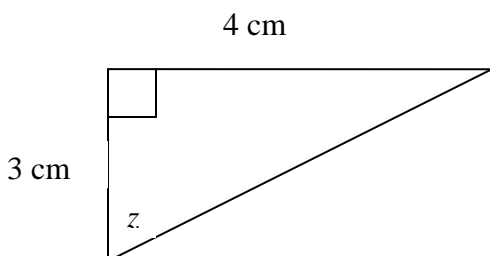


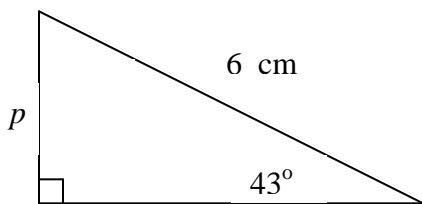
Please note that NOTA = none of the above

(1) Find  $z$  to be the nearest  $\frac{1}{10}$  of a degree



- a)  $41.4^\circ$     b)  $48.6^\circ$     c)  $36.9^\circ$     d)  $53.1^\circ$     e) NOTA

(2) Find the length of side  $p$ . Round to two places.



- a) 4.09 cm    b) 4.39 cm    c) 5.60 cm    d) 3.49 cm    e) NOTA

(3) Convert 600 degrees to radians.

- a)  $\frac{10\pi}{3}$     b)  $\frac{28\pi}{9}$     c)  $\frac{26\pi}{9}$     d)  $\frac{32\pi}{9}$     e) NOTA

(4) Convert 4.3 radians to degrees. Round to the nearest degree.

- a)  $14^\circ$     b)  $774^\circ$     c)  $493^\circ$     d)  $126^\circ$     e) NOTA

(5) Find the period of  $y = -4 \cot 2x$

- a)  $\pi$     b)  $\frac{\pi}{2}$     c)  $2\pi$     d)  $\frac{\pi}{4}$     e) NOTA

(6) Find the phase shift of the function  $y = -4 \sin(2\pi x + \pi)$

- a)  $-\frac{\pi}{4}$       b)  $\frac{1}{2}$       c)  $-\frac{1}{2}$       d)  $-\frac{\pi}{4}$       e)  $2\pi$

(7) The solutions of  $\cos^2 x - \cos x - 2 = 0$  are (where  $k$  denotes an arbitrary integer)

- a)  $2k\pi$       b)  $\frac{\pi}{2} + 2k\pi$       c)  $\pi + 2k$       d)  $-\pi + 2k\pi$       e)  $k\pi$

(8) The exact value of  $\csc\left(-\frac{\pi}{3}\right)$  is

- a) 2      b)  $\frac{\sqrt{3}}{2}$       c)  $-\frac{1}{2}$       d) -2      e)  $-\frac{2}{\sqrt{3}}$

(9) An angle measured in standard position has the point (4,-5) on its terminal ray. What is  $\cos(\theta)$ ?

- a)  $\frac{4}{\sqrt{41}}$       b)  $-\frac{5}{\sqrt{41}}$       c)  $\frac{5}{\sqrt{41}}$       d)  $-\frac{4}{\sqrt{41}}$       e)  $-\frac{4}{5}$

(10) Simplify the expression  $\frac{1}{\cos^2 a} - 1$  using fundamental identities. The result is

- a)  $\cot^2 a$       b)  $\sec^2 a$       c) 0      d)  $\tan^2 \alpha$       e) NOTA

(11)  $\frac{\sec^2 x - 1}{\tan x} =$

- a) 1      b)  $\tan x$       c)  $\tan^3 x$       d)  $\cot x$       e)  $\cot^2 x$

(12) Given that  $\cos\theta = \frac{\sqrt{3}}{2}$  and  $\theta$  is acute, what is value of  $\theta$ ?

- a)  $30^\circ$       b)  $45^\circ$       c)  $60^\circ$       d)  $15^\circ$       e)  $-30^\circ$

(13) Convert 2.1 radians to degrees. (Round to three significant figures).

- a)  $0.0367^\circ$     b)  $378^\circ$     c)  $120^\circ$     d)  $240^\circ$     e) NOTA

(14) If the radius of a circle is 3 cm., then the measure of the central angle that cuts an arc of length 6cm is

- a) 2 rad    b)  $120^\circ$     c)  $\frac{1}{2} \text{ rad}$     d)  $30^\circ$     e)  $2\pi$

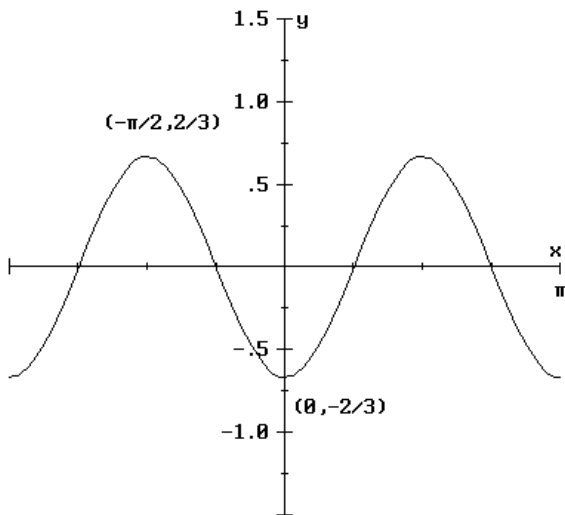
(15) The length of an arc intercepted by an angle of  $60^\circ$  on a circle of radius 6 is

- a)  $\pi$     b)  $2\pi$     c) 2    d)  $\frac{\pi}{2}$     e)  $\frac{1}{12}$

(16) Given that  $\tan \theta = \frac{\sqrt{3}}{3}$  and  $\theta$  is acute, what is value of  $\theta$ ?

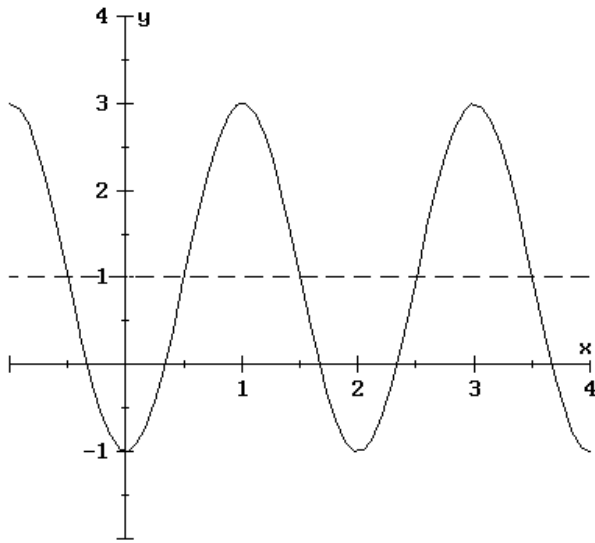
- a)  $30^\circ$     b)  $45^\circ$     c)  $60^\circ$     d)  $15^\circ$     e)  $-30^\circ$

(17) The amplitude of function shown below is



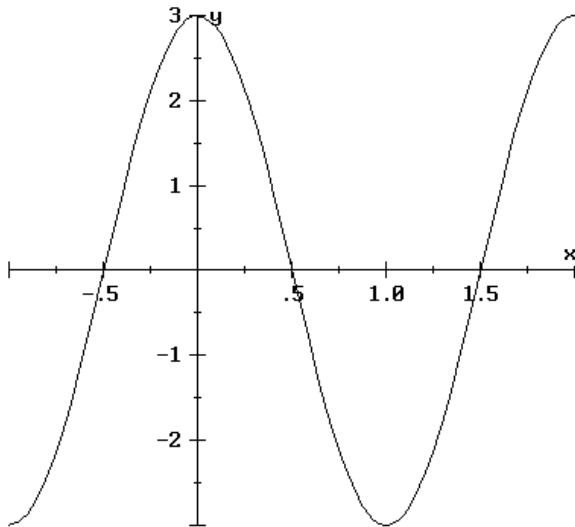
- a)  $\frac{2}{3}$     b) 1    c)  $-\frac{3}{2}$     d)  $-\frac{2}{3}$     e) NOTA

(18) The equation of the graph below is



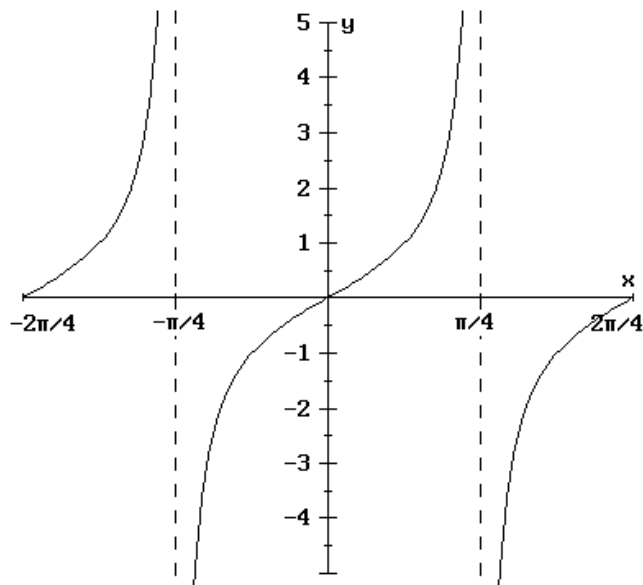
- a)  $y = 2 + 3\cos(2x + 2)$       b)  $y = 1 + 2\cos(\pi x + \pi)$   
 c)  $y = 1 + 2\sin(\pi x - \pi)$       d)  $y = 2 + 3\sin(2x - 2)$   
 e) NOTA

(19) The graph shows  $y = 3\sin(Bx + C)$ .  $B =$



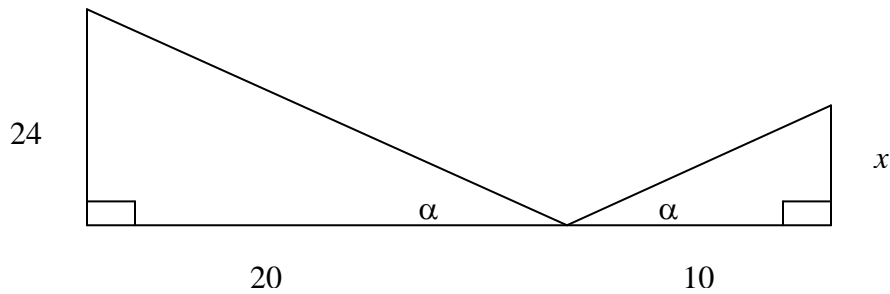
- a) 1      b)  $\pi$       c)  $-\frac{\pi}{2}$       d)  $\frac{3\pi}{2}$       e)  $\frac{1}{2}$

(20) Find the equation of the graph



- a)  $y = \tan \frac{\pi}{2} x$       b)  $y = \tan 4x$   
 c)  $y = \tan 2x$       d)  $y = \tan \frac{1}{2} x$   
 e) NOTA

(21) Given the figure, find  $x$



- a) 12      b) 40      c) 20      d) 48      e) 36

(22) A central angle of  $63^\circ$  is in a circle of radius 18cm. How long is the arc cut by the angle? Round to 2 places.

- a) 19.79 cm    b) 9.90 cm    c) 39.58 cm    d) 79.16 cm    e) NOTA

(23) A pole casts a 10 foot shadow. A man who is 6 feet tall casts a 3.5 foot shadow. How tall is the pole?

- a) 5.83 ft    b) 2.10 ft    c) 17.14 ft    d) 21.00 ft    e) NOTA

(24) Tim is 4'3" tall, and his brother Tom is 5'9". If Tim casts a 9 foot shadow, how long of a shadow will Tom cast?

- a) 6.65 ft    b) 12.18 ft    c) 2.71 ft    d) 24.44 ft    e) NOTA

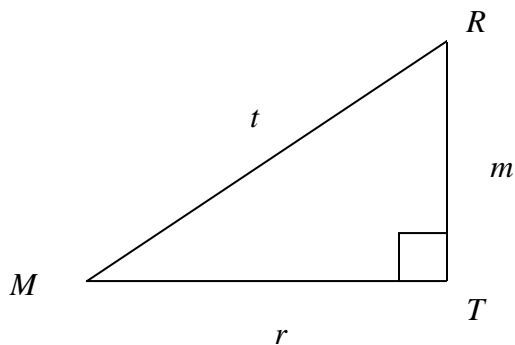
(25) A central angle of 70 degrees cuts an arc of 6 feet. Find the radius of the circle.

- a) 6 ft    b) 5.14 ft    c) 9.82 ft    d) 12 ft    e) NOTA

(26) A central angle cuts an arc of 45 m in a circle whose radius is 9 m. Find the measure of the angle. Round to one place.

- a) 405.0°    b) 452.4°    c) 286.5°    d) 202.5°    e) NOTA

Use the following figure for 27 and 28.



(27) Which ratio is equal to  $\sec R$ ?

- a)  $\frac{r}{t}$     b)  $\frac{r}{m}$     c)  $\frac{m}{t}$     d)  $\frac{m}{r}$     e) NOTA

(28) Which ratio is equal to  $\sin M$ ?

- a)  $\frac{m}{r}$     b)  $\frac{m}{t}$     c)  $\frac{r}{t}$     d)  $\frac{t}{m}$     e) NOTA

For 29, 30 use 3.14 for  $\pi$ . Which of the listed values is NOT coterminal with the given value of  $x$ ?

(29)  $x = -4.19$

- a) 14.65      b) -16.75      c) 17.79      d) 20.93      e) NOTA

(30)  $x = 86.05$

- a) 60.93      b) 48.37      c) 32.67      d) 16.97      e) NOTA

For 31 and 32,  $A$  is in Quadrant III and  $\sin A = -\frac{3}{5}$ .

(31) Find  $\cos A$ .

- a)  $-\frac{4}{5}$       b)  $\frac{4}{5}$       c)  $\frac{3}{5}$       d)  $-\frac{3}{5}$       e) NOTA

(32) Find  $\tan A$ .

- a)  $\frac{3}{4}$       b)  $-\frac{3}{4}$       c)  $\frac{4}{3}$       d)  $-\frac{4}{3}$       e) NOTA

(33) Angle  $B$  is in standard position in Quadrant II, and  $\sin B = \frac{3}{\sqrt{58}}$ .

Find a point on the terminal side of angle  $B$ .

- a)  $(3, \sqrt{58})$       b)  $(3, 7)$       c)  $(-7, 3)$       d)  $(7, 3)$       e) NOTA

(34) Angle  $C$  is in standard position in quadrant III, and  $\cos C = \frac{-4}{9}$ . Find a point on the terminal side of angle  $C$ .

- a)  $(\sqrt{65}, 9)$       b)  $(-\sqrt{65}, 9)$       c)  $(\sqrt{97}, 9)$       d)  $(-\sqrt{97}, 9)$       e) NOTA

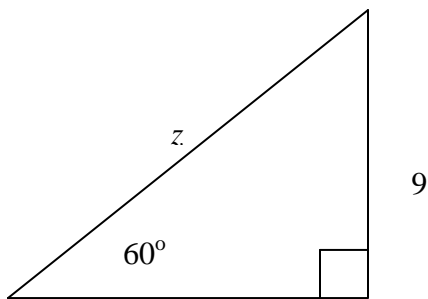
(35) Find  $\sin\left(\frac{7\pi}{6}\right)$  exactly.

- a)  $\frac{\sqrt{3}}{2}$     b)  $-\frac{\sqrt{3}}{2}$     c)  $-\frac{1}{2}$     d)  $\frac{1}{2}$     e) NOTA

(36) Find  $\cos\left(\frac{-4\pi}{3}\right)$  exactly.

- a)  $\frac{\sqrt{3}}{2}$     b)  $-\frac{\sqrt{3}}{2}$     c)  $-\frac{1}{2}$     d)  $\frac{1}{2}$     e) NOTA

(37) Find  $z$  exactly.



- a) 9    b)  $\frac{9\sqrt{3}}{2}$     c)  $\frac{18}{\sqrt{3}}$     d) 18    e) NOTA

(38) A function  $y = f(x)$  is periodic with period 6. If  $f(2) = 3$ , find another value for  $x$  such that  $f(x) = 3$ .

- a) 3    b) 5    c) 8    d) 9    e) NOTA

(39) Let  $m = \sin x$ , with  $-1 \leq m \leq 1$ . If  $x = n$ , with  $0 \leq n \leq \frac{\pi}{2}$ , is one solution, find another solution.

- a)  $-n$     b)  $2\pi - n$     c)  $\pi - n$     d)  $\pi + n$     e) NOTA

For 40, 41, 42, and 43 consider the function  $y = -5 - 4 \sin(3x - 2)$ .

(40) The amplitude is

- a)  $-5$     b)  $-4$     c) 3    d) 2    e) NOTA



(41) What is the vertical shift?

- a) 5 down    b) 5 up    c) 4 down    d) 4 up    e) NOTA

(42) What is the period?

- a)  $2\pi$     b)  $6\pi$     c)  $\frac{2\pi}{3}$     d)  $\pi$     e) NOTA

(43) What is the horizontal shift?

- a) 2 left    b) 1.5 right    c) 2 right    d)  $\frac{2}{3}$  left    e) NOTA

(44) If  $\cos m = n$  and  $\sin m = k$ , then

- a)  $\cos(-m) = -n$  and  $\sin(-m) = -k$     b)  $\cos(-m) = n$  and  $\sin(-m) = k$   
c)  $\cos(-m) = -n$  and  $\sin(-m) = k$     d)  $\cos(-m) = n$  and  $\sin(-m) = -k$   
e) NOTA

(45) A cosine function has period 12 and amplitude 8. It is also known that  $f(5) = 30$  is the maximum function value. Find  $f(11)$ .

- a) Not enough information    b) 24    c) 22    d) 14    e) NOTA

(46) Find exactly  $\sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)$ .

- a)  $\frac{\pi}{3}$     b)  $\frac{2\pi}{3}$     c)  $\frac{-\pi}{3}$     d)  $\frac{-2\pi}{3}$     e) NOTA

(47) Find exactly  $\cos^{-1}(-.5)$ .

- a)  $\frac{-\pi}{6}$     b)  $\frac{\pi}{6}$     c)  $\frac{-\pi}{3}$     d)  $\frac{\pi}{3}$     e) NOTA

(48) In  $\triangle ABC$

$$A = 40^\circ$$

$$a = 2.6\text{m}$$

$$B = 60^\circ$$

Find  $b$ .

- a) 3.5m      b) 3.9m      c) 1.9m      d) 2.7m      e) NOTA

(49) In  $\triangle ABC$

$$a = 5 \text{ ft}$$

$$b = 3 \text{ ft}$$

$$C = 68^\circ$$

Find  $c$ . Round to two places.

- a) 45.24 ft      b) 22.7 ft      c) 6.73 ft      d) 4.77 ft      e) NOTA

(50) Solve  $\sin x = .5$  on  $[0, 2\pi]$ .

a)  $\frac{\pi}{6}$  is the only solution      b)  $\frac{\pi}{3}$  is the only solution

c)  $\frac{\pi}{6}, \frac{5\pi}{6}$       d)  $\frac{\pi}{3}, \frac{2\pi}{3}$

e) NOTA

(51) What is the range of  $y = \sin x$ ?

- a)  $[-1, 1]$       b)  $[0, 2\pi]$       c)  $[-\pi, \pi]$       d)  $(-\infty, \infty)$       e) NOTA

(52) What is the range of  $y = \sin^{-1} x$ ?

- a)  $[0, 2\pi]$       b)  $[-1, 1]$       c)  $[0, \pi]$       d)  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$       e) NOTA

(53) What is the range of  $y = \tan^{-1} x$ ?

- a)  $(-\infty, \infty)$     b)  $[0, 2\pi]$     c)  $[0, \pi]$     d)  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$     e) NOTA

(54)  $y = g(x)$  is periodic with period 5;  $g(6.1) = 9.7$ . Find  $g(21.1)$ .

- a) 5                  b) 6.1                  c) 9.7                  d) 24.7                  e) NOTA

(55) A cosine function has period 12 and its maximum value at  $x = 5$ . At what  $x$  value will the function have a minimum?

- a) 8                  b) 11                  c) 14                  d) 17                  e) NOTA

(56) A tangent function has period 16, a horizontal intercept at  $x = 9$ , and no vertical shift. At what  $x$  value will the graph of this function have a vertical asymptote?

- a) 13                  b) 17                  c) 21                  d) 25                  e) NOTA

(1) Sketch angles in standard position.

a)  $-300$  degrees

b)  $500$  degrees

c)  $150$  degrees

d)  $3\pi$

e)  $\frac{-3\pi}{2}$

f)  $-3$

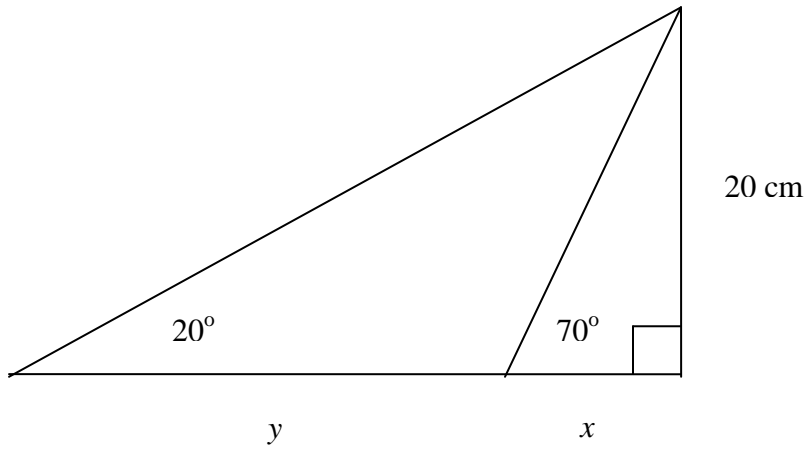
g)  $6$

h)  $\cos^{-1}\left(\frac{4}{5}\right)$

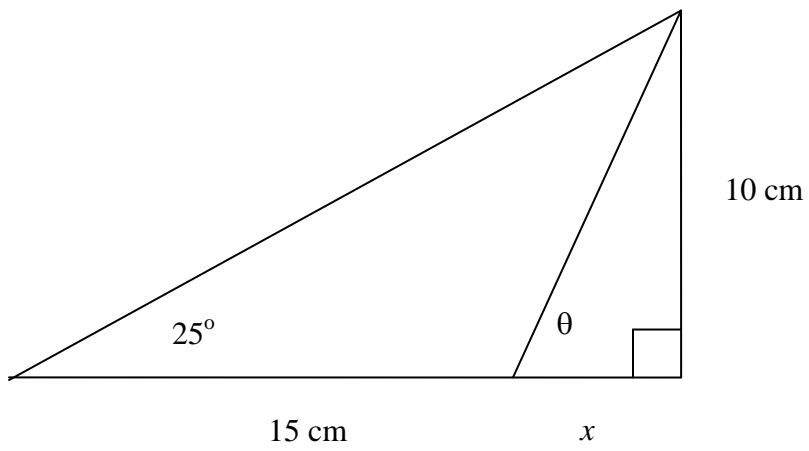
i)  $\cos^{-1}\left(-\frac{2}{3}\right)$

j)  $\tan^{-1}\left(-\frac{5}{3}\right)$

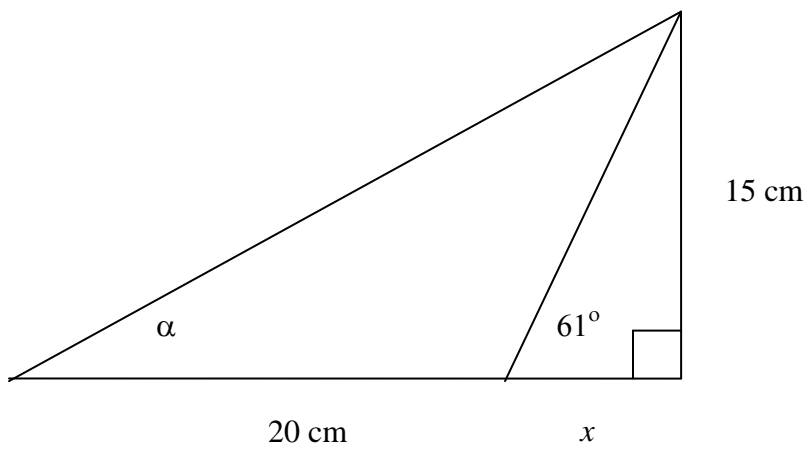
(2) Find  $x$  and  $y$ .



(3) Find  $\theta$  and  $x$ .



(4) Find  $\alpha$  and  $x$ .



(5) Use the fundamental identities to find the exact value of  $\sin x$ ,  $\csc x$ , and  $\tan x$  given that  $\cos x = \frac{2}{3}$  and  $\csc x < 0$ .

(6) Use a sketch of the unit circle to explain why:

a) the function  $y = \sin x$  is periodic.

b) the function  $y = \tan x$  has the vertical asymptotes where it does

c) the function  $y = \cos x$  has the range that it does

(7) Use the identity for  $\cos(x + y)$  to derive an identity for  $\cos(2x)$ .

(8) Find the exact value of  $\sin\left(\frac{\pi}{12}\right)$ .

(9) Find the exact value of  $\cos\left(\frac{5\pi}{12}\right)$ .

For Problems 10, 11, and 12 find one solution analytically, then find other solutions by any method.

(10)  $4.4 - 3.2 \cos(1.2x) = 5.1$  on the interval  $[0, 10]$ .

(11)  $2.7 \tan(.2x) = -6.5$  on  $[0, 50]$ .

(12)  $500 + 25 \sin(.52x) = 512$  on  $[0, 12]$ .

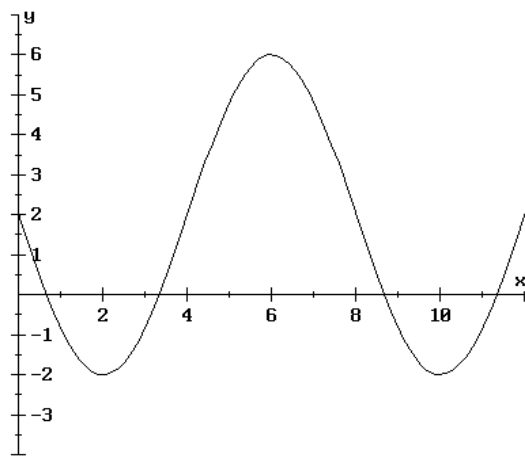
(13) Angle  $A = \frac{2\pi}{3}$ , and angle  $A$  is in standard position. The terminal side of angle  $A$  intersects the unit circle at the point  $(a, b)$ . Find the exact values of  $a$  and  $b$ .

(14) Repeat for angle  $B = \frac{7\pi}{6}$ .

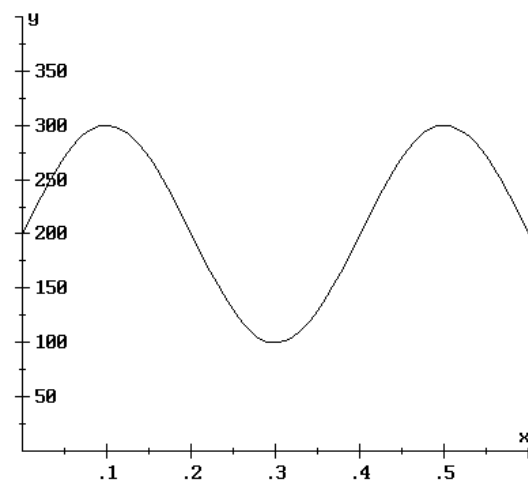
(15) Repeat for angle  $C = \frac{5\pi}{4}$ .

(16) Find a possible formula for each graph

a)



b)



(17) Simplify each expression by writing it without using any trigonometric functions. Find an exact value whenever possible.

a)  $\sin^{-1}\left(\sin\frac{7\pi}{6}\right)$

b)  $\sin(\sin^{-1}.5)$

c)  $\sin(\cos^{-1}0)$

d)  $\sin(\cos^{-1}x)$

e)  $\tan(\sin^{-1}x)$

(18) Find a possible formula for each data table.

a)

$x$	0	1	2	3	4
$y$	6	4	2	4	6

b)

$x$	$-\pi$	0	$\pi$	$2\pi$
$y$	Undefined	0	Undefined	0

c)

$x$	-1	-0.5	0	0.5	1	1.5
$y$	-10	-7	-10	-13	-10	-7

(19) A sine function  $y = f(x)$  has a period of 8 and amplitude of 3. It is also known that  $f(2) = 18$  is a minimum value of the function.

- Find the maximum value of the function.
- List three values for  $x$  that produce a maximum value.
- List three values for  $x$  that produce the average value of the function.
- Write an equation for this function.

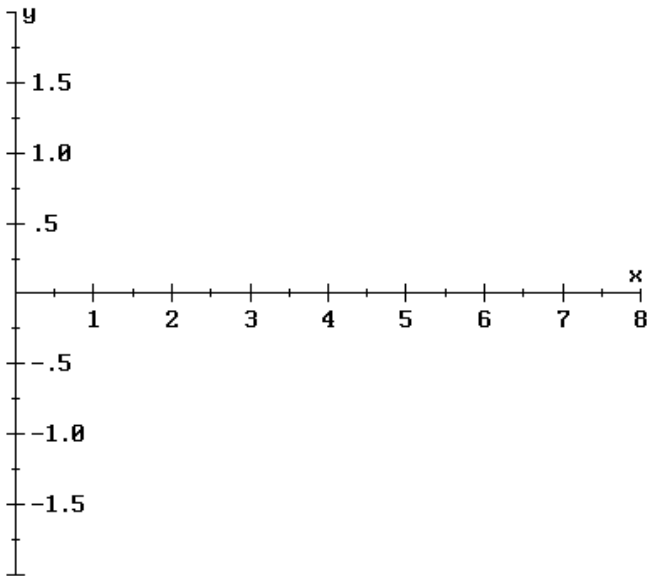
(20) Solve each triangle  $ABC$ , if possible. If there is no such triangle, explain how you know. If two triangles are possible, solve both.

- $a = 5$  cm,  $b = 6$  cm,  $c = 7$  cm
- $a = 6.17$  in,  $b = 11.52$  in,  $c = 17.41$  in
- $a = 5$  ft,  $b = 7$  ft,  $C = 78$  deg
- $a = 10$  m,  $b = 6$  m,  $B = 25$  deg
- $a = 5$  cm,  $b = 6$  cm,  $B = 35$  deg
- $A = 40$  deg,  $B = 50$  deg,  $c = 6$  ft



(21)

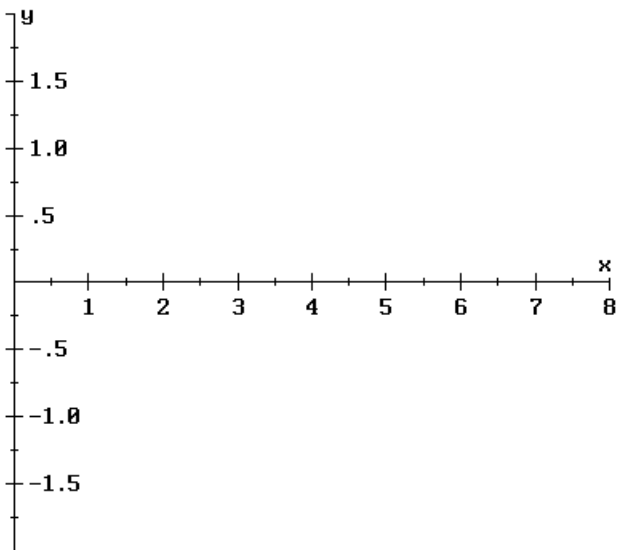
a) On the given axes, make a sketch of  $y = \cos x$ .



b) Indicate on the graph approximate solutions to  $\cos x = -0.4$

c) For each solution indicate the corresponding quadrant of the unit circle.

(22) Repeat #21 with  $y = \sin x$  and  $\sin x = -0.7$



(23) A cosine function  $y = g(x)$  has its average value at  $x = 2$  and  $x = 10$ .

- a) List three values that could be the period of this function.
- b) What is the largest possible period for this function? Explain.