MATHEMATICS · GRADES 10-12

Amplitude and period

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you describe a sound wave, a radio signal, or the swing of a playground swing. Amplitude tells you how tall the wave is, which is how loud a sound is or how far a swing goes. Period tells you how long one full repeat takes, which is what sets the pitch of a note or the timing of a signal.



Rule

Amplitude and period: for $y = a \sin(bx)$ or $y = a \cos(bx)$, amplitude $= |a|$ and period $= \frac{360}{b}$.

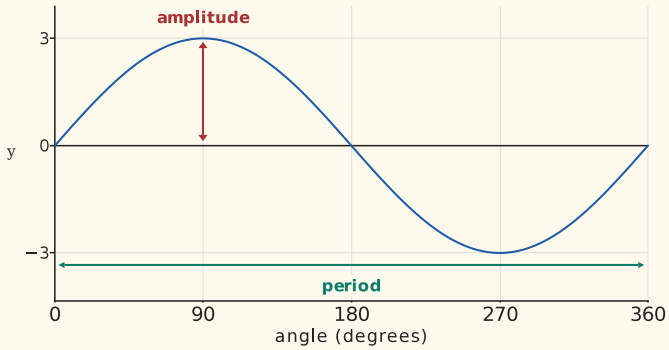
The amplitude is how tall the wave is, and the period is how long one full repeat takes.

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Worked examples

EXAMPLE 1

Q Find the amplitude and period of $y = 3 \sin x$.



SOLUTION

Amplitude is the number in front of sin, ignoring the sign: 3

Period = 360 ÷ 1 = 360 degrees.

Amplitude 3, period 360 degrees.

EXAMPLE 2

Q Find the amplitude and period of $y = 2 \cos (2x)$.

SOLUTION

Amplitude is 2, the number in front of cos.

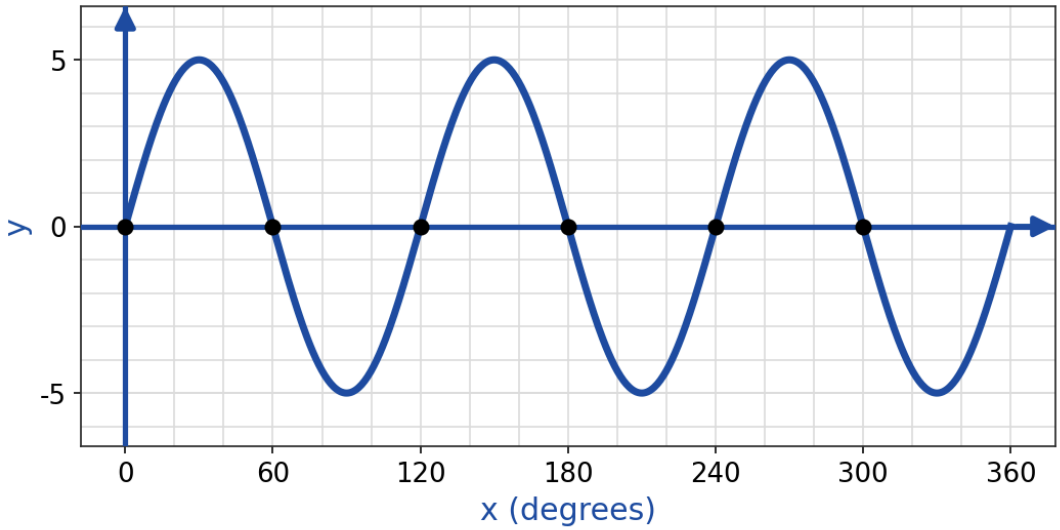
The number multiplying x is 2, so the wave repeats twice as fast.

Period = $\frac{360}{2}$ = 180 degrees.

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Practice questions

1 Find the amplitude and the period of the function graphed below.



A Amplitude 5, period 360 degrees

B Amplitude 3, period 120 degrees

C Amplitude 5, period 120 degrees

D Amplitude 5, period 60 degrees

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2 A sound wave is modelled by $y = 0.4\cos(2x)$, where y is the air pressure change. What are the amplitude and period of the wave?

- **A** Amplitude 0.4, period 360 degrees
- **B** Amplitude 0.4, period 180 degrees
- **C** Amplitude 2, period 180 degrees
- **D** Amplitude 0.4, period 90 degrees

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3 A radio signal follows $y = 6\sin x$. What is the greatest value of y, and what is the least value?

- **A** 6 and -6
- **B** 6 and 0
- **C** 3 and -3
- **D** 360 and -360

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4 **A playground swing moves so its distance from the middle follows $y = 1.5 \sin(4x)$, where y is in metres. How far does the swing go from the middle, and after how many degrees does the motion repeat?**

- **A** 1.5 metres from the middle; it repeats after 90 degrees
- **B** 1.5 metres from the middle; it repeats after 360 degrees
- **C** 4 metres from the middle; it repeats after 90 degrees
- **D** 3 metres from the middle; it repeats after 180 degrees

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5 **Which has the greater amplitude, $y = 2 \sin x$ or $y = 3 \cos(2x)$? Give the amplitude of each and the period of each.**

- **A** $y = 2 \sin x$ has the greater amplitude; periods 360 degrees and 180 degrees
- **B** $y = 3 \cos(2x)$ has the greater amplitude; periods 180 degrees and 360 degrees
- **C** $y = 3 \cos(2x)$ has the greater amplitude; periods 360 degrees and 180 degrees
- **D** $y = 2 \sin x$ has the greater amplitude; periods 180 degrees and 360 degrees

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6 **Write a sine function with amplitude 4 and period 180 degrees.**

- **A** y = 2 sin(2x)
- **B** y = 4 sin(4x)
- **C** y = 4 sin(2x)
- **D** y = 4 cos(2x)

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7 **A pendulum swings as y = -3 cos x. What are its amplitude and period?**

- **A** Amplitude -3, period 360 degrees
- **B** Amplitude 3, period 360 degrees
- **C** Amplitude 3, period 180 degrees
- **D** Amplitude 1, period 360 degrees

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8 **The height of a tide above its middle level follows $y = 2.5 \sin(\frac{x}{2})$. Find its amplitude and period.**

A Amplitude 2.5, period 360 degrees

B Amplitude 2.5, period 180 degrees

C Amplitude 0.5, period 720 degrees

D Amplitude 2.5, period 720 degrees

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9 **Two notes are modelled by y = sin(6x) and y = sin(2x). Which one repeats faster, and what is the period of each?**

A. y = sin(6x) repeats faster; periods 60 degrees and 180 degrees

B. y = sin(2x) repeats faster; periods 60 degrees and 180 degrees

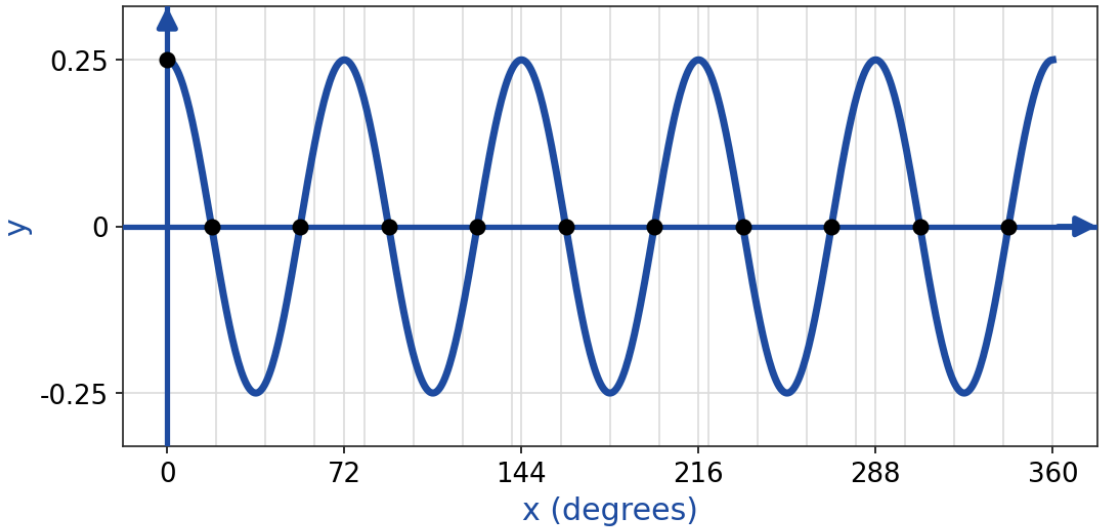
C. y = sin(6x) repeats faster; periods 180 degrees and 60 degrees

D. y = sin(2x) repeats faster; periods 180 degrees and 60 degrees

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10 **A tuning fork vibrates as shown in the graph below. Find its amplitude and period.**



- **A** Amplitude 0.25, period 360 degrees
- **B** Amplitude 0.25, period 72 degrees
- **C** Amplitude 0.5, period 72 degrees
- **D** Amplitude 0.25, period 144 degrees

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ANSWER KEY

1. Amplitude 5, period 120 degrees

2. Amplitude 0.4, period 180 degrees

3. 6 and -6

4. 1.5 metres from the middle; it repeats after 90 degrees

5. y = 3 cos(2x) has the greater amplitude; periods 360 degrees and 180 degrees

6. y = 4 sin(2x)

7. Amplitude 3, period 360 degrees

8. Amplitude 2.5, period 720 degrees

9. y = sin(6x) repeats faster; periods 60 degrees and 180 degrees

10. Amplitude 0.25, period 72 degrees

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