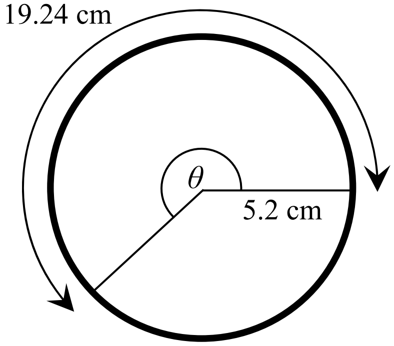


1) For the diagram on the left, determine the value of angle θ in radians.

$$\theta = \frac{a}{r}$$
$$= \frac{19.24}{5.2}$$
$$= 3.7 \text{ rad}$$

2) State the related acute angle for $-\frac{16\pi}{9}$ in exact form. $\underline{\frac{2\pi}{9}}$

3) Convert $\frac{5\pi}{18}$ radians to degree measure.

$$\pi \text{ rad} = 180°$$
$$\frac{5\pi}{18} \text{ rad} = \frac{180° \times 5}{18}$$
$$\frac{5\pi}{18} \text{ rad} = 50°$$

4) Convert 2 radians to degree measure. Round your answer to the nearest tenth of a degree.

$$\pi \text{ rad} = 180°$$
$$1 \text{ rad} = \frac{180°}{\pi}$$
$$2 \text{ rad} = 2 \times \frac{180°}{\pi}$$
$$2 \text{ rad} \approx 114.6°$$

5) Convert $125°$ to radian measure. Express your answer in simplified **exact** form.

$$180° = \pi \text{ rad}$$
$$1° = \frac{\pi}{180} \text{ rad}$$
$$125° = \frac{125\pi}{180} \text{ rad}$$
$$125° = \frac{25\pi}{36} \text{ rad}$$

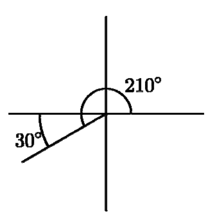
6) Convert $-65.2°$ to radian measure. Round your answer to the nearest hundredth of a radian.

$$180° = \pi \text{ rad}$$
$$1° = \frac{\pi}{180} \text{ rad}$$
$$-65.2° = \frac{-65.2\pi}{180} \text{ rad}$$
$$-65.2° \approx -1.14 \text{ rad}$$

7) For each of the following,
   i) rewrite the expression in terms of the **related acute angle**.
   ii) determine the **exact** value of the expression.

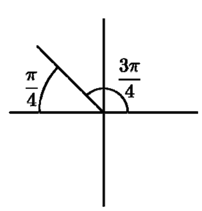
a) $\csc(210°)$

$$= -\csc 30°$$
$$= -2$$



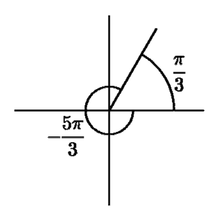
b) $\tan\left(\frac{3\pi}{4}\right)$

$$= -\tan\frac{\pi}{4}$$
$$= -1$$



c) $\cos\left(-\frac{5\pi}{3}\right)$

$$= \cos\frac{\pi}{3}$$
$$= \frac{1}{2}$$



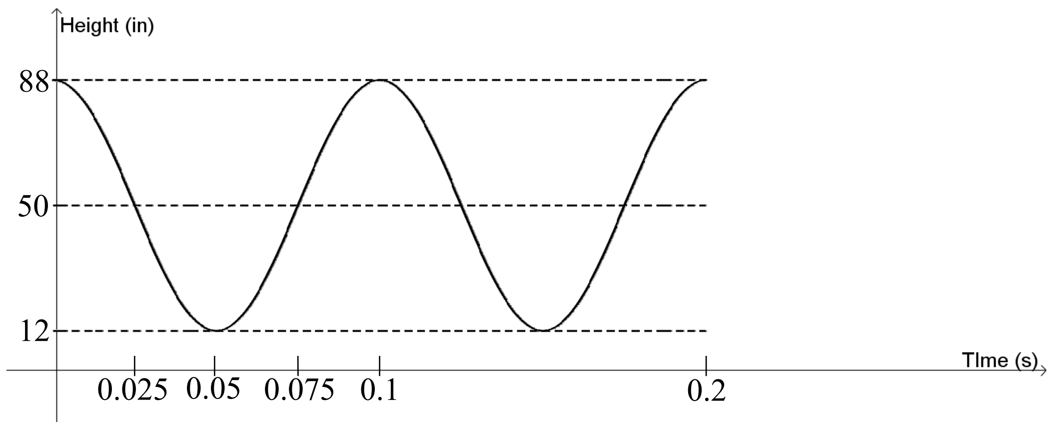
8) The propeller on a small aircraft has a diameter of 76 inches. In its lowest position, the tip of a blade is 12 inches from the ground. While idling on the ground, the propeller is rotating at a speed of 600 revolutions per minute.

a) Determine, in seconds, how long it takes for the propeller to make one revolution.

600 revolutions in 1 minute
10 revolutions in 1 second
1 revolution in $\frac{1}{10}$ second

$\therefore$ one revolution takes 0.1 seconds

b) Draw a rough sketch showing the height of a blade's tip off the ground versus time, in seconds, for two revolutions, beginning with the tip of the blade in its highest position. Be sure to label key values on the axes.



c) Determine the equation of a function, $h(t)$, to model a blade tip's height off the ground after t seconds, starting with the tip of the blade in its highest position.

To find the horizontal compression factor:

$$2\pi n = 0.1$$
$$n = \frac{0.1}{2\pi} = \frac{1}{20\pi}$$

$$h(t) = 38\cos 20\pi t + 50$$

or

$$h(t) = 38\sin 20\pi\left(t - 0.075\right) + 50$$

d) Determine the propeller's angular velocity in radians per second. Leave your answer in exact form.

10 revolutions in 1 second
20π radians in 1 second

$\therefore$ 20π rad/sec

e) Determine how far the tip of a blade travels in 3 minutes. Round your final answer to the nearest inch.

20π radians in 1 second
1200π radians in 1 minute
3600π radians in 3 minutes

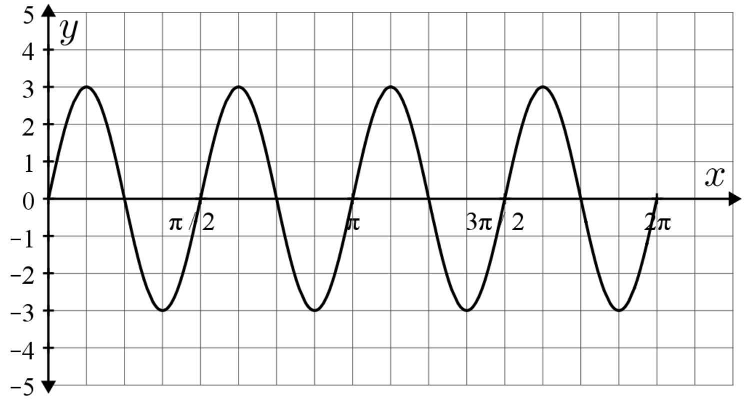
$$\theta = \frac{a}{r}$$
$$3600\pi = \frac{a}{38}$$
$$a \approx 429770 \text{ inches}$$

9) Sketch the graph of $y = 3\sin(4x - 2\pi)$ on the domain $0 \le x \le 2\pi$.

$$y = 3\sin 4\left(x - \frac{\pi}{2}\right)$$

x-scale:

$$\frac{\pi}{2} \times \frac{1}{4} = \frac{\pi}{8}$$



10) Mitchell was planning to sketch the graph of $y = 8\cos 3\left(x + \frac{2\pi}{5}\right) - 9$. What would be an appropriate value by which to go up on the x-axis?

Horizontal compression:

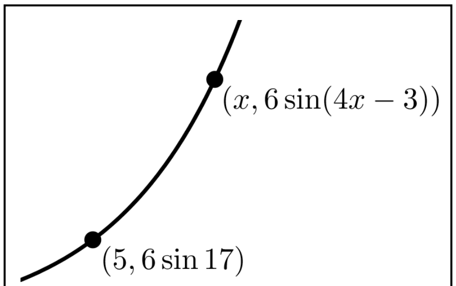
$$\frac{\pi}{2} \times \frac{1}{3} = \frac{\pi}{6}$$

Horizontal shift:

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

$\therefore$ go up by $\frac{\pi}{30}$

11) Determine the instantaneous rate of change of the function $y = 6\sin(4x - 3)$ at $x = 5$. Round your final answer to the nearest tenth.



$$m_{\text{sec}} = \frac{\Delta y}{\Delta x} = \frac{6\sin(4x-3) - 6\sin 17}{x - 5}$$

From left:

x	m_{sec}
4.9	−10.9827248
4.99	−7.063568478
4.999	−6.65004951
4.9999	−6.6085345
4.99999	−6.604381

From right:

x	m_{sec}
5.1	−1.875713316
5.01	−6.14074994
5.001	−6.55775549
5.0001	−6.5993053
5.00001	−6.603459

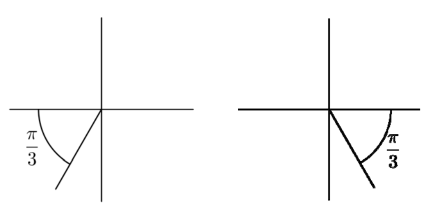
$\therefore$ the instantaneous rate of change is approximately −6.6

12) If $\sin\theta = -\frac{\sqrt{3}}{2}$ and $0 \le \theta \le 2\pi$, determine all of the possible values of θ.

R.A.A. $= \frac{\pi}{3}$

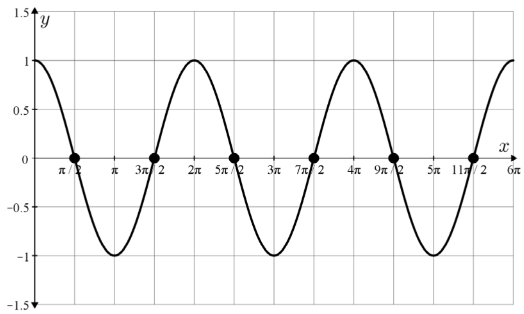
sin is negative

Quadrant 3 or 4



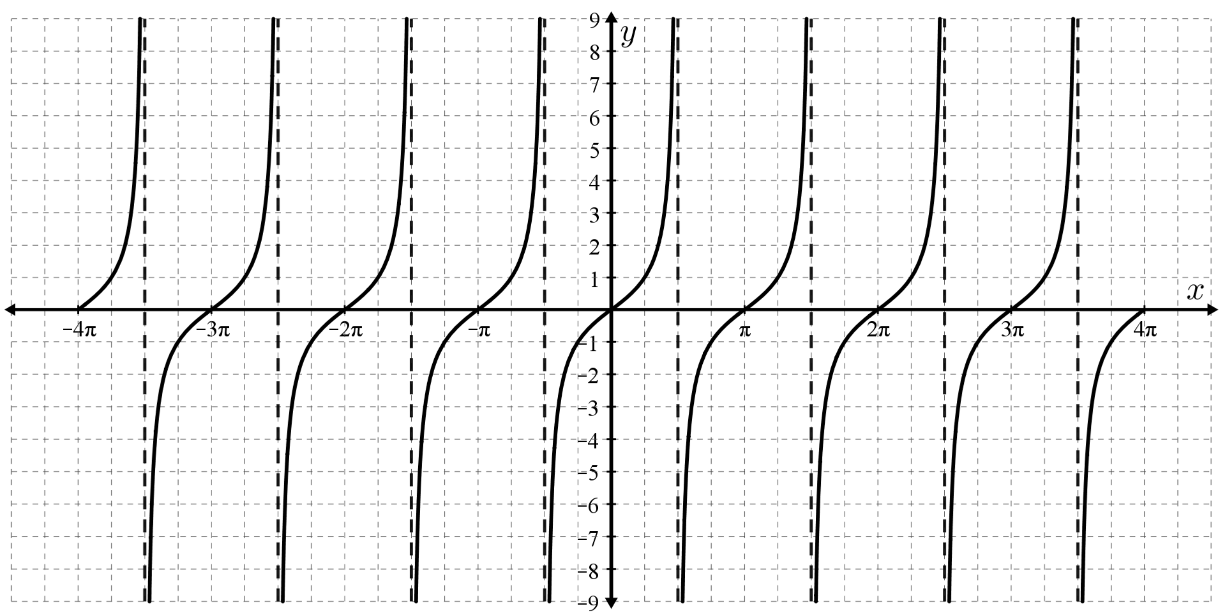
$$\theta = \frac{4\pi}{3} \text{ or } \theta = \frac{5\pi}{3}$$

13) Pedro was investigating the graph of $y = \sec x$. He claimed that the domain of this function is $\left\{x \in \mathbb{R} \mid x \neq \frac{\pi}{2}n, n \in \mathbb{Z}\right\}$. Is Pedro's claim correct? Explain.



Pedro is incorrect. $y = \sec x$ would have a vertical asymptote wherever $y = \cos x$ has a zero. $y = \cos x$ has a zero at $\frac{\pi}{2}$ and every integer multiple of π above or below that. Therefore, the domain should be $\left\{x \in \mathbb{R} \mid x \neq \frac{\pi}{2} + \pi n, n \in \mathbb{Z}\right\}$

14) Sketch the graph of $y = \tan x$ over the domain $-4\pi \leq x \leq 4\pi$.



15) State an expression that gives the location of all x-intercepts for the function $y = \tan\left(x - \frac{\pi}{7}\right)$.

$$\frac{\pi}{7} + \pi n, \ n \in \mathbb{Z}$$