 2.2\sin \frac{\pi}{3}(t + 2.5) + 1.1$ where h represents the height (in m) and t, the time (in s).

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9. At 15 *seconds*

10. For 200 *seconds*

12. 100 *times*

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20. a) 2 *cm*

b) 6 *cm*

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5. **a)** $x = \frac{10}{3} + 4n$ and $x = \frac{14}{3} + 4n$, $n \in \mathbb{Z}$.
b) $x = 2 + 16n$ and $x = 10 + 16n$, $n \in \mathbb{Z}$.
c) $x = 6n$, $n \in \mathbb{Z}$
d) $x = \frac{2}{9} + \frac{2}{3}n$ and $x = \frac{4}{9} + \frac{2}{3}n$, $n \in \mathbb{Z}$.
e) $x = \frac{\pi + 4}{4} + n\pi$, $n \in \mathbb{Z}$
f) $x = \frac{5\pi}{16} + n\pi$, $n \in \mathbb{Z}$

6. **a)** $f(x) = -\sin x$ or $f(x) = \cos\pi\left(x + \frac{\pi}{2}\right)$.
b) $f(x) = -3\cos x$ or $f(x) = 3\cos(x + \pi)$.
c) $f(x) = 2\sin 3x + 1$ or $f(x) = 2\cos 3\left(x - \frac{\pi}{6}\right) + 1$.
d) $f(x) = \sin\pi x - 1$ or $f(x) = \cos\pi\left(x - \frac{1}{2}\right) - 1$.
e) $f(x) = \sin x$ or $f(x) = \cos\left(x - \frac{\pi}{2}\right)$.
f) $f(x) = -10\sin x - 20$ or $f(x) = 10\cos\left(x + \frac{\pi}{2}\right) - 20$.

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7. **a)** No solution.
b) $\left\{-\frac{25\pi}{9}, -\frac{23\pi}{9}, -\frac{19\pi}{9}, -\frac{17\pi}{9}, -\frac{13\pi}{9}, -\frac{11\pi}{9}, -\frac{5\pi}{9}, -\frac{\pi}{9}, \frac{\pi}{9}, \frac{5\pi}{9}, \frac{7\pi}{9}, \frac{11\pi}{9}, \frac{13\pi}{9}, \frac{17\pi}{9}, \frac{19\pi}{9}, \frac{23\pi}{9}, \frac{25\pi}{9}\right\}$
c) $-\frac{5\pi}{4}$
d) No solution.
e) $\left\{-\frac{71\pi}{24}, -\frac{67\pi}{24}, -\frac{47\pi}{24}, -\frac{43\pi}{24}, -\frac{23\pi}{24}, -\frac{19\pi}{24}, \frac{\pi}{24}, \frac{5\pi}{24}, \frac{25\pi}{24}, \frac{29\pi}{24}, \frac{49\pi}{24}, \frac{53\pi}{24}\right\}$
f) $\left\{-\frac{11\pi}{4}, -\frac{9\pi}{4}, -\frac{7\pi}{4}, -\frac{5\pi}{4}, -\frac{3\pi}{4}, -\frac{\pi}{4}, \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}, \frac{9\pi}{4}, \frac{11\pi}{4}\right\}$

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19. **a)** *Several answers possible. Example:*
$f(x) = 3\cos\pi(x - 1) + 1.5$ or $f(x) = 3\sin\pi\left(x - \frac{1}{2}\right) + 1.5$.

b) 1) {1, 3, 5}

2) $\left\{\frac{1}{3}, \frac{5}{3}, \frac{7}{3}, \frac{11}{3}, \frac{13}{3}, \frac{17}{3}\right\}$

21. The device is saturated over the following intervals: [0, ≈ 0.01[s,]≈ 0.08, 0.11[s,]≈ 0.19, ≈ 0.21[s,]≈ 0.29, ≈0.31[s,]≈ 0.39, ≈ 0.41[s,]≈ 0.49, ≈ 0.51[s,]≈ 0.59, ≈ 0.61[s,]≈ 0.69, ≈ 0.71[s,]≈ 0.79, ≈ 0.81[s,]≈ 0.89, ≈ 0.91[s and]≈ 0.99, 1] s.

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24. Considering the *x*-axis as the surface of the water, you must find two consecutive zeros for the function $h = 250\cos\frac{\pi t}{15} + 125$ when the curve is found above the *x*-axis.

$t = 20$ s and $t = 10$ s. Therefore 20 s − 10 s = 10 s.

The water bomber takes 10 s to fill its tank.

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26. **a) 1)** *Several answers possible. Example:*

$P = 30\cos\frac{\pi}{4}(x - 4) + 210$ or $P = 30\sin\frac{\pi}{4}(x - 2) + 210$ where P represents the population of deer and x represents the time elapsed since 2000 (in years).

2) *Several answers possible. Example:*

$P = 4\cos\frac{\pi}{4}(x - 5) + 20$ or $P = 4\sin\frac{\pi}{4}(x - 3) + 20$ where P represents the population of coyotes and x represents the time elapsed since 2000 (in years).

b) 1) In 2021, the population of deer would be approximately 231 animals.

2) In 2027, the population of coyotes would be 20 animals.

c) 1) From September 1, 2010 to April 30, 2013; from September 1, 2018 to April 30, 2021 and from September 1, 2026 to April 30, 2029.

2) Since 24 is the maximum number of coyotes, the population of coyotes is always less than or equal to 24 animals.