

## Physics, Foundation Programme – Problem Solving Exercises 6

### Trigonometric Functions

1. \*Find the measure of (if possible) of the complement and the supplement of each angle:

a)  $15^\circ$                                       a: cpl= $75^\circ$                                       spl= $165^\circ$

b)  $70^\circ 15'$                                       a: cpl= $19^\circ 45'$                                       spl= $109^\circ 45'$

c)  $56^\circ 33' 15''$                                       a: cpl= $33^\circ 26' 45''$                                       spl= $123^\circ 26' 45''$

d)  $\frac{\pi}{3}$     a: cpl= $\frac{\pi}{6}$     spl:  $\frac{2\pi}{3}$

2. Determine measure of the positive angle with measure less than  $360^\circ$  that is coterminal angle with given angle and the classify the angle by quadrant. Assume the angles are in the standard position.

a)  $\alpha = 610^\circ$                                       a:  $\alpha' = 250^\circ$                                       Q=III

b)  $\alpha = 765^\circ$                                       a:  $\alpha' = 45^\circ$                                       Q=I

c)  $\alpha = 872^\circ$                                       a:  $\alpha' = 152^\circ$                                       Q=II

3. Use a calculator to convert each DMS measure to its equivalent decimal degree measure.

a)  $211^\circ 46' 48''$                                       a:  $211.78^\circ$

b)  $25^\circ 25' 12''$                                       a:  $25.42^\circ$

4. Convert each decimal degree measure to its equivalent DMS measure

a)  $24.56^\circ$     a:  $24^\circ 33' 36''$

b)  $211.78^\circ$     a:  $211^\circ 46' 48''$

5. Convert the degree measure to the exact radian measure

a)  $30^\circ$                       a:  $\frac{\pi}{6}$

b)  $315^\circ$                       a:  $\frac{7\pi}{4}$

6. Find the length of an arc that subtends a central angle with the given measure in a circle with the given radius. Round the answers to the nearest hundredth.

a)  $r = 8 \text{ cm}, \theta = \frac{\pi}{4}$                       a: 6.28 cm

b)  $r = 5 \text{ m}, \theta = 144^\circ$                       a: 12.57 m

7. \* Each tire of a bicycle has a radius of 0.31 meters. The tires are rotating 4 revolutions per second. Find the speed of the bicycle to the nearest tenth of meters per second.

A: 7.8 m/s

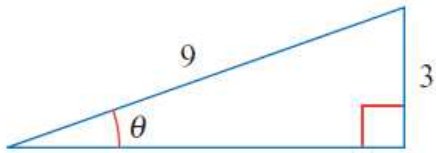
8. Find the values of the functions sin, cos, and tan of  $\theta$  for the right triangle:

a)



a:  $r = 58, \sin \theta = \frac{7}{\sqrt{58}}, \cos \theta = \frac{3}{\sqrt{58}}, \tan \theta = \frac{7}{3}$

b)

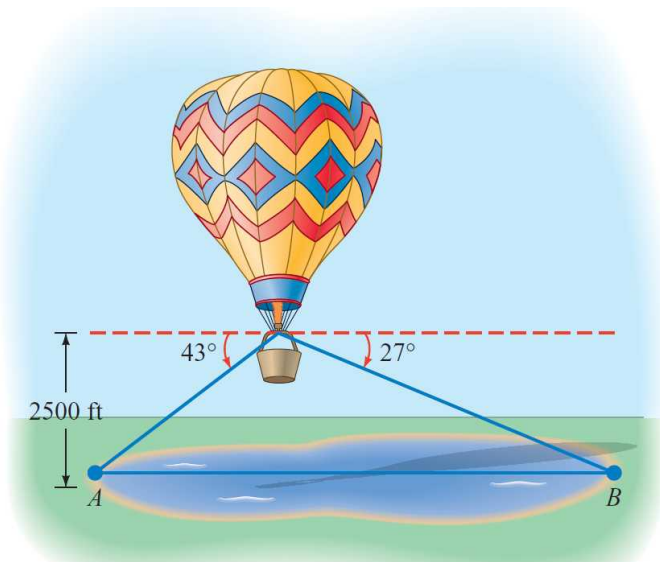


a:  $a = 6\sqrt{2}$ ,  $\sin \theta = \frac{1}{3}$ ,  $\cos \theta = \frac{2\sqrt{2}}{3}$ ,  $\tan \theta = \frac{1}{2\sqrt{2}}$

9. The angle of elevation from a point 116 meters from the base of the Eiffel Tower to the top of the tower is  $68.9^\circ$ . Find the approximate height of the tower in meters.

a: 301 m

10. The angle of depression to one side of a lake, measured from a balloon 2500 feet above the lake as shown in the accompanying figure, is  $43^\circ$ . The angle of depression to the opposite side of the lake is  $27^\circ$ . Find the width of the lake.



a: 7587 ft  $\approx$  2313 m

11. Find the value of each of the trigonometric functions  $\sin$ ,  $\cos$ , and  $\tan$  for the angle, in standard position, whose terminal side passes through the given point.

a)  $P(2,3)$  a:  $\sin \theta = \frac{3}{\sqrt{13}}$ ,  $\cos \theta = \frac{2}{\sqrt{13}}$ ,  $\tan \theta = \frac{3}{2}$

b)  $P(-2,3)$  a:  $\sin \theta = \frac{3}{\sqrt{13}}$ ,  $\cos \theta = \frac{-2}{\sqrt{13}}$ ,  $\tan \theta = -\frac{3}{2}$

c)  $P(-6,-9)$  a:  $r = 3\sqrt{13}$ ,  $\sin \theta = -\frac{3}{\sqrt{13}}$ ,  $\cos \theta = -\frac{2}{\sqrt{13}}$ ,  $\tan \theta = \frac{3}{2}$

12. Evaluate the trigonometric functions of the indicated angles, or state that the function is undefined.

$\theta$	$0^\circ$	$90^\circ$	$\frac{3\pi}{2}$	$180^\circ$	$\frac{\pi}{3}$	$\frac{7\pi}{6}$
$\sin(\theta)$	0	1	-1	0	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$
$\cos(\theta)$	1	0	0	-1	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$
$\tan(\theta)$	0	undef.	undef.	0	$\sqrt{3}$	$\sqrt{3}$

13. State the amplitude, and period of the function defined by each equation

a)  $y = 2 \sin x$  a:  $a = 2$ ,  $p = 2\pi$

b)  $y = \frac{1}{2} \sin(2\pi x)$  a:  $a = 1/2$ ,  $p = 1$

c)  $y = -\frac{1}{2} \sin\left(\frac{\pi x}{3}\right)$

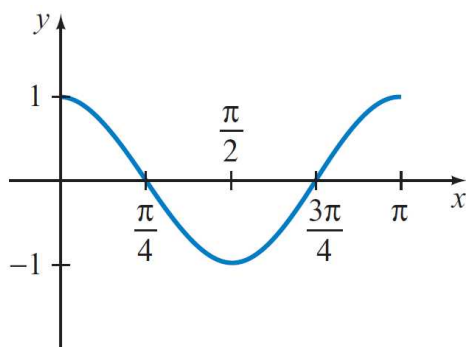
a:  $a = \frac{1}{2}, p = 6$

d)  $y = 4.7 \cos(0.8\pi t)$

a:  $a = 4.7, p = \frac{5}{2} = 2.5$

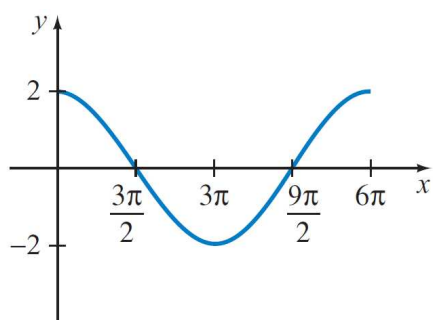
14. \*One cycle of the graph of a sine or cosine function is show. Find an equation of each of graph.

a)



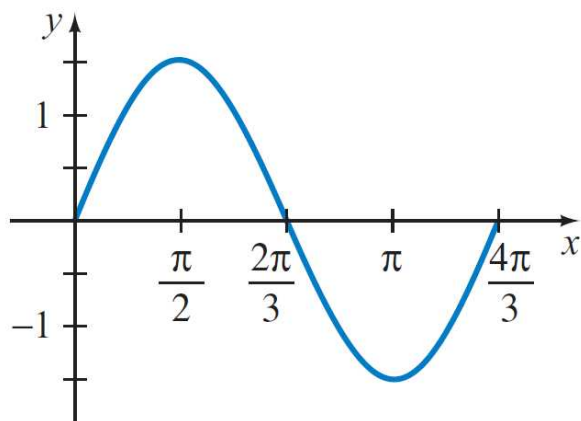
a:  $y = \cos(2x)$

b)



a:  $y = 2 \cos\left(\frac{1}{3}x\right)$

c)



a:  $y = \frac{3}{2} \sin\left(\frac{3}{2}x\right)$

15. Find the amplitude, phase shift and period for the graph of each function.

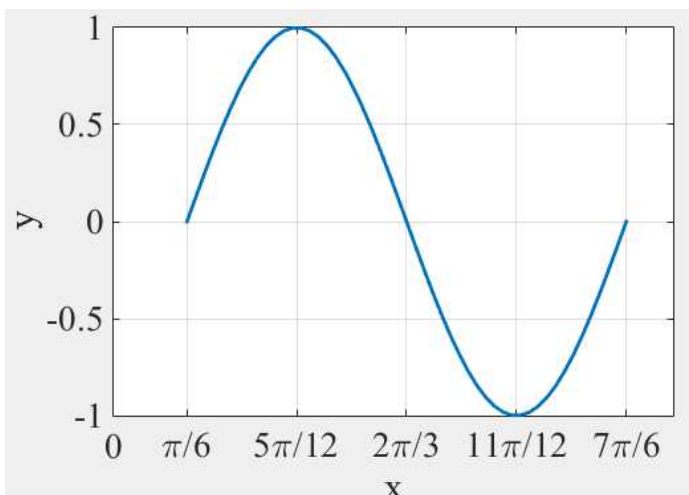
a)  $y = 2 \sin \left( x - \frac{\pi}{2} \right)$       a:  $a = 2, p = 2\pi, s = \frac{\pi}{2}$

b)  $y = \cos \left( 2x - \frac{\pi}{4} \right)$       a:  $a = 1, p = \pi, s = \frac{\pi}{8}$

c)  $y = -4 \sin \left( \frac{2}{3}x + \frac{\pi}{6} \right)$       a:  $a = 4, p = 3\pi, s = -\frac{\pi}{4}$

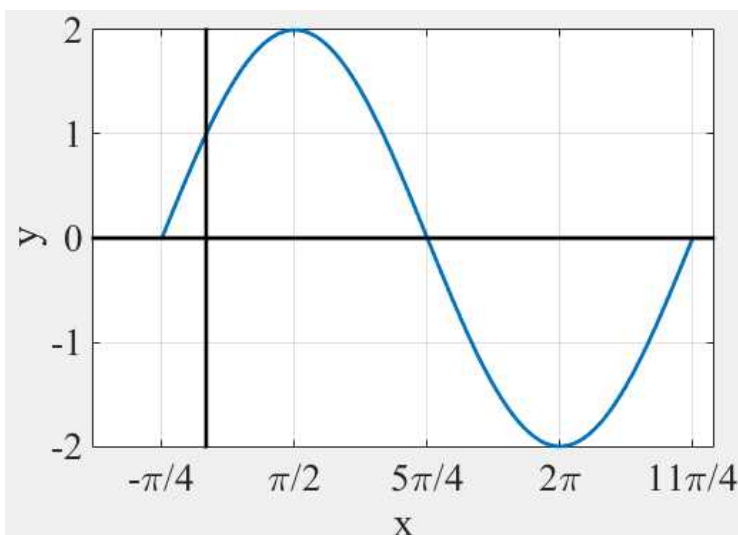
16. \* Each graph displays one cycle of the graph of a trigonometric function. Find an equation of each graph.

a)



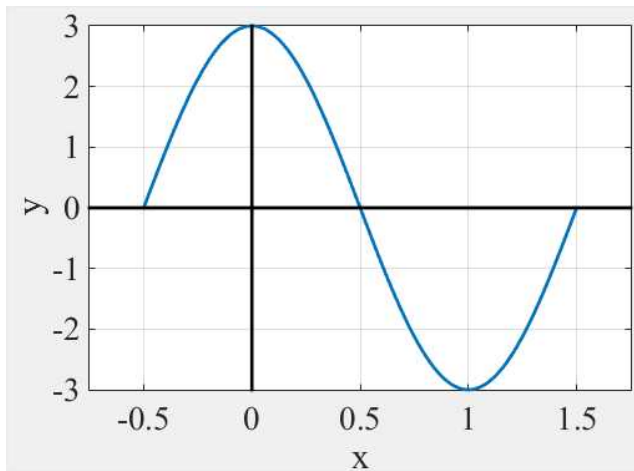
a:  $y = \sin \left( 2x - \frac{\pi}{3} \right)$

b)



a:  $y = 2 \sin \left( \frac{2}{3}x + \frac{\pi}{6} \right)$

c)



$$a: y = 3 \sin \left( \pi x + \frac{\pi}{2} \right)$$

17. The function

$$bp(t) = 32 \cos \left( \frac{10\pi}{3} t - \frac{\pi}{3} \right) + 112, 0 \leq t \leq 20,$$

gives the blood pressure in millimeters of mercury (mm Hg), of a patient during a 20-second interval. Here,  $t$  is time in seconds.

a. Find the phase shift and the period of

$$a: p = \frac{3}{5} \text{ s}, s = \frac{1}{10} \text{ s}$$

b. What are the patient's maximum (systolic) and minimum (diastolic) blood pressure readings during the given time interval?

$$a: M=144 \text{ mmHg}, m=80 \text{ mmHg}$$

c. What is the patient's pulse rate in beats per minute?

$$pr = 60/p = 100 \text{ bpm}$$

18. Find exact radian value:

a)  $\arcsin 1$  a:  $\pi/2$

b)  $\arccos\left(-\frac{1}{2}\right)$  a:  $\frac{2\pi}{3}$

c)  $\arctan \sqrt{3}$  a:  $\frac{\pi}{3}$

d)  $\arctan -1$  a:  $-\frac{\pi}{4} \iff \frac{7}{4}\pi$

19. Use a calculator to approximate each function accurate to four decimal places

a)  $\arcsin(0.8422)$  a:  $57.37^\circ, 1.001$  radian

b)  $\arccos(-.0356)$  a:  $92.04^\circ, 1.606$  radian

c)  $\arctan(3.7555)$  a:  $75.09^\circ, 1.3106$  radian