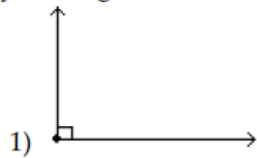
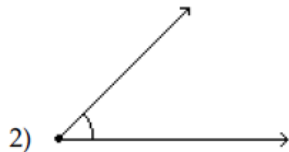


MULTIPLE CHOICE.

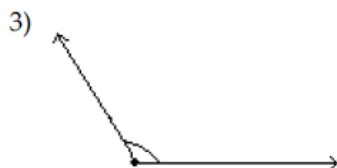
Classify the angle as acute, right, obtuse, or straight.



- A) Obtuse                      B) Straight                      C) Acute                      D) Right



- A) Right                      B) Obtuse                      C) Straight                      D) Acute



- A) Right                      B) Obtuse                      C) Straight                      D) Acute

4)



- A) Obtuse                      B) Right                      C) Straight                      D) Acute

If possible, find the indicated complement or supplement of the given angle.

5)  $66^\circ$ ; supplement

- A)  $24^\circ$                       B)  $204^\circ$                       C)  $294^\circ$                       D)  $114^\circ$

6)  $118^\circ$ ; supplement

- A)  $242^\circ$                       B)  $62^\circ$   
C) No supplement                      D)  $152^\circ$

7)  $7^\circ$ ; complement

- A)  $83^\circ$                       B)  $173^\circ$                       C)  $263^\circ$                       D)  $353^\circ$

8)  $147^\circ$ ; complement

- A)  $147^\circ$                       B) No complement  
C)  $33^\circ$                       D)  $57^\circ$

**SHORT ANSWER.**

**Find the measure of the indicated angle.**

9) Two angles of a triangle are  $50^\circ$  and  $30^\circ$ . Find the third angle.

10) Two angles of a triangle are  $40^\circ$  and  $70^\circ$ . Find the third angle.

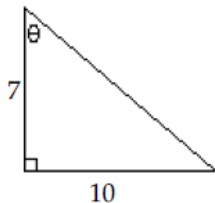
## Answers

- 1) D
- 2) D
- 3) B
- 4) C
- 5) D
- 6) B
- 7) A
- 8) B
- 9)  $100^\circ$
- 10)  $70^\circ$

**MULTIPLE CHOICE.**

Find the value of the indicated trigonometric function of the angle  $\theta$  in the figure.  
Give an exact answer with a rational denominator.

1)



Find  $\csc \theta$ .

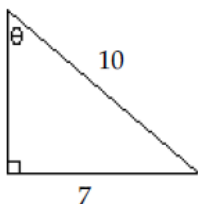
A)  $\csc \theta = \frac{\sqrt{149}}{7}$

B)  $\csc \theta = \frac{7\sqrt{149}}{149}$

C)  $\csc \theta = \frac{\sqrt{149}}{10}$

D)  $\csc \theta = \frac{10\sqrt{149}}{149}$

2)



Find  $\cot \theta$ .

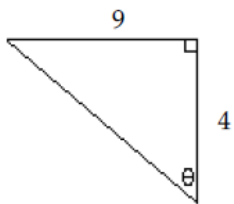
A)  $\frac{10\sqrt{51}}{51}$

B)  $\frac{\sqrt{51}}{10}$

C)  $\frac{\sqrt{51}}{7}$

D)  $\frac{7\sqrt{51}}{51}$

3)



Find  $\cot \theta$ .

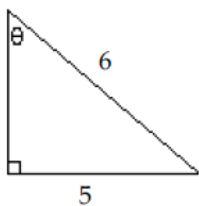
A)  $\cot \theta = \frac{9}{4}$

B)  $\cot \theta = \frac{4}{9}$

C)  $\cot \theta = \frac{4\sqrt{97}}{97}$

D)  $\cot \theta = \frac{9\sqrt{97}}{97}$

4)



Find  $\cot \theta$ .

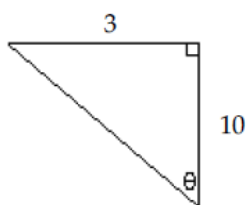
A)  $\frac{\sqrt{11}}{5}$

B)  $\frac{6\sqrt{11}}{11}$

C)  $\frac{5\sqrt{11}}{11}$

D)  $\frac{\sqrt{11}}{6}$

5)



Find  $\tan \theta$ .

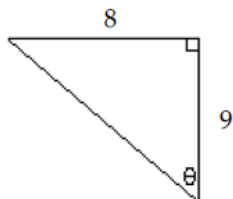
A)  $\tan \theta = \frac{10}{3}$

B)  $\tan \theta = \frac{\sqrt{109}}{3}$

C)  $\tan \theta = \frac{\sqrt{109}}{10}$

D)  $\tan \theta = \frac{3}{10}$

6)



Find  $\tan \theta$ .

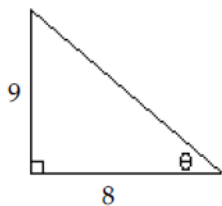
A)  $\tan \theta = \frac{8}{9}$

B)  $\tan \theta = \frac{\sqrt{145}}{8}$

C)  $\tan \theta = \frac{\sqrt{145}}{9}$

D)  $\tan \theta = \frac{9}{8}$

7)



Find  $\cos \theta$ .

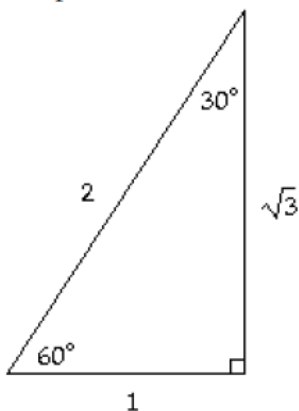
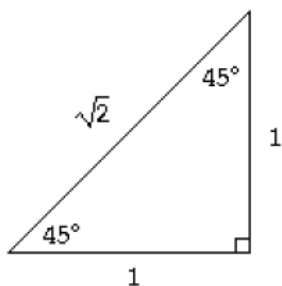
A)  $\cos \theta = \frac{\sqrt{145}}{9}$

B)  $\cos \theta = \frac{9\sqrt{145}}{145}$

C)  $\cos \theta = \frac{8\sqrt{145}}{145}$

D)  $\cos \theta = \frac{\sqrt{145}}{8}$

Use the given triangles to evaluate the expression. Rationalize all denominators.



8)  $\tan 30^\circ$

A)  $\sqrt{3}$

B)  $\frac{\sqrt{3}}{3}$

C)  $\frac{\sqrt{3}}{2}$

D) 1

9)  $\csc 60^\circ$

A) 2

B)  $\frac{2\sqrt{3}}{3}$

C)  $\frac{\sqrt{3}}{2}$

D)  $\sqrt{2}$

10)  $\tan 45^\circ - \sin 60^\circ$

A)  $\frac{2\sqrt{3} - 3\sqrt{2}}{6}$

B)  $\frac{2 - \sqrt{2}}{2}$

C)  $\frac{-\sqrt{3}}{6}$

D)  $\frac{2 - \sqrt{3}}{2}$

11)  $\cot 60^\circ - \cos 45^\circ$

A)  $\frac{2\sqrt{2} - 3\sqrt{3}}{6}$

B)  $\frac{2\sqrt{3} - 3\sqrt{2}}{6}$

C)  $\frac{2 - \sqrt{3}}{2}$

D)  $\frac{2 - \sqrt{2}}{2}$

12)  $\sec 45^\circ$

A)  $\sqrt{3}$

B)  $\sqrt{2}$

C)  $\frac{\sqrt{2}}{2}$

D)  $\frac{2\sqrt{3}}{3}$

13)  $1 - \sin^2 30^\circ - \sin^2 60^\circ$

A)  $\frac{1}{4}$

B)  $\frac{1 - \sqrt{3}}{2}$

C) 0

D) 1

14)  $1 + \cot^2 30^\circ - \sec^2 45^\circ$

A) 2

B) 0

C) 1

D) 3

SHORT ANSWER.

Use the definition or identities to find the exact value of the indicated trigonometric function of the acute angle  $\theta$ .

15)  $\sec \theta = \frac{13}{12}$  Find  $\csc \theta$ .

16)  $\tan \theta = \frac{7}{\sqrt{15}}$  Find  $\sin \theta$  and  $\cos \theta$ .

17)  $\cos \theta = \frac{2\sqrt{6}}{5}$  Find  $\sin \theta$  and  $\tan \theta$ .

18)  $\cot \theta = \frac{\sqrt{3}}{3}$  Find  $\sin \theta$ .

## Answers

- 1) C
- 2) C
- 3) B
- 4) A
- 5) D
- 6) A
- 7) C
- 8) B
- 9) B
- 10) D
- 11) B
- 12) B
- 13) C
- 14) A
- 15)  $\frac{13}{5}$

16)  $\sin \theta = \frac{7}{8}, \cos \theta = \frac{\sqrt{15}}{8}$

17)  $\sin \theta = \frac{1}{5}, \tan \theta = \frac{\sqrt{6}}{12}$

18)  $\frac{\sqrt{3}}{2}$



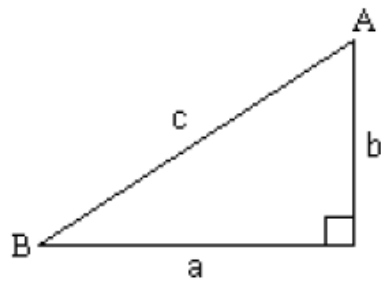
# Applying Right Triangles

## SHORT ANSWER.

### Solve the problem.

- 1) A 29 foot water slide has a 17 foot vertical ladder. How far is it along the ground from the end of the slide back to the base of the ladder that leads to the slide?
- 2) A painter leans a 30 foot ladder against one wall of a house. At what height does the ladder touch the wall if the foot of the ladder is 10 ft from the base of the wall?
- 3) From a distance of 45 feet from the base of a building, the angle of elevation to the top of the building is  $68^\circ$ . Estimate the height of the building to the nearest foot.
- 4) A kite is currently flying at an altitude of 15 meters above the ground. If the angle of elevation from the ground to the kite is  $35^\circ$ , find the length of the kite string to the nearest meter.
- 5) From a distance of 1217 feet from a spotlight, the angle of elevation to a cloud base is  $43^\circ$ . Find the height of the cloud base to the nearest foot.

Solve the right triangle using the information given.  
Round answers to two decimal places, if necessary.



6)  $b = 8$ ,  $A = 30^\circ$ ; Find  $a$ ,  $c$ , and  $B$ .

7)  $a = 2$ ,  $A = 40^\circ$ ; Find  $b$ ,  $c$ , and  $B$ .

8)  $a = 7$ ,  $b = 4$ ; Find  $c$ ,  $A$ , and  $B$ .

9)  $a = 4$ ,  $c = 9$ ; Find  $b$ ,  $A$ , and  $B$ .

## Answers

- 1)  $\approx 23.5$  ft
- 2)  $\approx 28.3$  ft
- 3) 111 ft
- 4) 26 m
- 5) 1135 ft
- 6)  $a = 4.62$   
 $c = 9.24$   
 $B = 60^\circ$
- 7)  $b = 2.38$   
 $c = 3.11$   
 $B = 50^\circ$
- 8)  $c = 8.06$   
 $A = 60.26^\circ$   
 $B = 29.74^\circ$
- 9)  $b = 8.06$   
 $A = 26.39^\circ$   
 $B = 63.61^\circ$

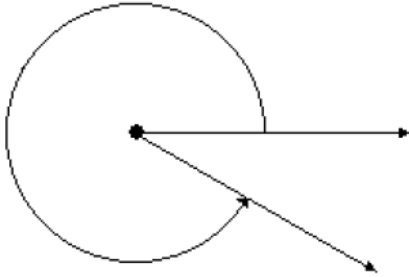
# Trigonometric Functions of Any Angles

## MULTIPLE CHOICE.

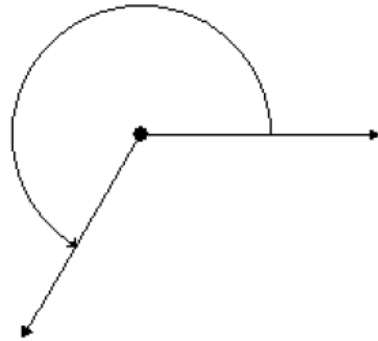
Draw the angle in standard position.

1)  $330^\circ$

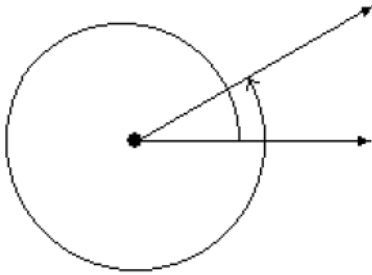
A)



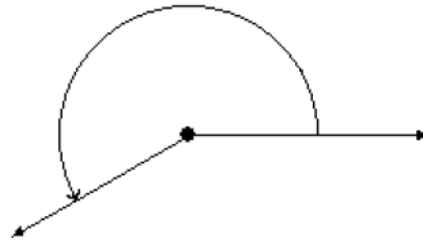
B)



C)

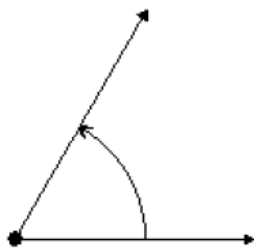


D)

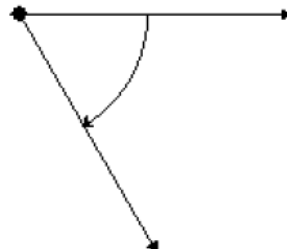


2)  $60^\circ$

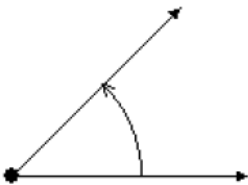
A)



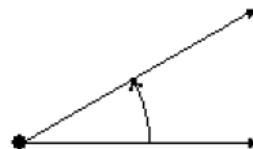
B)



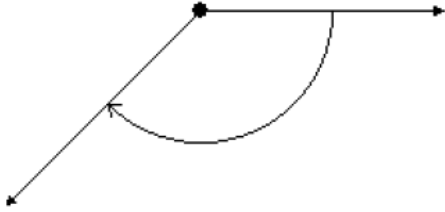
C)



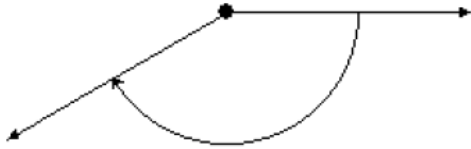
D)



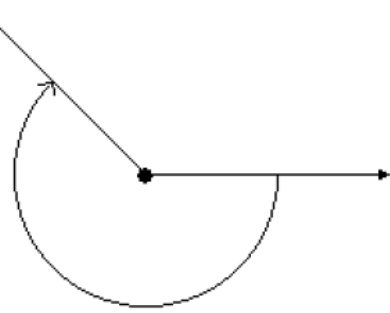
3)  $-150^\circ$   
A)



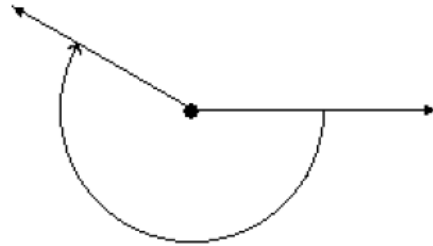
C)



B)

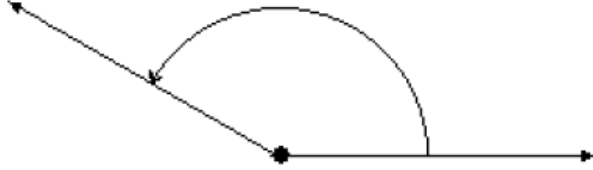


D)

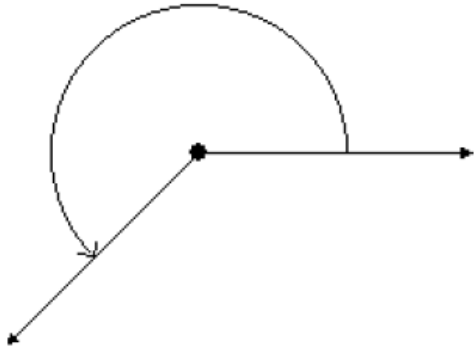


4)  $405^\circ$

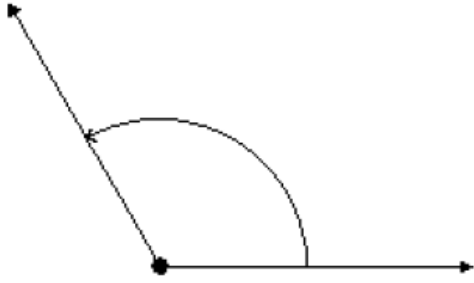
A)



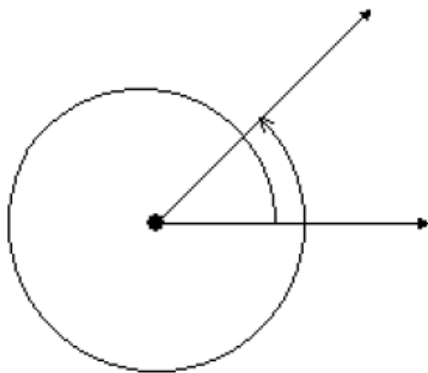
B)



C)



D)



Find a positive angle less than  $360^\circ$  that is coterminal with the given angle.

5)  $-185^\circ$

A)  $-5^\circ$

B)  $185^\circ$

C)  $355^\circ$

D)  $175^\circ$

6)  $548^\circ$

A)  $274^\circ$

B)  $178^\circ$

C)  $368^\circ$

D)  $188^\circ$

7)  $-1031^\circ$

A)  $671^\circ$

B)  $49^\circ$

C)  $311^\circ$

D)  $131^\circ$

**SHORT ANSWER.**

Use a coterminal angle to find the exact value of the expression. Do not use a calculator.

8)  $\cos 405^\circ$

9)  $\csc -660^\circ$

10)  $\cot -180^\circ$

**MULTIPLE CHOICE.**

**Name the quadrant in which the angle  $\theta$  lies.**

11)  $\sin \theta > 0, \quad \cos \theta < 0$

A) I

B) II

C) III

D) IV

12)  $\tan \theta > 0, \quad \sin \theta < 0$

A) I

B) II

C) III

D) IV

13)  $\cot \theta < 0, \quad \cos \theta > 0$

A) I

B) II

C) III

D) IV

**Solve the problem.**

14) Which of the following trigonometric values are negative?

I.  $\sin(-292^\circ)$

II.  $\tan(-193^\circ)$

III.  $\cos(-207^\circ)$

IV.  $\cot 222^\circ$

A) II, III, and IV

B) III only

C) I and III

D) II and III



SHORT ANSWER.

Find the reference angle of the given angle.

15)  $122^\circ$

16)  $-42^\circ$

17)  $379^\circ$

18)  $-253^\circ$

19)  $-517^\circ$

Use the reference angle to find the exact value of the expression. Do not use a calculator.

20)  $\sin 495^\circ$

21)  $\tan 750^\circ$

22)  $\cot 390^\circ$

Find the exact value of the indicated trigonometric function of  $\theta$ .

23)  $\cos \theta = \frac{2}{9}$ ,  $\tan \theta < 0$  Find  $\sin \theta$ .

24)  $\sec \theta = \frac{5}{2}$ ,  $\theta$  in quadrant IV Find  $\tan \theta$ .

25)  $\tan \theta = -\frac{10}{3}$ ,  $\theta$  in quadrant II Find  $\cos \theta$ .

26)  $\cot \theta = -\frac{9}{2}$ ,  $\cos \theta < 0$  Find  $\csc \theta$ .

## Answers

- 1) A
- 2) A
- 3) C
- 4) D
- 5) D
- 6) D
- 7) B
- 8)  $\frac{\sqrt{2}}{2}$
- 9)  $\frac{2\sqrt{3}}{3}$
- 10) undefined
- 11) B
- 12) C
- 13) D
- 14) D
- 15)  $58^\circ$
- 16)  $42^\circ$
- 17)  $19^\circ$
- 18)  $73^\circ$
- 19)  $23^\circ$
- 20)  $\frac{\sqrt{2}}{2}$
- 21)  $\frac{\sqrt{3}}{3}$
- 22)  $\sqrt{3}$
- 23)  $-\frac{\sqrt{77}}{9}$
- 24)  $-\frac{\sqrt{21}}{2}$
- 25)  $-\frac{3\sqrt{109}}{109}$
- 26)  $\frac{\sqrt{85}}{2}$

## Radians and Degrees / Arc Length

SHORT ANSWER.

Convert the angle in degrees to radians.

Express the answer in decimal form, rounded to two decimal place

1)  $-139^\circ$

2)  $-480^\circ$

3)  $6^\circ$

4)  $12^\circ$

Convert the angle in radians to degrees.

Express the answer in decimal form, rounded to two decimal place

5) 2

6)  $\sqrt{2}$

Convert the angle in radians to degrees.

7)  $3\pi$

8)  $\frac{\pi}{6}$

9)  $\frac{6\pi}{7}$

10)  $\frac{\pi}{4}$

Solve the problem.

- 11) The minute hand of a clock is 7 inches long. How far does the tip of the minute hand move in 5 minutes? If necessary, round the answer to two decimal places.

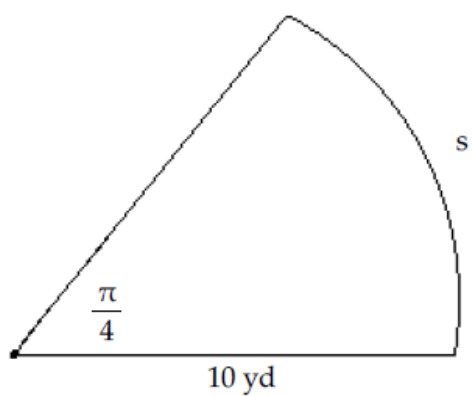
If  $s$  denotes the length of the arc of a circle of radius  $r$  subtended by a central angle  $\theta$ , find the missing quantity.

12)  $s = 6.24$  meters,  $\theta = 2.6$  radians,  $r = ?$

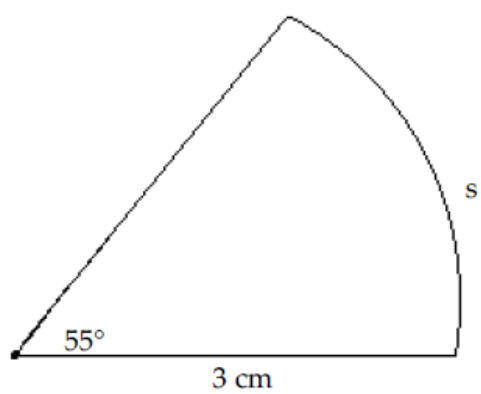
13)  $r = \frac{2}{3}$  feet,  $s = 14$  feet,  $\theta = ?$

Find the length  $s$ . Round the answer to three decimal places.

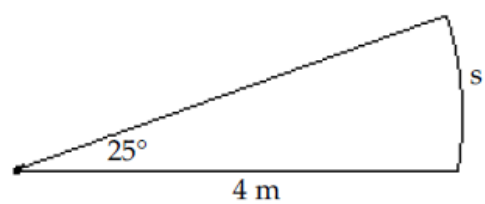
14)



15)



16)



## Answers

1) -2.43

2)  $-\frac{8\pi}{3}$

3)  $\frac{\pi}{30}$

4) 0.21

5)  $114.59^\circ$

6)  $81.03^\circ$

7)  $540^\circ$

8)  $30^\circ$

9)  $154.29^\circ$

10)  $45^\circ$

11) 3.67 in.

12) 2.4 m

13) 21 radians

14) 7.854 yd

15) 2.88 cm

16) 1.745 m

17) 4.19 ft

18) 18.33 in.



Solve the problem.

17) For a circle of radius 4 feet, find the arc length  $s$  subtended by a central angle of  $60^\circ$ . Round to the nearest hundredth.

18) A pendulum swings through an angle of  $30^\circ$  each second. If the pendulum is 35 inches long, how far does its tip move each second? If necessary, round the answer to two decimal places.

## Graphing the Trigonometric Functions / Unit Circle

### MULTIPLE CHOICE.

Solve the problem.

- 1) What is the domain of the cosine function?
  - A) all real numbers, except integral multiples of  $\pi$  ( $180^\circ$ )
  - B) all real numbers
  - C) all real numbers, except odd multiples of  $\frac{\pi}{2}$  ( $90^\circ$ )
  - D) all real numbers from -1 to 1, inclusive
  
- 2) What is the range of the cosine function?
  - A) all real numbers greater than or equal to 0
  - B) all real numbers greater than or equal to 1 or less than or equal to -1
  - C) all real numbers from -1 to 1, inclusive
  - D) all real numbers

### SHORT ANSWER.

Solve the equation on the interval  $0 \leq \theta < 2\pi$ .

3)  $\cos x = 0$

4)  $\sin x = -1$

5)  $\tan x = -1$

6)  $2 \cos x - \sqrt{3} = 0$

7)  $2 \sin x + \sqrt{2} = 0$

# Graphing the Trigonometric Functions / Unit Circle

## MULTIPLE CHOICE.

Solve the problem.

- 1) What is the domain of the cosine function?
  - A) all real numbers, except integral multiples of  $\pi$  ( $180^\circ$ )
  - B) all real numbers
  - C) all real numbers, except odd multiples of  $\frac{\pi}{2}$  ( $90^\circ$ )
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- 2) What is the range of the cosine function?
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  - C) all real numbers from -1 to 1, inclusive
  - D) all real numbers

## SHORT ANSWER.

Solve the equation on the interval  $0 \leq \theta < 2\pi$ .

3)  $\cos x = 0$

4)  $\sin x = -1$

5)  $\tan x = -1$

6)  $2 \cos x - \sqrt{3} = 0$

7)  $2 \sin x + \sqrt{2} = 0$

8)  $2 \sin x - 1 = 0$

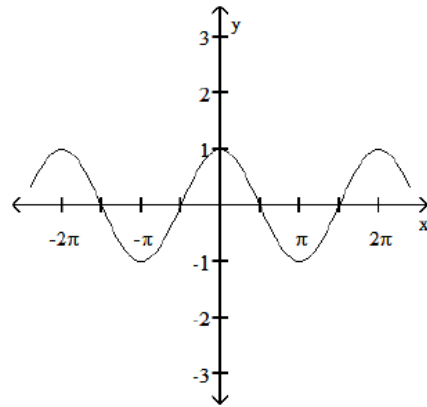
9)  $\cos \theta - 1 = 0$

MULTIPLE CHOICE.

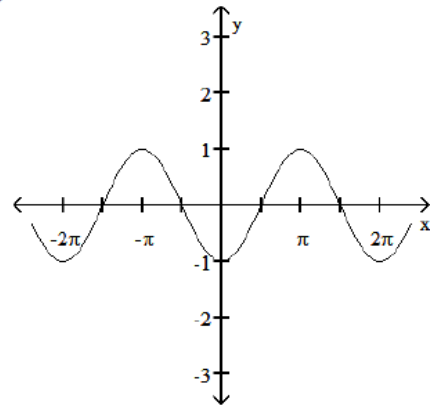
Match the function with its graph.

10)  $y = \sin x$

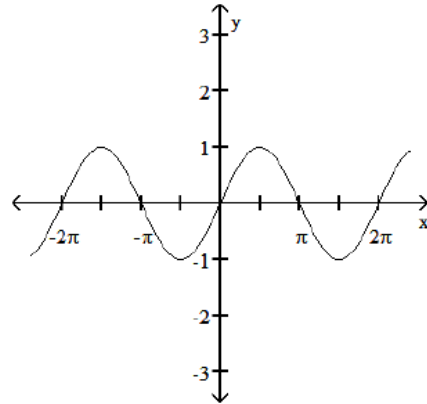
A)



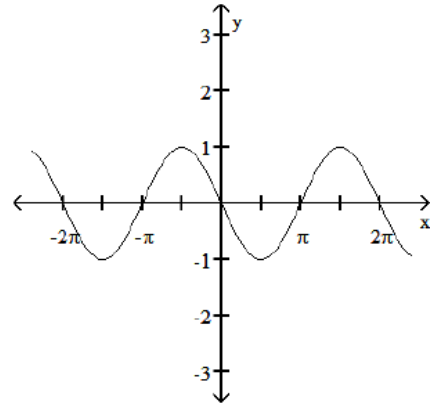
B)



C)

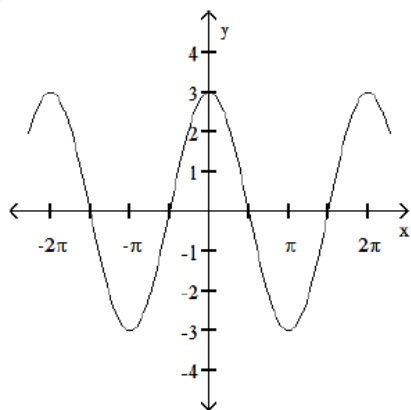


D)

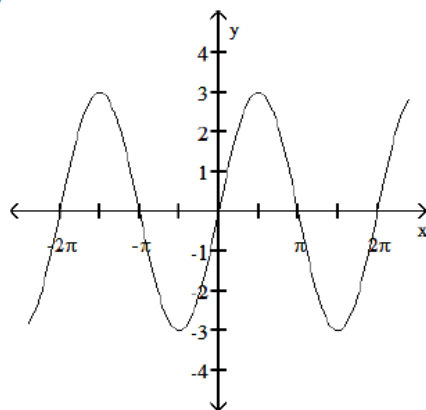


11)  $y = 3 \sin x$

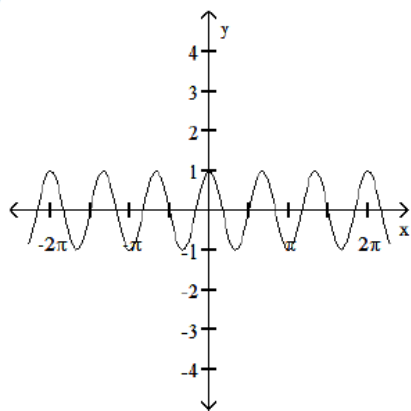
A)



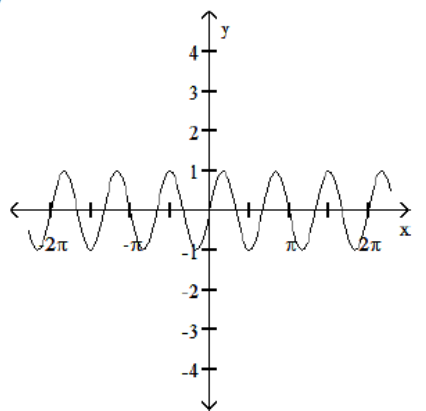
B)



C)

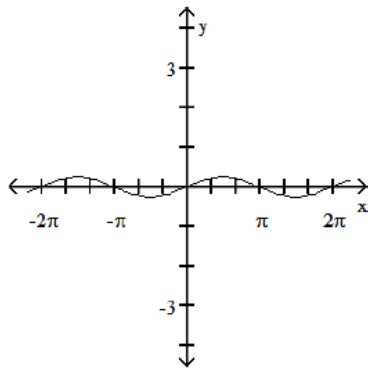


D)

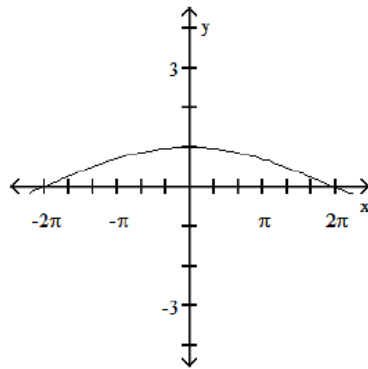


12)  $y = \frac{1}{4} \sin x$

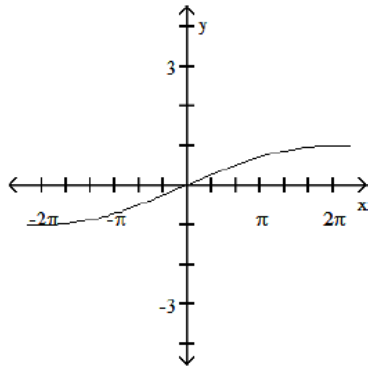
A)



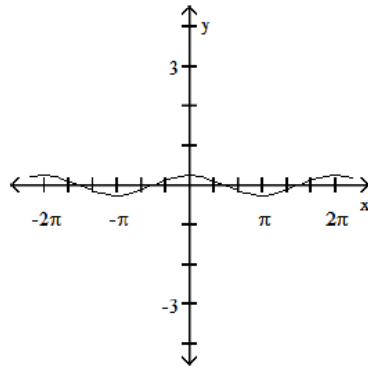
B)



C)

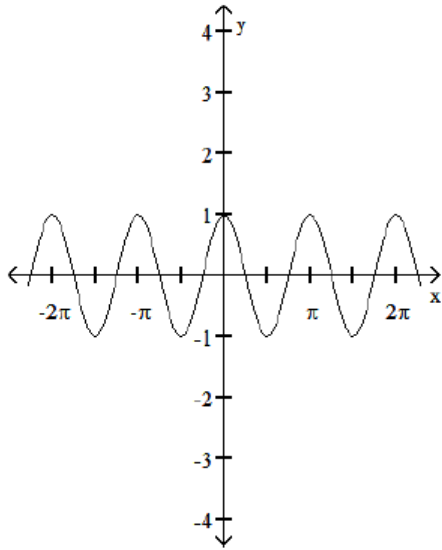


D)

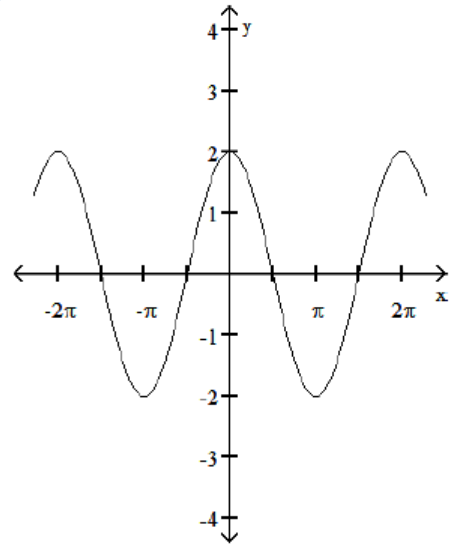


13)  $y = 2 \cos x$

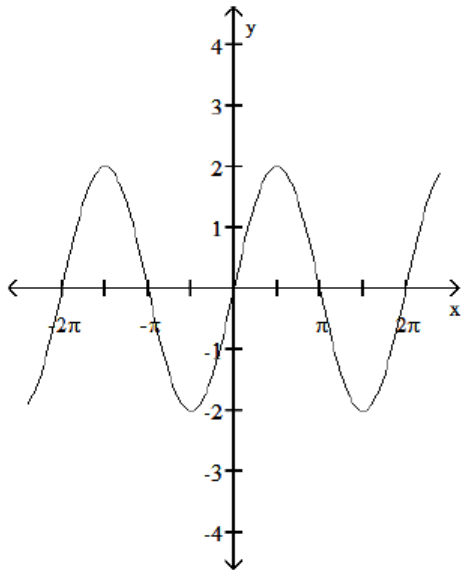
A)



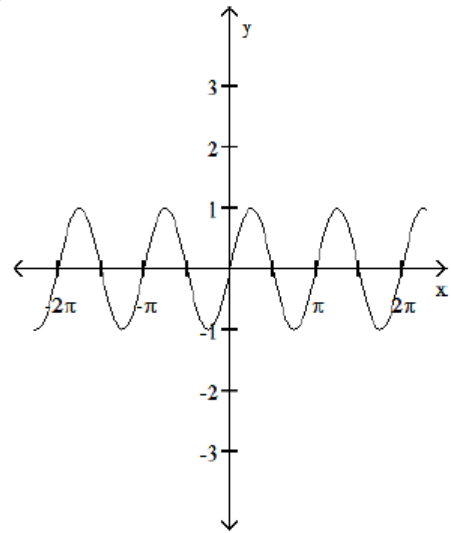
B)



C)

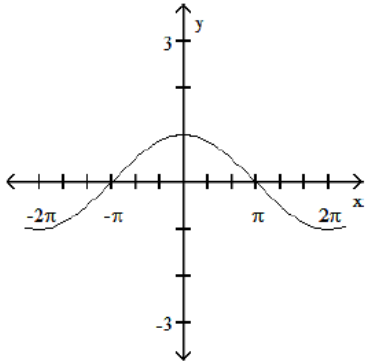


D)

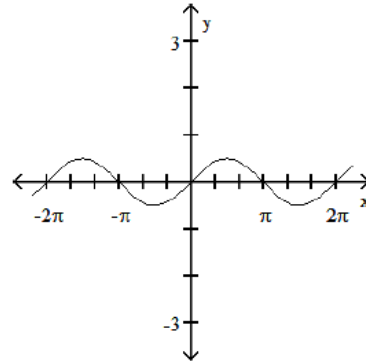


14)  $y = \frac{1}{2} \cos x$

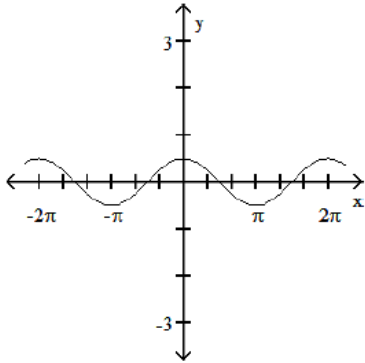
A)



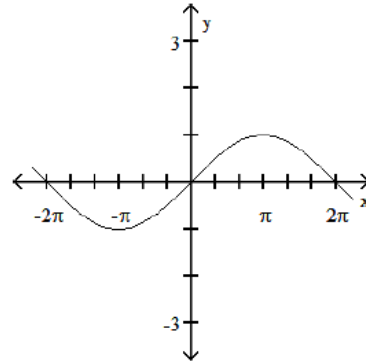
B)



C)



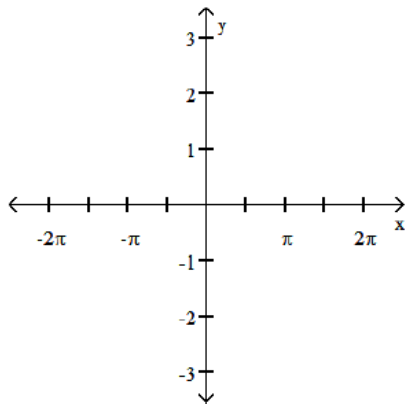
D)



**SHORT ANSWER.**

**Graph the function using key points.**

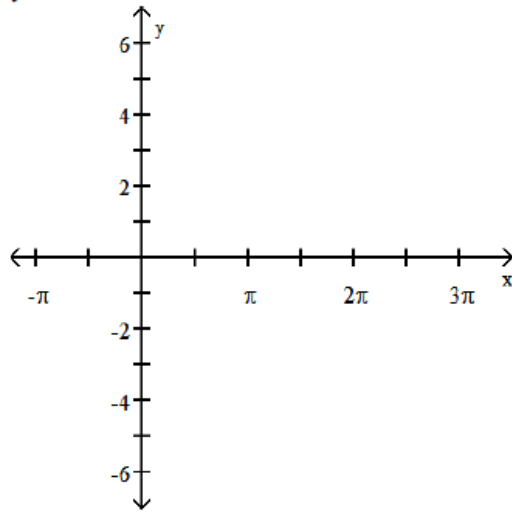
15)  $y = \sin x - 2$



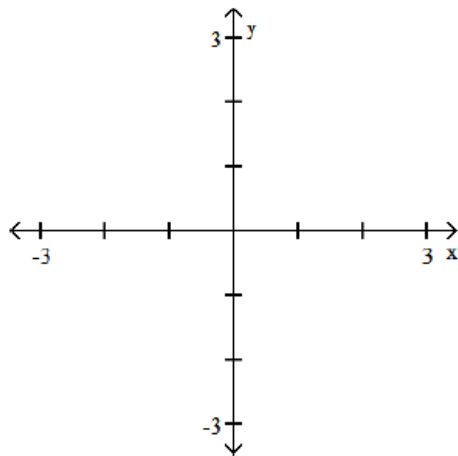


Graph the function.

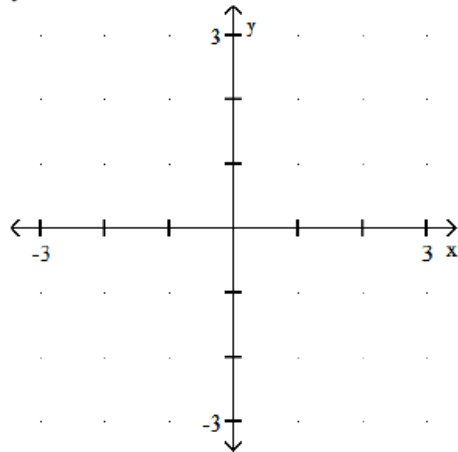
16)  $y = 2 \sin x$



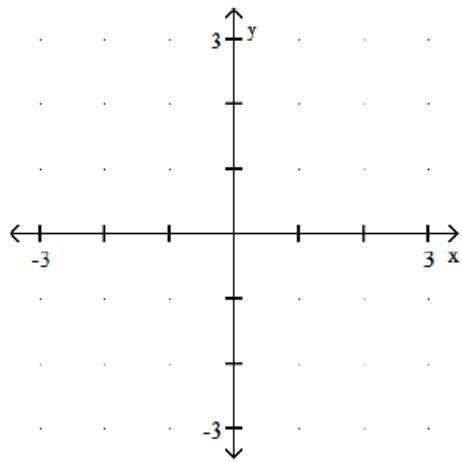
17)  $y = -3 \cos x$



18)  $y = -2 \sin x$



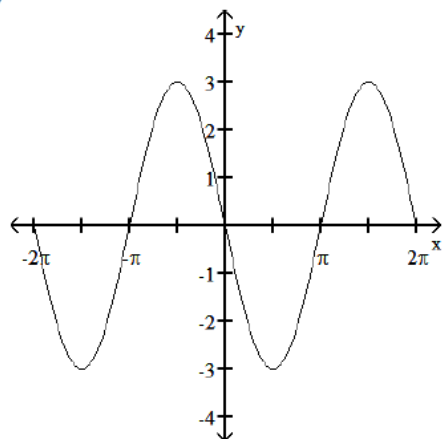
19)  $y = 0.4 \cos x$



MULTIPLE CHOICE.

Find an equation in the form  $y = A\cos x$  or  $y = A\sin x$  that represents the given graph.

20)



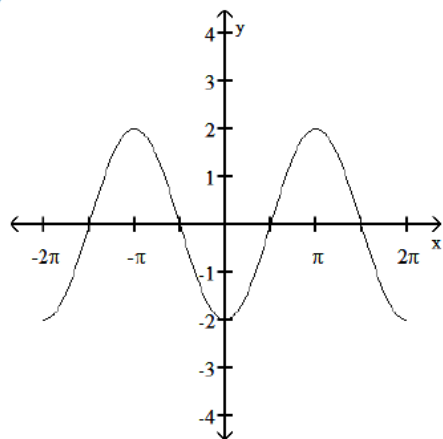
A)  $y = 3\cos x$

B)  $y = -3\cos x$

C)  $y = -3\sin x$

D)  $y = 3\sin x$

21)



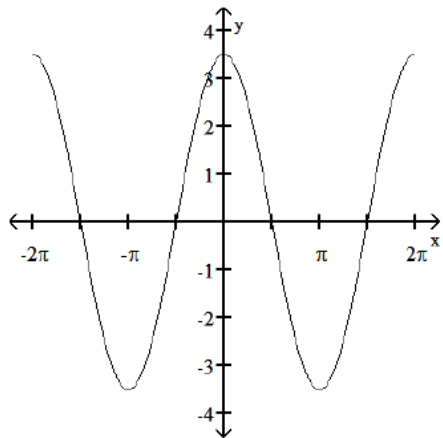
A)  $y = 2\cos x$

B)  $y = -2\cos x$

C)  $y = -2\sin x$

D)  $y = 2\sin x$

22)



A)  $y = 3.5\cos x$

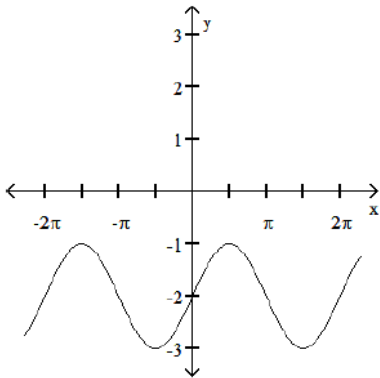
B)  $y = -3.5\cos x$

C)  $y = 3.5\sin x$

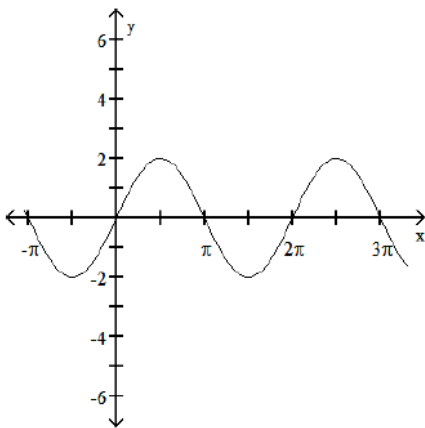
D)  $y = -3.5\sin x$

## Answers

- 1) B
- 2) C
- 3)  $\frac{\pi}{2}, \frac{3\pi}{2}$
- 4)  $\frac{3\pi}{2}$
- 5)  $\frac{3\pi}{4}, \frac{7\pi}{4}$
- 6)  $\frac{\pi}{6}, \frac{11\pi}{6}$
- 7)  $\frac{5\pi}{4}, \frac{7\pi}{4}$
- 8)  $\frac{\pi}{6}, \frac{5\pi}{6}$
- 9) 0
- 10) C
- 11) B
- 12) A
- 13) B
- 14) C
- 15)

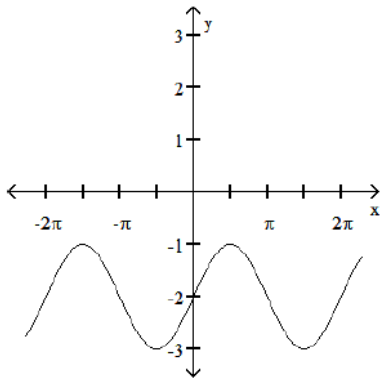


16)

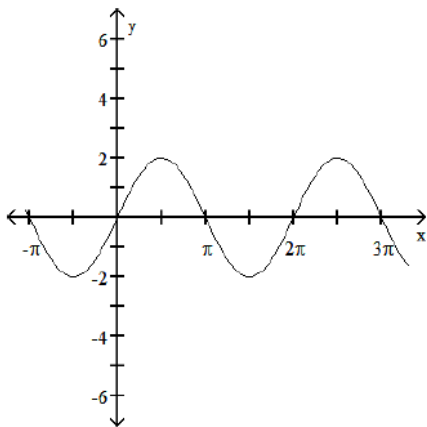


## Answers

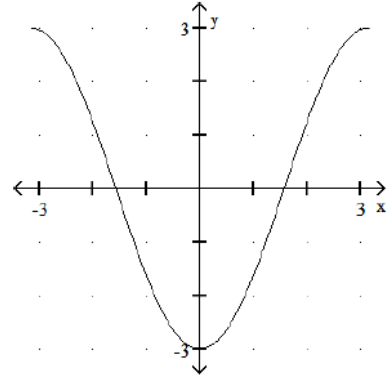
- 1) B
- 2) C
- 3)  $\frac{\pi}{2}, \frac{3\pi}{2}$
- 4)  $\frac{3\pi}{2}$
- 5)  $\frac{3\pi}{4}, \frac{7\pi}{4}$
- 6)  $\frac{\pi}{6}, \frac{11\pi}{6}$
- 7)  $\frac{5\pi}{4}, \frac{7\pi}{4}$
- 8)  $\frac{\pi}{6}, \frac{5\pi}{6}$
- 9) 0
- 10) C
- 11) B
- 12) A
- 13) B
- 14) C
- 15)



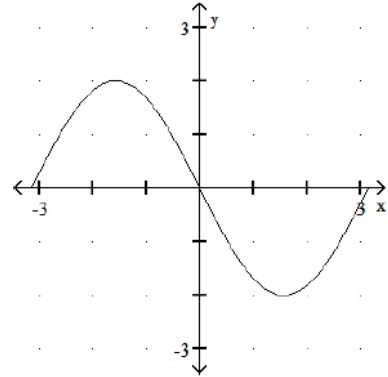
16)



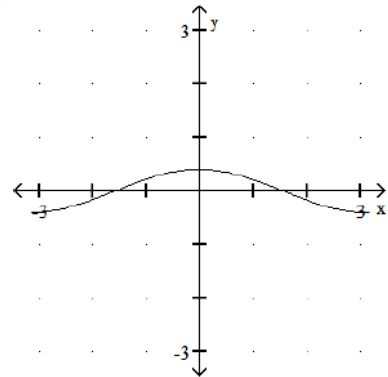
17)



18)



19)



20) C

21) B

22) A

# Trigonometric Identities

## MULTIPLE CHOICE.

Use the fundamental identities and appropriate algebraic operations to simplify the expression.

1)  $\cos x (\csc x - \sec x) - \cot x$

A) -1

B) 1

C) 0

D)  $\cos^2 x - \tan^2 x$

2)  $\sin^2 x (\cot^2 x + 1)$

A) 1

B)  $\cos^2 x + 1$

C)  $\tan^2 x$

D) -1

3)  $\frac{\cos x}{1 + \sin x} + \tan x$

A) 1

B)  $\cos x + \sin x$

C)  $\sin^2 x$

D)  $\sec x$

4)  $\frac{1 + \tan^2 x}{\sec x}$

A)  $\csc x$

B)  $\sec x$

C)  $-\sec x$

D) 1

5)  $\frac{\cos^2 x}{\sin^2 x} + \cos x \sec x$

A)  $\csc x$

B)  $\cot^2 x$

C)  $\csc^2 x$

D)  $\sec^2 x$

6)  $1 - \frac{\cos^2 x}{1 + \sin x}$

A) 0

B)  $\cot x$

C)  $\sin x$

D)  $\tan x$

## SHORT ANSWER.

Verify the identity.

7)  $\tan x (\csc x - \sin x) = \cos x$

8)  $(1 - \cos x)(1 + \cos x) = \sin^2 x$

9)  $(\sec x - \tan x)(\sec x + \tan x) = 1$

10)  $(1 + \tan^2 x)(1 - \sin^2 x) = 1$

11)  $\frac{\sec x - 1}{\tan x} = \frac{\tan x}{\sec x + 1}$

12)  $1 + \sec^2 x \sin^2 x = \sec^2 x$

## Answers

1) A

2) A

3) D

4) B

5) C

6) C

$$\begin{aligned} 7) \tan x(\csc x - \sin x) &= \tan x \cdot \csc x - \tan x \cdot \sin x = \frac{\sin x}{\cos x} \cdot \frac{1}{\sin x} - \frac{\sin x}{\cos x} \cdot \sin x \\ &= \frac{1}{\cos x} - \frac{\sin^2 x}{\cos x} = \frac{1 - \sin^2 x}{\cos x} \\ &= \frac{\cos^2 x}{\cos x} = \cos x \end{aligned}$$

$$8) (1 - \cos x)(1 + \cos x) = 1 - \cos^2 x = \sin^2 x$$

$$9) (\sec x - \tan x)(\sec x + \tan x) = \sec^2 x - \tan^2 x = 1$$

$$10) (1 + \tan^2 x)(1 - \sin^2 x) = \sec^2 x \cdot \cos^2 x = \frac{1}{\cos^2 x} \cdot \cos^2 x = 1$$

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

$$12) 1 + \sec^2 x \sin^2 x = 1 + \frac{\sin^2 x}{\cos^2 x} = 1 + \tan^2 x = \sec^2 x.$$