

Exercise walk-through

3.5

Sinusoidal Functions

AP Precalculus

What we will cover

- 1 Periodic phenomena
- 2 Sine cosine & tangent
- 3 Sinusoidal functions
- 4 Transformations & modelling
- 5 Inverse trig & equations
- 6 Identities
- 7 Polar functions

The identities the exam expects

Pythagorean identity

$\sin^2 \theta + \cos^2 \theta = 1$, and its two derived forms with $\tan$ and $\cot$

sum identities

$\sin(a \pm b) = \sin a \cos b \pm \cos a \sin b$;
 $\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$

double-angle

$\sin 2\theta = 2 \sin \theta \cos \theta$; $\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 1 - 2 \sin^2 \theta$

arcsine and friends

inverse trig functions need a **restricted domain** to be functions at all

the special triangles

the **equilateral triangle**
 square halved gives 45°

halved gives 30° – 60° ; the

Every one of these lets you rewrite an expression into a form you can solve. Identities are **tools for rewriting**, not facts to recite.

Exam tips

- Use radians and the **unit circle**: $\cos \theta$ and $\sin \theta$ are the coordinates, always between -1 and 1 .
- For a sinusoid $a \sin(b(\theta + c)) + d$: $|a|$ is the amplitude, $\frac{2\pi}{|b|}$ the period, d the midline, and the phase shift is $-c$ ($a + c$ shifts left).
- Model periodic data by reading period, amplitude, and midline from the max and min.
- **Inverse trig** functions need a restricted domain and return an angle; trig equations have infinitely many solutions (add the period).
- Convert polar $\leftrightarrow$ rectangular with $x = r \cos \theta$, $y = r \sin \theta$.

Exercises 2.1·2.3

2.1 In $y = a \sin(bx)$, state the amplitude. [1]

2.2 State the period of $y = \sin(2x)$. [2]

2.3 In $y = \sin x + 3$, state the midline. [1]

Exercises 2.1·2.3

2.1 In $y = a \sin(bx)$, state the amplitude. [1]

2.1

- $|a|$
-

2.2 State the period of $y = \sin(2x)$. [2]

2.2

- period = $\frac{2\pi}{2} = \pi$
-

2.3 In $y = \sin x + 3$, state the midline. [1]

2.3

- $y = 3$

Exercise 3.1

3.1 In $y = a \sin(b(x - h)) + k$, the amplitude is

[1]

☐

A b

B $|a|$

C k

D h

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3.1 In $y = a \sin(b(x - h)) + k$, the amplitude is

[1]

☐

A b

B $|a|$

C k

D h

3.1 B

- $|a|$.

Exercise 3.2

3.2 The period of $y = a \sin(bx)$ is

[1]

☐

A 2π

B $\frac{2\pi}{b}$

C $\frac{b}{2\pi}$

D πb

Exercise 3.2

3.2 The period of $y = a \sin(bx)$ is

[1]

☐

A 2π

B $\frac{2\pi}{b}$

C $\frac{b}{2\pi}$

D πb

3.2 B

• $\frac{2\pi}{b}$.

Exercise 3.3 (a)

3.3 $y = 3 \sin(2x) + 1.$

(a) State the amplitude.

[1]

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(a) State the amplitude.

[1]

(a)

- 3

Exercise 3.3 (b)

3.3 $y = 3 \sin(2x) + 1.$

(b) State the period.

[1]

Exercise 3.3 (b)

3.3 $y = 3 \sin(2x) + 1.$

(b) State the period.

[1]

(b)

- π

Exercise 3.3 (c)

3.3 $y = 3 \sin(2x) + 1.$

(c) State the midline.

[1]

$$y = \boxed{3} \sin(\boxed{2}x) + \boxed{1}$$

Exercise 3.3 (c)

3.3 $y = 3 \sin(2x) + 1.$

(c) State the midline.

[1]

$$y = \boxed{3} \sin(\boxed{2}x) + \boxed{1}$$

(c)

- $y = 1$