F1

Annie Bai	Franklin Chen	Charlie Cheng	Zoey Cheng	Harry Cui	King Deng	Aisling Fu	Ken He	Ivy Jing
Lee Li	Ziheng Li	Lewis Liu	Sam Liu	Ava Peng	Peter Shen	Sylvia Song	Coco Wang	Eileen Wang
Jason Wang	Luna Wang	Cathy Yan	Melody You	Allen Zhang	Lucas Zhang	Lynette Zhang	Ryder Zhang	Flora Zhou
Cyntina Zuo								

F2

Angelina Wang	Azura Cheng	Bonnie Zhao	Cecilia Jia	Diana Li	Oscar Liu	Zavier Liu	Tom Ou	Mia Peng
Joshua Hui	Julius Lv	Justin Jia	Lucas Li	Lyra Zhang	Iris Shao	Dylan Suo	PeytonAson Wang	Struck Wang
Selene Hou	Serena Feng	Silas Lv	Simon Wang	Stella Sun	Yola Wang	Mark Xiao	Elsa Ye	Emily Zhang
Zinnia Dong	Flora Zhang							

F3

Allen Peng	Aurora Yuan	Brittney Wei	Cynthia Liu	Erya Hu	Eva Gai	Felicity Pan	Fiona Ding	Freya Fan
Gordon Yao	Helios Luo	Honey Ruan	Iris Xie	Jasper Wu	Kaven Zhang	Kevin Gao	Leo Yang	Linger Li
Lydia Wei	Maggie Gao	Micheal Zhao	Ray Meng	Rose Jiang	Ross Ma	Roy Liu	Ryan Wang	Sky Bai
Star Su	Stella Xi							

F4

Aris Cheng	Tracy Dang	Jason Du	Alanna Fan	Iris Gao	Eason Gong	Vardy Hai	Edmund He	Liora Li
Miranda Li	Leo Liu	Francis Lv	Dorothy Qian	Dary Song	Jerry Tu	Belinda Wang	Winnie Wang	Elena Wei
James Xu	Mike Yan	Simon Yang	Coco Zhang	Patrick Zhang	Sophia Zhang	Molly Zheng	Carrie Zhou	Rudy Zhu

F5

Abbie Dong	Alan Chen	Angela An	Annette Zhao	Asher Tian	Jove Bai	Camellia Long	Candice Li	Carmen Du
Ricardo Lian	Emma Zhang	Ethan Yu	Ethen Li	Jack Spark Men	Jarry Wang	Cressen Liang	Leo Liu	Lucas Bai
Lycia Liu	Nina Dang	August Mao	Robin Mi	Vicky Yang	Victor Li	Yolanda Wang	Zephyra Hu	

F6

Lucas Chang	Chloe Fang	Bruce Gao	Wyatt Hou	Jackson Jiang	Ivan Lei	Eric Li	Keira Li	Vivian Li
Jeremy Lin	Orange Liu	Serika Ren	Yumiko Shi	Hannah Si	Eric Song	Eric Tan	Silas Wang	Niki Wei
Kiki Wen	Miyu Wu	Tia Wu	Kumi Yuan	Estelle Zhang	Soren Zhang	Viakey Zhang	Jack Zhao	

Turn and Talk

$$\frac{5+2i}{3-i}$$

Turn and Talk

$$\frac{5+2i}{3-i}$$

$$\boxed{\frac{13}{10}+\frac{11}{10}i}$$

Trigonometric Functions

trigonometric function — 三角函数 (*sān jiǎo hán shù*)

angle — 角 (*jiǎo*)

degree — 度 (*dù*)

radian — 弧度 (*hú dù*)

sine — 正弦 (*zhèng xián*)

cosine — 余弦 (*yú xián*)

tangent — 正切 (*zhèng qiē*)

right triangle — 直角三角形 (*zhí jiǎo sān jiǎo xíng*)

hypotenuse — 斜边 (*xié biān*)

opposite side — 对边 (*duì biān*)

adjacent side — 邻边 (*lín biān*)

unit circle — 单位圆 (*dān wèi yuán*)

period — 周期 (*zhōu qī*)

amplitude — 振幅 (*zhèn fú*)

Reminders:
Q2 Gradebook has now closed
Posters and Notes will contribute to Q3 gradebook
Desmos (A3 or A4) or any other Mathematics Posters sent to me by Friday 6th February

Radians - we do

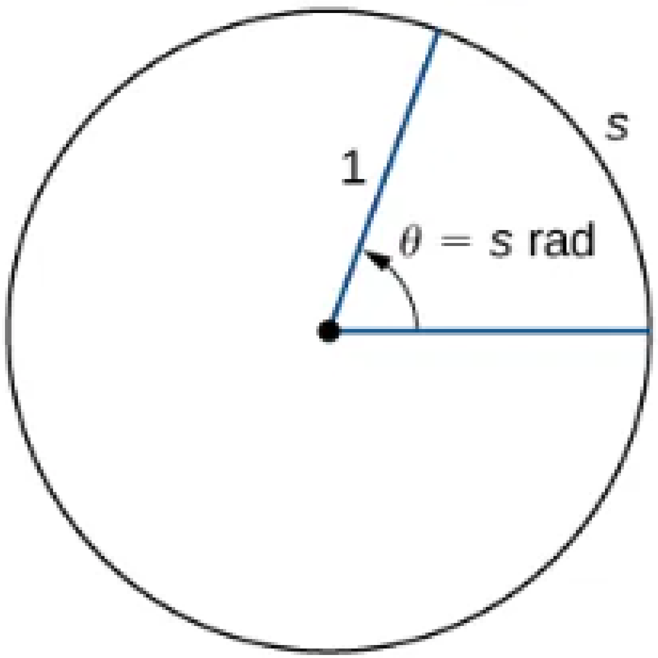


Figure 1.30 The radian measure of an angle θ is the arc length s of the associated arc on the unit circle.

360 degrees = ---- Rad

--- degrees = 1 Rad

Radians - you do

Degrees	Radians	Degrees	Radians
0		120	
30		135	
45		150	
60		180	
90			

Converting between Radians and Degrees

a. Express $225°$ using radians.

b. Express $5\pi/3$ rad using degrees.

Converting between Radians and Degrees

a. Express $225°$ using radians.

b. Express $5\pi/3$ rad using degrees.

Solution

Use the fact that $180°$ is equivalent to π radians as a conversion factor: $1 = \frac{\pi\,\text{rad}}{180°} = \frac{180°}{\pi\,\text{rad}}$.

a. $225° = 225° \cdot \frac{\pi}{180°} = \frac{5\pi}{4}$ rad

b. $\frac{5\pi}{3}$ rad = $\frac{5\pi}{3} \cdot \frac{180°}{\pi} = 300°$

Six Basic Trigonometric Functions

DEFINITION

Let $P = (x, y)$ be a point on the unit circle centered at the origin O. Let θ be an angle with an initial side along the positive x-axis and a terminal side given by the line segment OP. The **trigonometric functions** are then defined as

$$\begin{aligned} \sin\theta &= y & \csc\theta &= \frac{1}{y} \\ \cos\theta &= x & \sec\theta &= \frac{1}{x} \\ \tan\theta &= \frac{y}{x} & \cot\theta &= \frac{x}{y} \end{aligned} \qquad (1.9)$$

If $x = 0$, $\sec\theta$ and $\tan\theta$ are undefined. If $y = 0$, then $\cot\theta$ and $\csc\theta$ are undefined.

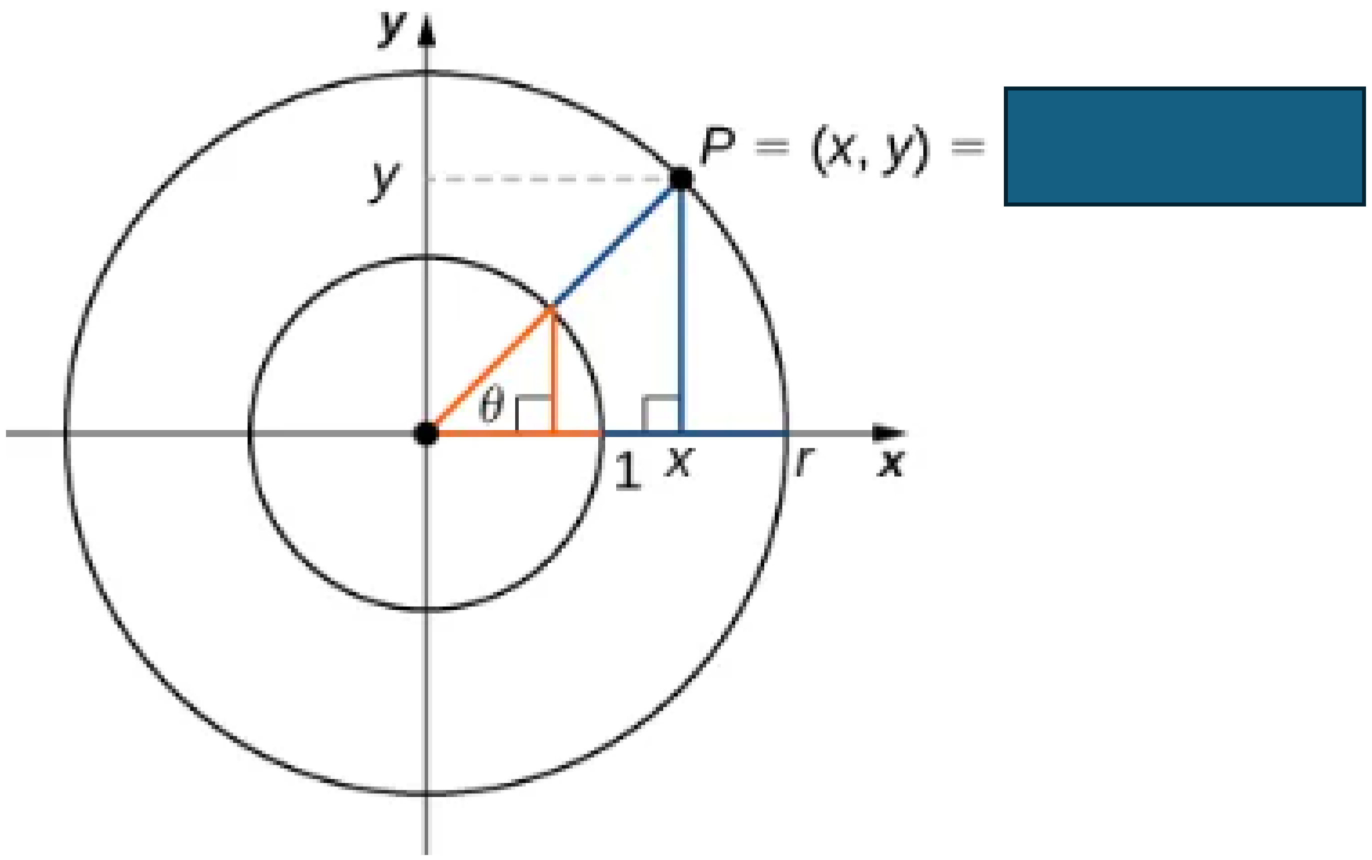
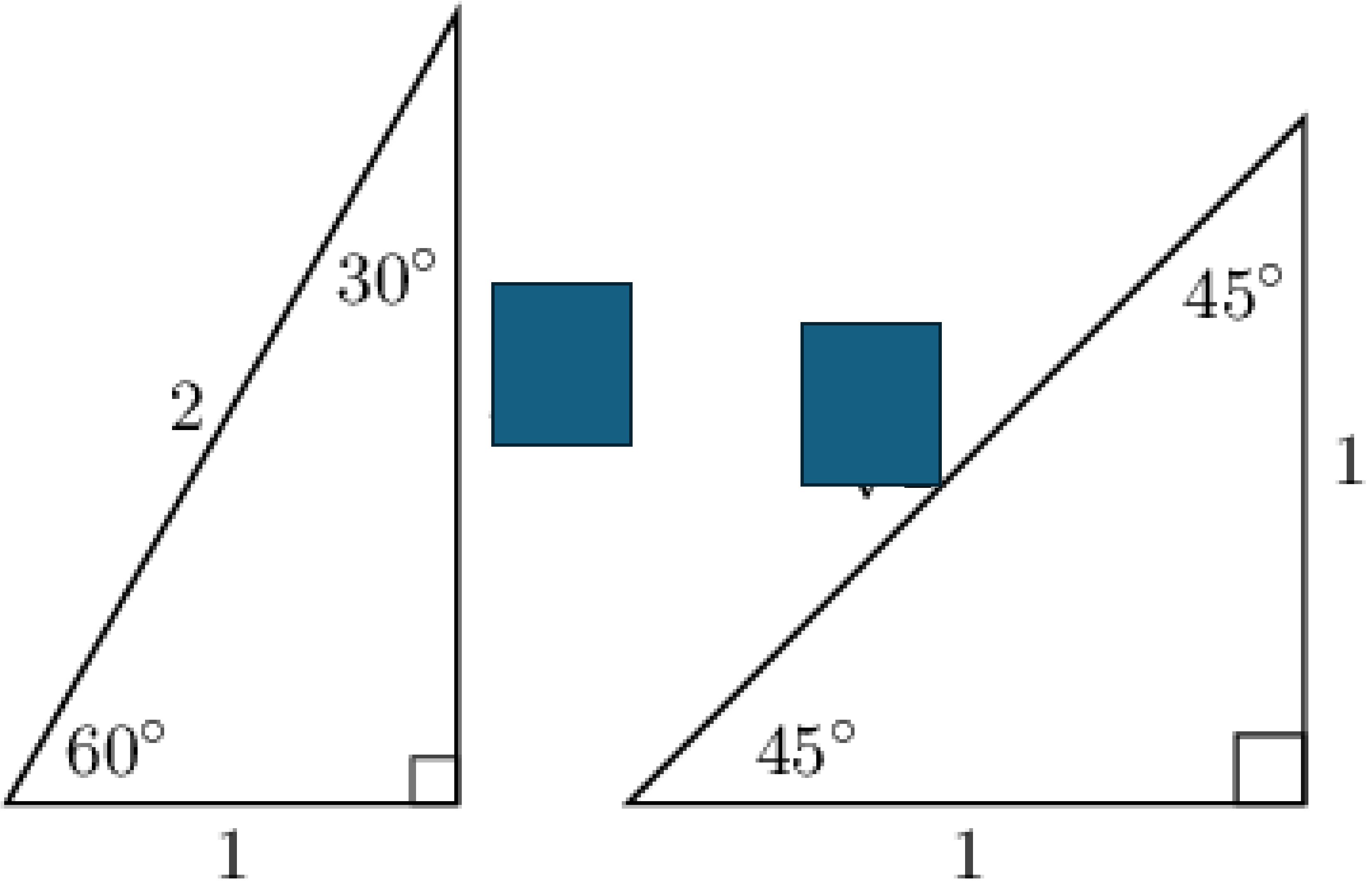


Figure 1.32 For a point $P = (x, y)$ on a circle of radius r, the coordinates x and y satisfy $x = r\cos\theta$ and $y = r\sin\theta$.

SPECIAL ANGLES



θ	$\sin\theta$	$\cos\theta$
0	[redacted]	[redacted]
$\frac{\pi}{6}$	[redacted]	[redacted]
$\frac{\pi}{4}$	[redacted]	[redacted]
$\frac{\pi}{3}$	[redacted]	[redacted]
$\frac{\pi}{2}$	[redacted]	[redacted]

Table 1.9 Values of $\sin\theta$ and $\cos\theta$ at Major Angles θ in the First Quadrant

Evaluating Trigonometric Functions

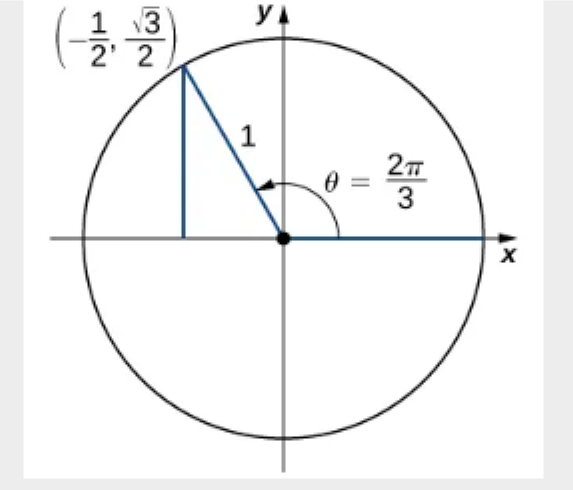
Evaluate each of the following expressions.

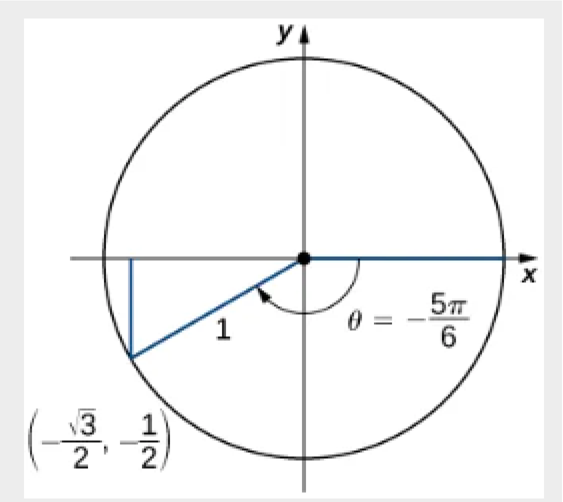
a. $\sin\left(\frac{2\pi}{3}\right)$
b. $\cos\left(-\frac{5\pi}{6}\right)$
c. $\tan\left(\frac{15\pi}{4}\right)$

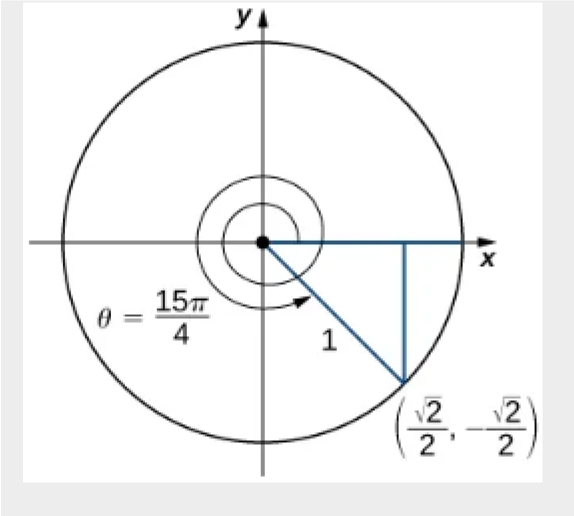
Evaluating Trigonometric Functions

Evaluate each of the following expressions.

a. $\sin\left(\frac{2\pi}{3}\right)$
b. $\cos\left(-\frac{5\pi}{6}\right)$
c. $\tan\left(\frac{15\pi}{4}\right)$







$$\sin\theta = \frac{O}{H} \qquad \csc\theta = \frac{H}{O}$$
$$\cos\theta = \frac{A}{H} \qquad \sec\theta = \frac{H}{A}$$
$$\tan\theta = \frac{O}{A} \qquad \cot\theta = \frac{A}{O}$$

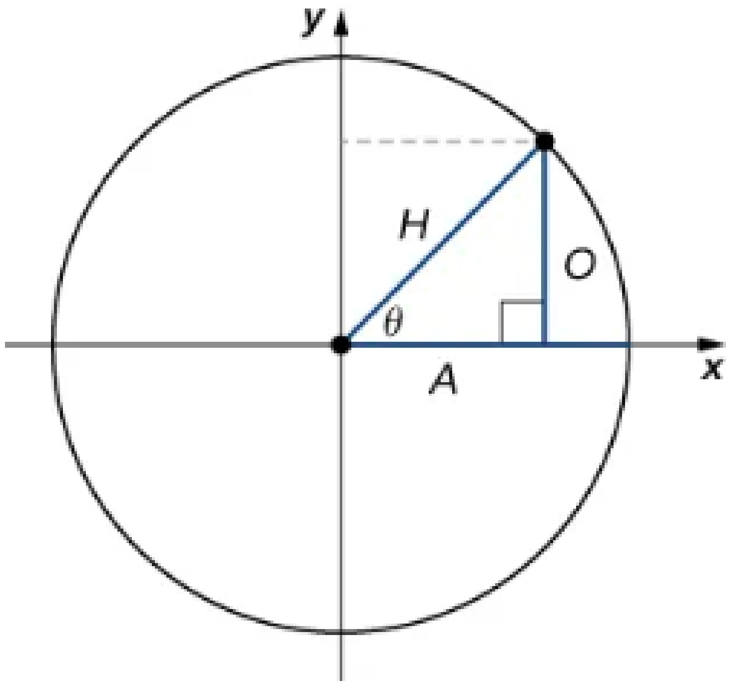


Figure 1.33 By inscribing a right triangle in a circle, we can express the ratios of the side lengths in terms of the trigonometric functions evaluated at θ.

Constructing a Wooden Ramp

A wooden ramp is to be built with one end on the ground and the other end at the top of a short staircase. If the top of the staircase is 4 ft from the ground and the angle between the ground and the ramp is to be $10°$, how long does the ramp need to be?

Let x denote the length of the ramp. In the following image, we see that x needs to satisfy the equation $\sin(10°) = 4/x$. Solving this equation for x, we see that $x = 4/\sin(10°) \approx 23.035$ ft.

Trigonometric Identities

Reciprocal identities

$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{\cos\theta}{\sin\theta}$$
$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta}$$

Pythagorean identities

[redacted]

Addition and subtraction formulas

[redacted]

Double-angle formulas

[redacted]

Solving Trigonometric Equations

For each of the following equations, use a trigonometric identity to find all solutions.

a. $1 + \cos(2\theta) = \cos\theta$

b. $\sin(2\theta) = \tan\theta$

$$\theta = \frac{\pi}{2} + n\pi, \theta = \frac{\pi}{3} + 2n\pi, \text{ and } \theta = -\frac{\pi}{3} + 2n\pi, n = 0, \pm 1, \pm 2, \ldots.$$

$$\theta = n\pi \quad \text{and} \quad \theta = \frac{\pi}{4} + \frac{n\pi}{2}, n = 0, \pm 1, \pm 2, \ldots.$$

Prove the trigonometric identity $1 + \tan^2\theta = \sec^2\theta$.

We start with the identity

$$\sin^2\theta + \cos^2\theta = 1.$$

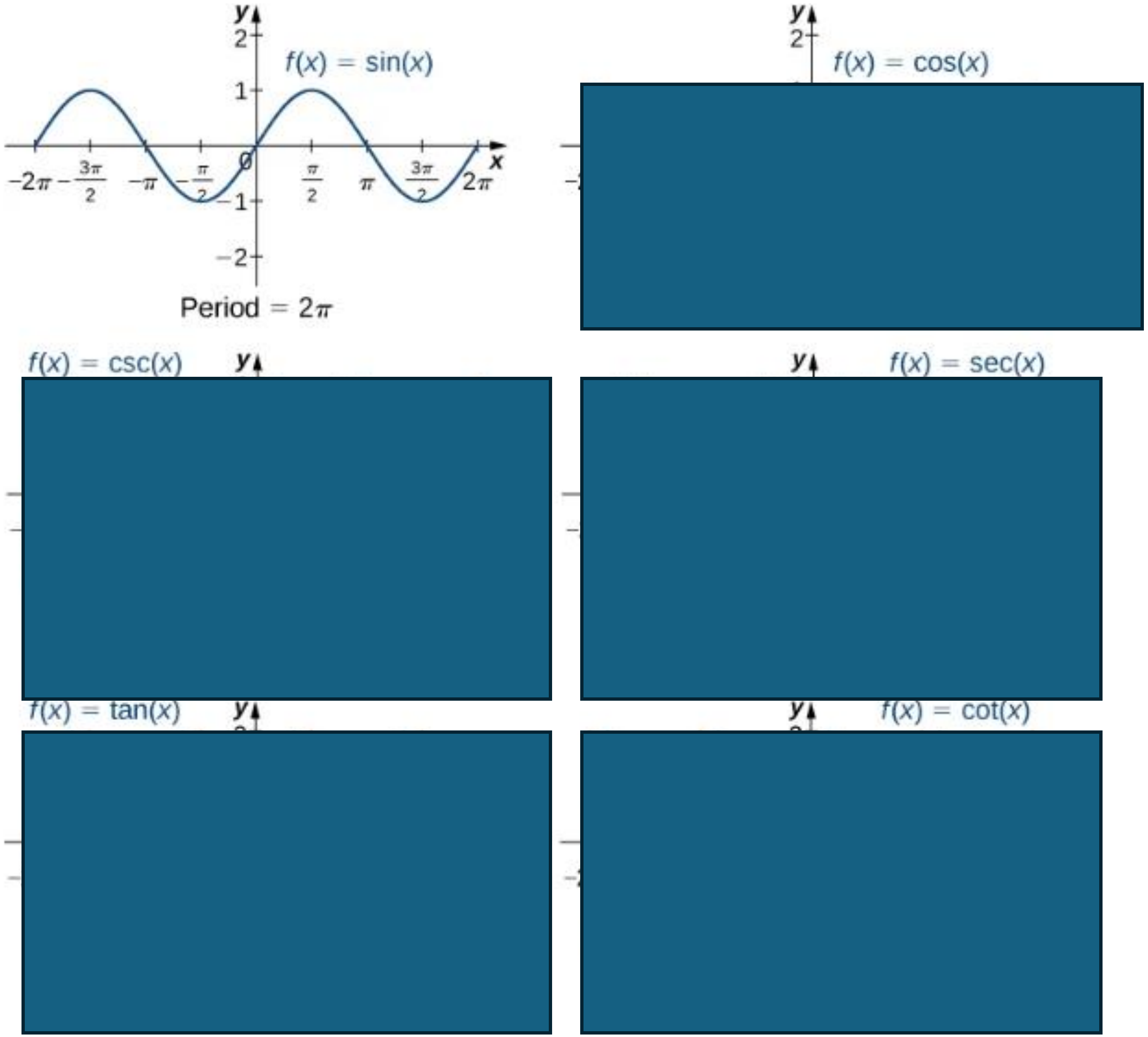
Dividing both sides of this equation by $\cos^2\theta$, we obtain

$$\frac{\sin^2\theta}{\cos^2\theta} + 1 = \frac{1}{\cos^2\theta}.$$

Since $\sin\theta/\cos\theta = \tan\theta$ and $1/\cos\theta = \sec\theta$, we conclude that

$$\tan^2\theta + 1 = \sec^2\theta.$$

Trigonometric Graphs



Angular Speed

Angular speed measures **how fast something rotates.** It tells you the angle covered per unit of time.

- **Formula:**

$$\omega = \frac{\theta}{t}$$

where:

ω = angular speed (radians per second)

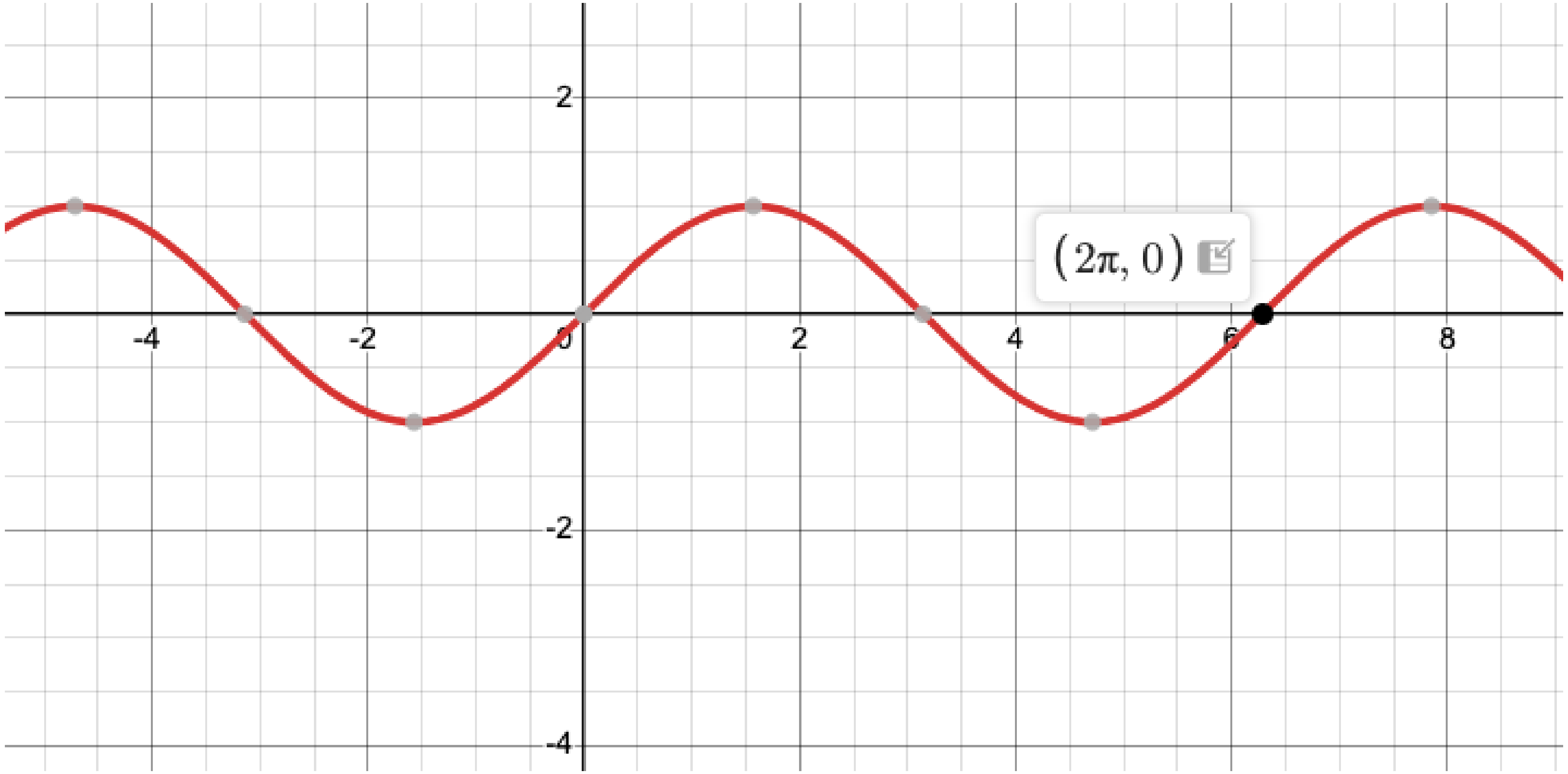
θ = angle rotated (radians)

t = time (seconds)

- If the motion is **circular**, the angular speed is related to **frequency** (f) and **period** (T):

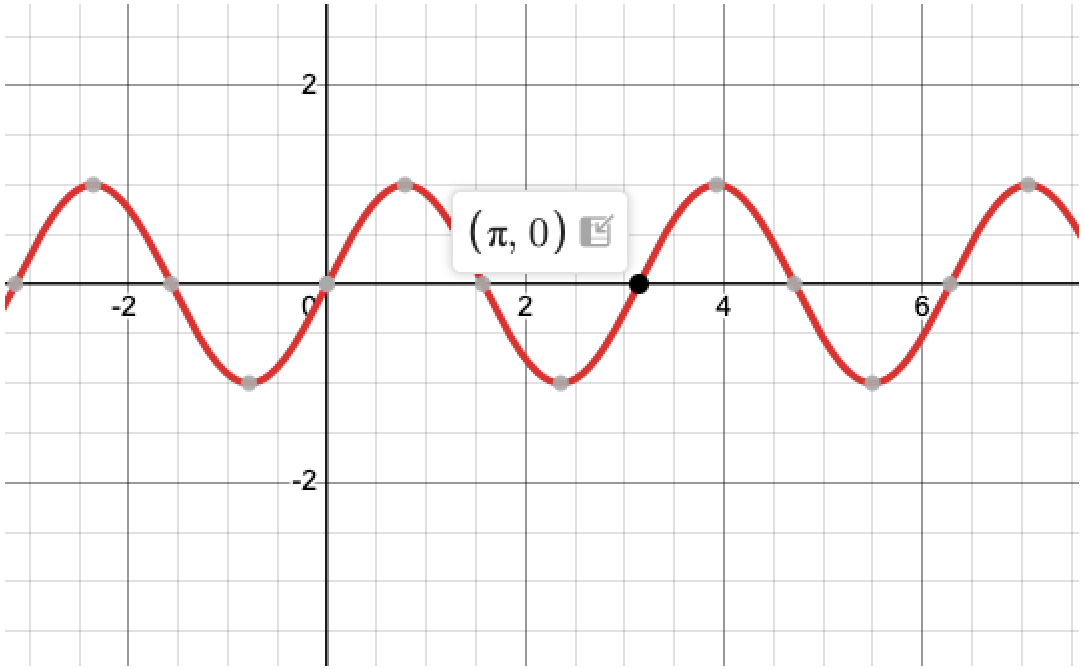
$$\omega = 2\pi f = \frac{2\pi}{T}$$

Sin(t) What is the angular speed?



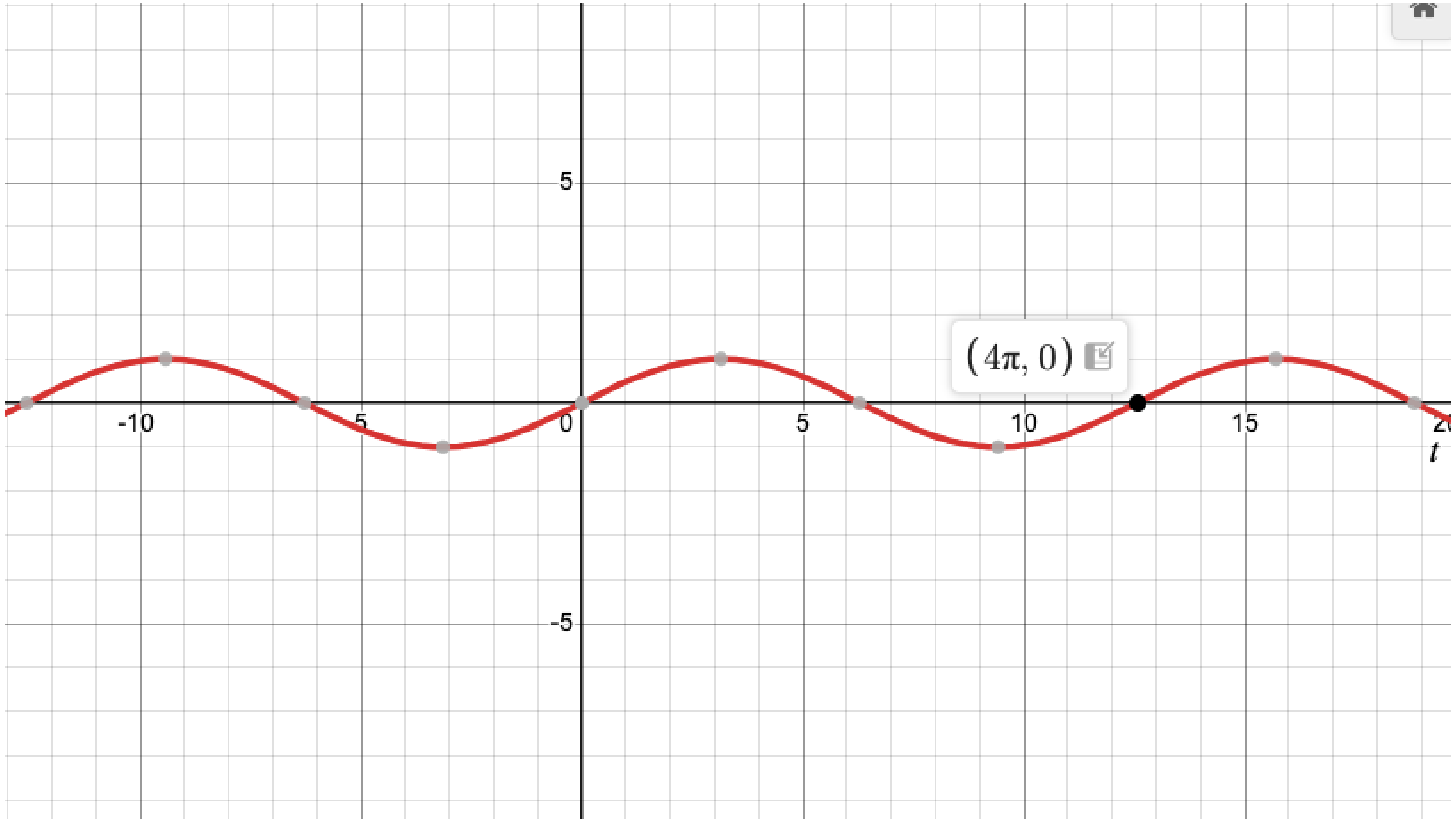
W = 1

Sin(2t) What is the angular speed?



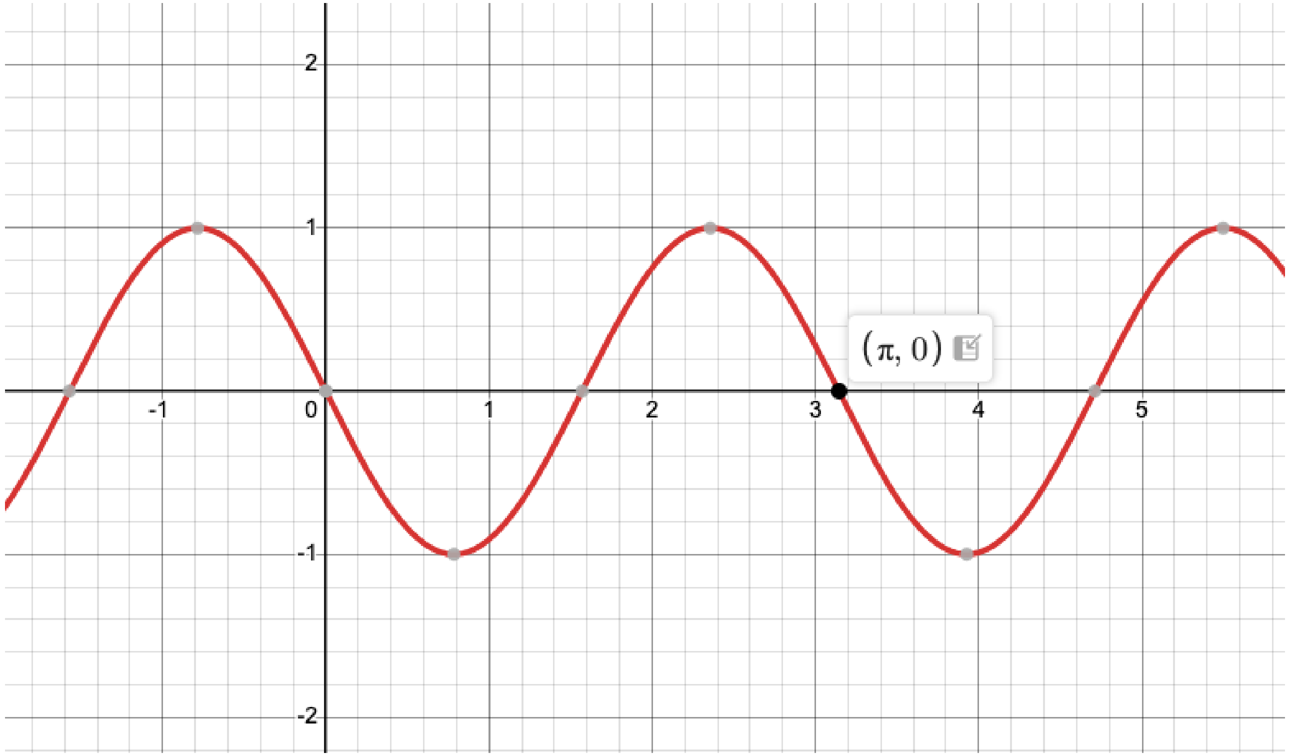
w= 2

Sin(t/2) What is the angular speed?



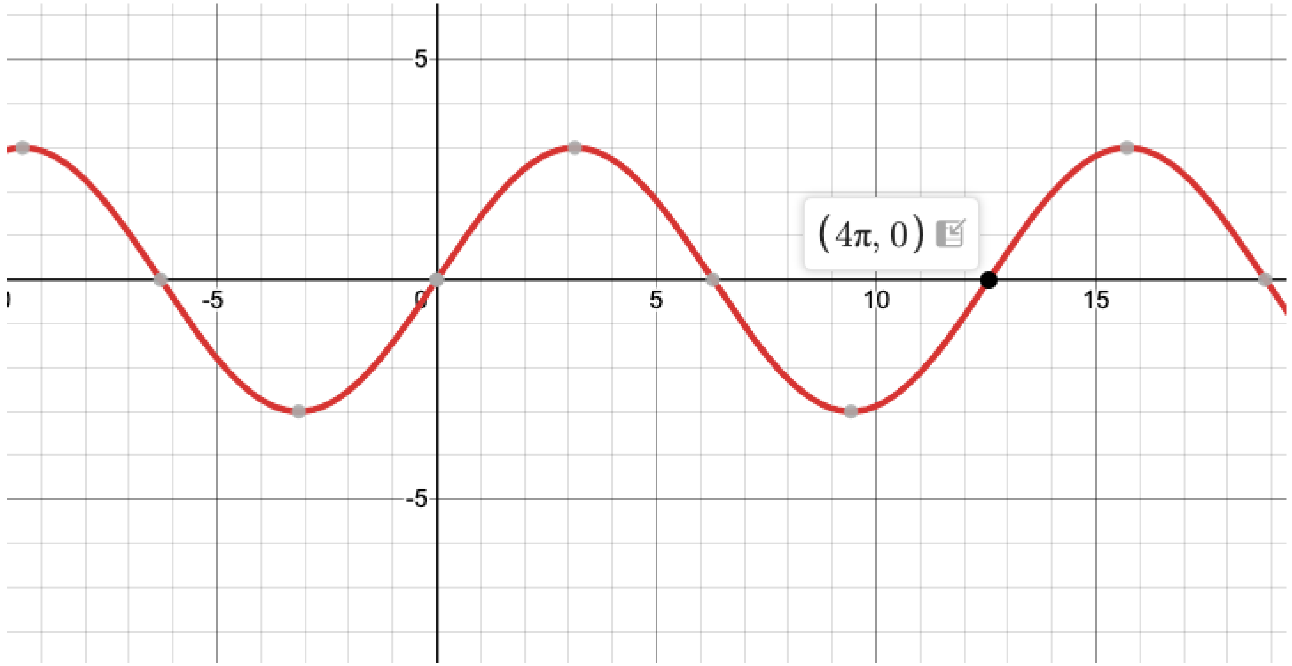
w= 1/2

Sin(2(t-0.5π))   What is the angular speed



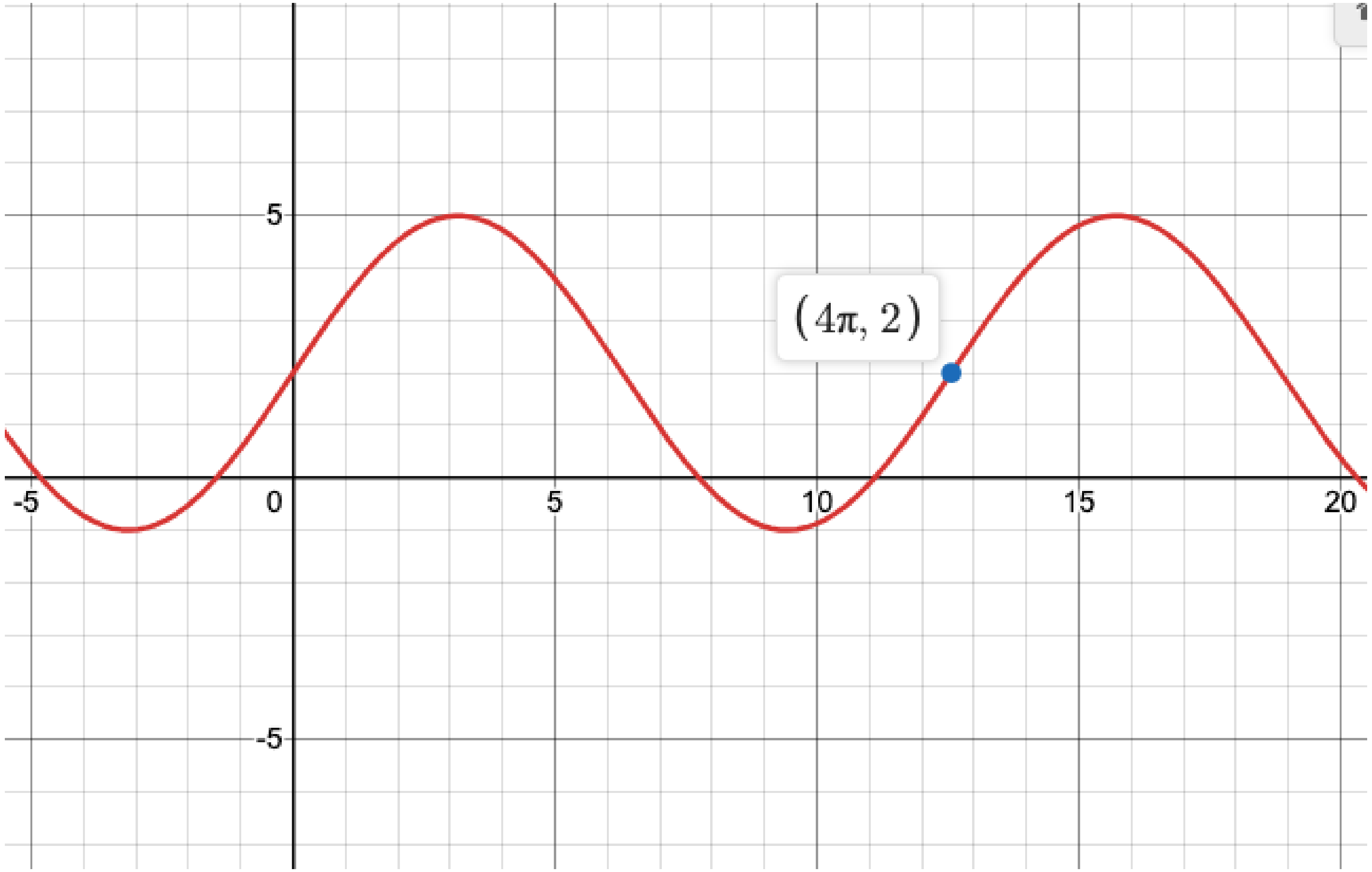
w= 2

3Sin(t/2) What is the angular speed?



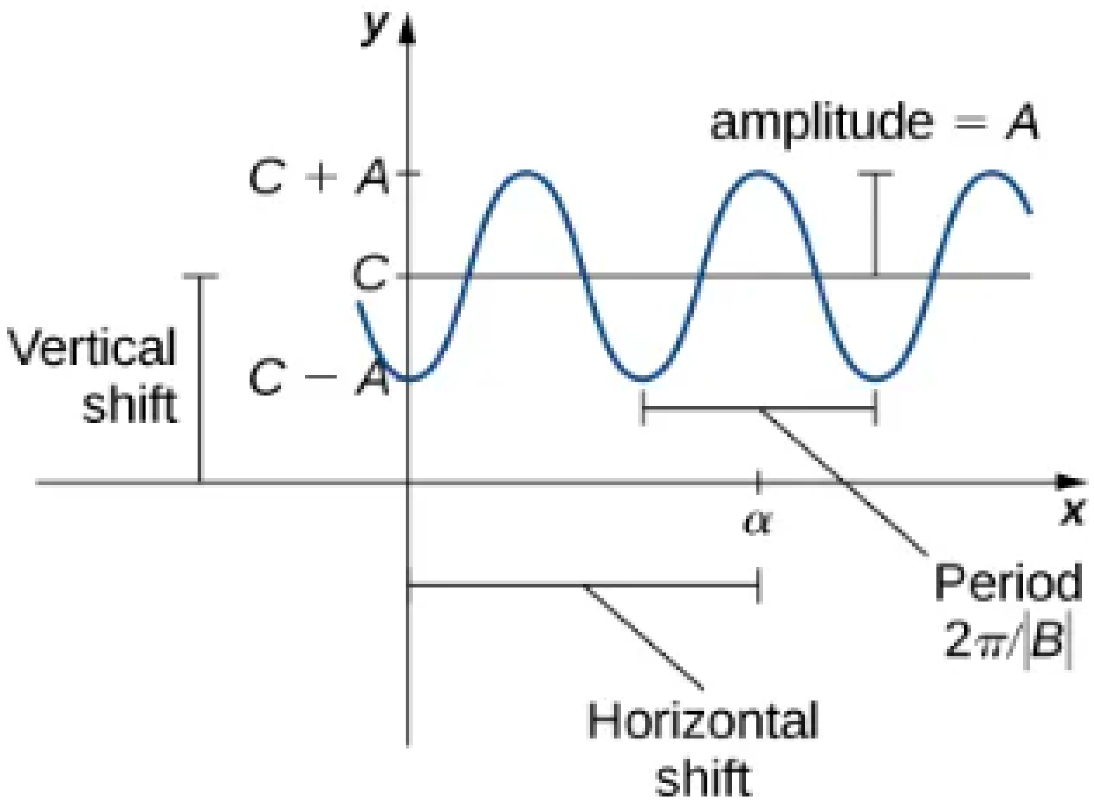
w= 1/2

3Sin(t/2)+2 What is the angular speed?

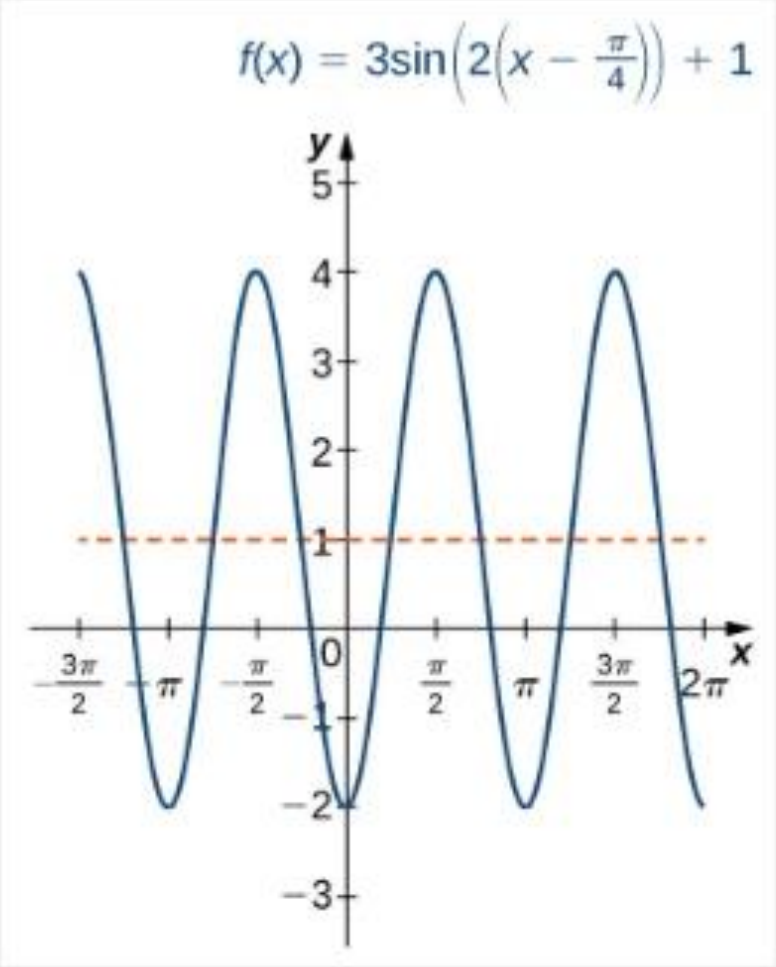


w= 1/2

$$f(x) = A\cos(B(x - \alpha)) + C$$



Sketch a graph of $f(x) = 3\sin\left(2\left(x - \frac{\pi}{4}\right)\right) + 1.$



Sketch a graph of $f(x) = 3\sin\left(2\left(x - \frac{\pi}{4}\right)\right) + 1$.