(1)

Section 5.1 Angles And Arcs.

1. The front wheel of a bicycle has a radius of 20 inches and the back wheel has a radius of 30 inches. If the linear speed of the bicycle is 150 inches per second, then the sum of the angular speeds of the two wheels is

60 radians per second

10 radians per second

5 radians per second

12.5 radians per second

15 radians per second

2. If $\alpha = 575^\circ$ and $\theta = \frac{-11\pi}{6}$ are two angles in the standard position, then which one of the following statements is TRUE about the locations of α and θ?

α is a Quadrant III angle and θ is a Quadrant IV angle

α is a Quadrant II angle and θ is a Quadrant IV angle

α is a Quadrant IV angle and θ is a Quadrant III angle

α is a Quadrant III angle and θ is a Quadrant I angle

α is a Quadrant I angle and θ is a Quadrant II angle

3. The degree measure of a central angle that cuts off an arc of length $\frac{\pi}{2}$ inches on a circle of diameter 10 inches is equal to

18°

$\left(\frac{\pi}{10}\right)^\circ$

$\left(\frac{10}{\pi}\right)^\circ$

9°

90°

4. The arc length that subtends a central angle 50° in a circle of diameter 10 cm is equal to

$\frac{25\pi}{18}$ cm

250 cm

500 cm

$\frac{9\pi}{25}$ cm

5 cm

5. The smallest positive angle coterminal with the angle $\theta = -870°$ is equal to

210°

150°

30°

−150°

−210°

6. If a wheel with a diameter of 16 centimeters is rotating at 10 radians per minute, then the linear speed of a point on the edge of the wheel is equal to

$\frac{4}{3}$ centimeters/second

$\frac{5}{3}$ centimeters/second

$\frac{3}{2}$ centimeters/second

$\frac{2}{3}$ centimeters/second

$\frac{3}{10}$ centimeters/second

7. If a wheel with a diameter of 20 centimeters is rotating at 100 revolutions per minute, then the linear speed of the wheel in centimeters per second is equal to

$\frac{100\pi}{3}$

$\frac{50\pi}{3}$

200

$\frac{10\pi}{3}$

$\frac{20\pi}{3}$

8. The diameter of a circle in which an arc length of $30\,\pi$ centimeters subtends a central angle of 135° is equal to

80 centimeters

50 centimeters

$\frac{6\pi}{25}$ centimeters

30π centimeters

135π centimeters

9. If a wheel rotates at 750 revolutions per minute, then the angular speed of the wheel in radians per second is equal to

25π

1500π

750

750π

$\frac{375}{\pi}$

10. If a car with a wheel of radius 40 cm is moving with a speed of 120 kilometers per hour, then the **angular** speed of the wheel of the car in **radian per minute** is

5000

4000

500

3000

50000

11. The smallest positive angle in radians that is coterminal with the angle $-255°$ is

$\frac{7\pi}{12}$

$\frac{5\pi}{12}$

$\frac{4\pi}{9}$

$\frac{5\pi}{9}$

$\frac{11\pi}{9}$

(5)

12. If a wheel is rotating at 100 revolutions per minute, then the angular speed in radians per second is equal to

$\frac{10\pi}{3}$

$\frac{50\pi}{3}$

$\frac{5\pi}{3}$

$\frac{200\pi}{3}$

$\frac{25\pi}{3}$

13. The length of an arc that subtends a central angle of 105° in a circle of diameter 30 cm is equal to

$\frac{35\pi}{4}$ cm

1575 cm

3150 cm

30π cm

15π cm

14. If α is the smallest positive angle coterminal with $-743°$ and β is the smallest positive angle coterminal with $610°$, then $\alpha - \beta$ is equal to

$87°$

$105°$

$337°$

$250°$

$225°$

15. The arc length that subtends a central angle $100°$ in a circle of diameter 36 centimeters is equal to

10π centimeters

20π centimeters

1800 centimeters

3600 centimeters

$\frac{25}{9}$ centimeters

16. The length of an arc that subtends a central angle of $135°$ in a circle of radius 40 ft is

30π feet

20π feet

25π feet

15π feet

35π feet

17. The linear speed, (in cm/second) of a point on the edge of a wheel of radius 3 cm that is turning at a speed of 50 revolutions per minute is

5 cm/sec

5π cm/sec

$\frac{5\pi}{2}$ cm/sec

150 cm/sec

$\frac{5\pi}{3}$ cm/sec

18. If α is the complementary angle of $26^\circ 25' 21''$ and $\beta = 32^\circ 31' 41''$ then $\alpha + \beta$ is equal to

$96^\circ\ 6'\ 20''$

$96^\circ\ 16'\ 59''$

$95^\circ\ 6'\ 62''$

$95^\circ\ 56'\ 2''$

$96^\circ\ 59'\ 40''$.

19. The degree measure of the smallest positive coterminal angle of $\theta = \frac{52\pi}{9}$ is

160°

40°

220°

320°

140°

20. A car has wheels that are 3.6 feet in diameter. If the wheels, rolling without slipping, turn through 72° degrees, then the distance moved by the car is equal to

$\frac{18\pi}{25}$ feet

$\frac{21\pi}{25}$ feet

$\frac{13\pi}{25}$ feet

$\frac{19\pi}{25}$ feet

$\frac{17\pi}{25}$ feet

21. The smallest positive angle coterminal with the angle $(820.25)^\circ$ is

$100^\circ\ 15'$

$20^\circ\ 52'$

$100^\circ\ 15'\ 2''$

$20^\circ\ 50'\ 2''$

$100^\circ\ 15'\ 1''$

22. An arc of length 150 m subtends a central angle of $300°$ in a circle of radius r. The radius r is equal to

$\frac{90}{\pi}$ m

$\frac{1}{2}$ m

$\frac{\pi}{90}$ m

$\frac{180}{\pi}$ m

2500π m

23. If a wheel of radius 8 centimeters is rotating at 450 revolutions per minute, then the **linear speed** of a point on the edge of the wheel in centimeters per seconds is equal to

120π

240π

110π

220π

230π

24. If a belt runs a drive wheel of radius 8 centimeters at 15 revolutions per minute, then the linear speed of the belt in centimeter per second is

$\frac{\pi}{4}$

$\frac{\pi}{16}$

4π

16π

$\frac{15}{4}\pi$

25. If α and β are, respectively, the complement and the supplement of the angle $\theta = 64°15'$, then $2\alpha + \beta$ is equal to

$167°15'$

$154°15'$

$167°45'$

$152°15'$

$25°45'$

26. Which one of the following statements is TRUE?

a) 40° and 400° are coterminal angles.

b) Angles that have a measure greater than 90° but less than 180° are acute angles.

c) 90° angles are straight angles.

d) π radian $= \pi^\circ$

e) π radian is less than π°.

27. The length of an arc that subtends a central angle 240° in a circle of radius 15cm is equal to:

$28\pi\, cm$
$5\pi\, cm$
$3\pi\, cm$
$20\pi\, cm$
$16\pi\, cm$

28. The wheels on a truck turn at the rate of K revolutions per second when the truck is travelling at 60 feet per second. If the diameter of the wheels is 3 feet, what is the value of K?

$20/\pi$
$30/\pi$
$6/\pi$
$54/\pi$
3π

29. A car with 30-centimeter-radius tires makes a 400 kilometer trip in 3 hours. The angular speed of its tires is equal to (Hint: 1 kilometer $= 10^5$ cm)

$\frac{4}{9} \times 10^6$ radian/hour

$\frac{3}{4} \times 10^4$ radian/hour

$\frac{4}{3} \times 10^6$ radian/hour

$\frac{4}{3} \times 10^6$ kilometer/hour

$\frac{9}{4} \times 10^4$ kilometer/hour

30. The arc length that subtends a central angle 75° in a circle of diameter 36 centimeters is equal to

- $\frac{15\pi}{4}$ centimeters
- 9π centimeters
- $\frac{15\pi}{2}$ centimeters
- 18π centimeters
- 15π centimeters

31. The greatest negative angle that is coterminal with $\frac{27\pi}{5}$ is

- $-\frac{3\pi}{5}$
- $-\pi$
- $-\frac{2\pi}{5}$
- $-\frac{4\pi}{5}$
- $-\frac{\pi}{5}$

32. If $\alpha = \pi/3$ radians and β is the complementary angle of α, then $150^\circ - \beta$ equals:

- 180°
- 90°
- 210°
- 30°
- 120°

Section 5.2 Trig of Acute Angles

1. If β is an acute angle of a right triangle with $\csc\beta = \frac{13}{12}$, then the exact value of the expression $\frac{\sec\beta - \tan\beta}{\cos\beta + \sin\beta}$ is equal to

$\frac{13}{85}$

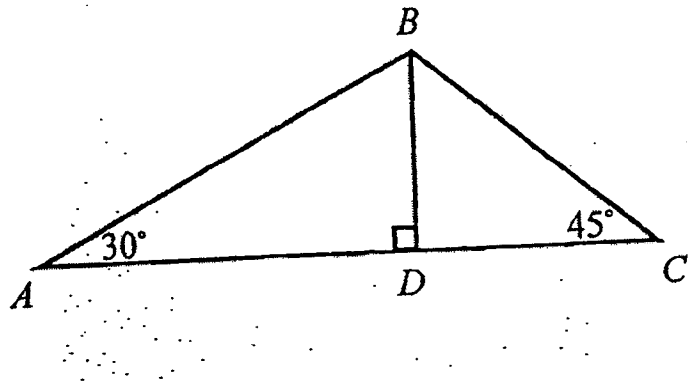
$\frac{11}{25}$

$\frac{1}{169}$

$\frac{17}{60}$

$\frac{25}{168}$

2. If, in the given figure, the length of AC is 10 cm, then the length of BD is



$\frac{10}{1+\sqrt{3}}$ cm

$\frac{10}{\sqrt{3}-1}$ cm

$\frac{10\sqrt{3}}{1+\sqrt{3}}$ cm

$\frac{10\sqrt{3}}{\sqrt{3}-1}$ cm

$\frac{20}{1+\sqrt{3}}$ cm

3. If α is an acute angle of a right triangle for which $\sec\alpha = \frac{13}{12}$, then the value of $\csc\alpha - \frac{13}{5}\cos\alpha + \cot\alpha$ is:

$\frac{12}{13}$

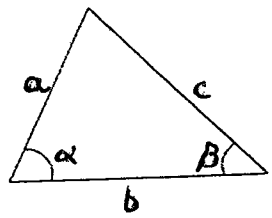
$\frac{13}{12}$

$\frac{13}{5}$

$\frac{12}{5}$

1

4. Consider the triangle given in the figure. If $\alpha = 60°$, $\beta = 45°$, the length of $a = 4$ feet and the length of $b = 2 + 2\sqrt{3}$ feet, then the length of c is equal to



$2\sqrt{6}$ feet

5 feet

4 feet

$3\sqrt{3}$ feet

$3\sqrt{2}$ feet

5. If the hypotenuse of a 30°, 60°, and 90° triangle is 10 cm, then the perimeter of the triangle is equal to

$(15 + 5\sqrt{3})$ cm

$(15 + 5\sqrt{2})$ cm

$(2 + 2\sqrt{10})$ cm

$(10 + 10\sqrt{2})$ cm

$(10 + 5\sqrt{2} + 5\sqrt{3})$ cm

6. A 22 foot ladder is resting against a vertical wall and makes an angle of 60° with ground. Find the exact height to which the ladder will reach the wall

$22\sqrt{3}$ feet

11 feet

$11\sqrt{2}$ feet

22 feet

$11\sqrt{3}$ feet

7. If the angle of elevation from a point 10 feet from the base of a tree to the top of the tree is θ, and if $\sin\theta = \frac{3}{5}$, then the height of the tree is

$\frac{15}{2}$ feet.

$\frac{20}{3}$ feet.

$\frac{25}{4}$ feet

6 feet.

15 feet.

8. From a point 130 meters away from the base of a tower, the angle of elevation to the top of the tower is 60°. Then the height of the tower is

$130\sqrt{3}$ meters

$\frac{260}{\sqrt{3}}$ meters

65 meters

$\frac{130}{\sqrt{3}}$ meters

$65\sqrt{3}$ meters

4

9. The angle of elevation from a point A to the top of the tower is 30°. From B, which is on the same line but 100 feet closer to the tower, the angle of elevation is 60°. The height of the tower is

$\frac{50}{\sqrt{3}}$ feet

$\frac{200}{\sqrt{3}}$ feet

$50\sqrt{3}$ feet

$\frac{100}{\sqrt{3}}$ feet

$100\sqrt{3}$ feet

10. The top of a radio antenna is 100 m high from the ground. A wire 200 m long is attached to the top from the ground. The angle the wire makes with the ground is equal to:

$30°$

$45°$

$60°$

$-30°$

$-60°$

11. A man stands 10 feet from a tree and measures the angle of elevation to the top of the tree as 60°. He moves back from the tree until the angle becomes 30°. How far did he move back?

(a) 30 feet
(b) 20 feet
(c) $10\sqrt{3}$ feet
(d) $20\sqrt{3}$ feet
(e) 50 feet

12. In the adjacent figure, the angle of elevation measured from a point on the ground to the top of a pole which is 10 meters high is found to be 30°. The measurement is taken again after moving x meters closer to the pole and is found to be 45°. What is the value of x?

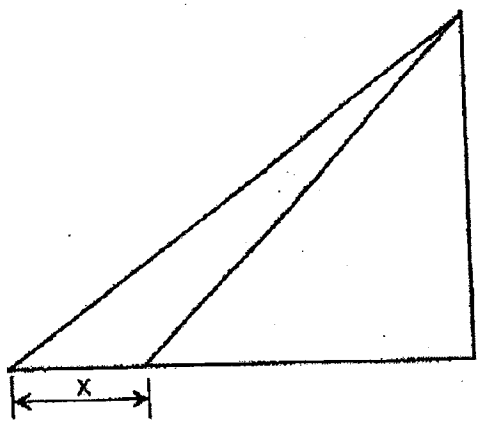
(a) $\sqrt{3}-1$

(b) $10\sqrt{3}$

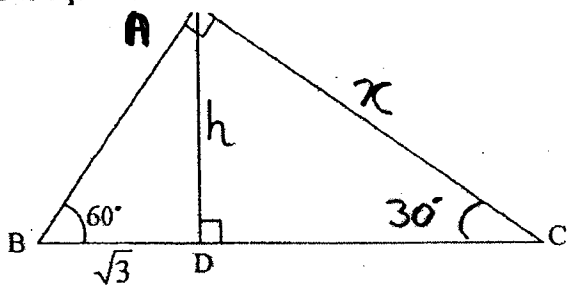
(c) $10-\sqrt{3}$

(d) $10(\sqrt{3}-1)$

(e) $9\sqrt{3}$



13. In the following diagram ΔABC is a right triangle and AD is perpendicular to BC. If BD $=\sqrt{3}$, then AC is equal to



A) $2\sqrt{3}$

B) $4\sqrt{3}$

C) $3\sqrt{3}$

D) 4

E) 6

14. Two buildings are 240 feet apart. The angle of elevation from the top of the shorter building to the top of the taller building is 30°. If the shorter building is 80 feet high, how high is the taller building?

$80(\sqrt{3}+1)$ feet

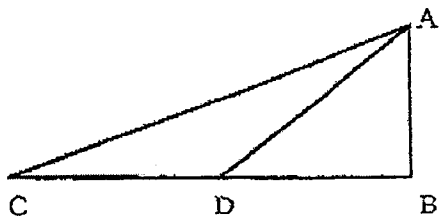
$80(3\sqrt{3}+1)$ feet

$240\sqrt{3}$ feet

$80(\sqrt{3}+2)$ feet

$80\sqrt{3}$ feet

15. In the adjacent figure, the angle of elevation from C to A is 30° and the angle of elevation from D to A is 60°. If $CD = 10$ feet, then $AB =$



$5\sqrt{3}$ feet

5 feet

10 feet

$10\sqrt{3}$ feet

$\sqrt{5}$ feet

16. An observer notes that the angle of elevation from point A to the top of a tower is 45°. From a point 10 m further from point A, the angle of elevation is 30°. Then the height of the tower is equal to

$5\sqrt{3}+5$ m

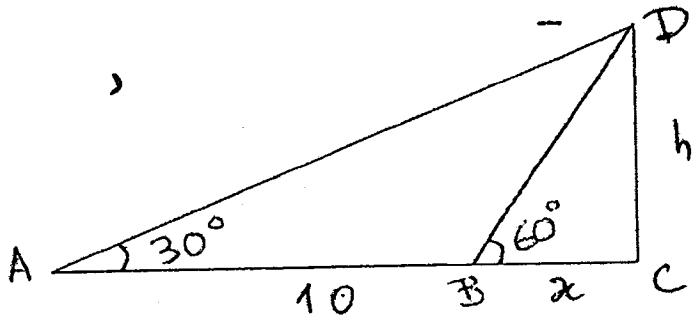
5 m

10 m

$10\sqrt{3}$ m

$5\sqrt{3}$ m

17. If the length of AB in the following figure is 10 cm, then the length of DC is



$5\sqrt{3}$ cm

$\frac{15}{2}\sqrt{3}$ cm

15 cm

5 cm

$10\sqrt{3}$

18. Two buildings are 90 meters apart. If the shorter building is 40 meters high, and the angle of depression from the top of the taller building to the top of the shorter building is $30°$, then the height of the taller building in meter is

85

$40+30\sqrt{3}$

$40\sqrt{3}$

150

$40+90\sqrt{3}$

19. A ladder of 6 meters length is placed against a wall forms an angle of $30°$ with the ground. If the foot of the ladder is moved towards the wall, the angle changed to $45°$. The exact distance moved by the top of the ladder on the wall is

$3\left(\sqrt{2}+1\right)$

$3\left(\sqrt{2}-1\right)$

$2-\sqrt{3}$

$2\left(\sqrt{3}-1\right)$

$4-\sqrt{3}$

20 Two buildings are 240 meters apart. The angle of elevation from the top of the shorter building to the top of the taller building is 30°. If the shorter building is 8 meters high, then the taller building is

(a) $(8 + 80\sqrt{3})$ meters high

(b) $(8 + 8\sqrt{3})$ meters high

(c) $(8 + 80\sqrt{2})$ meters high

(d) 88 meters high

(e) $(8 + 8\sqrt{2})$ meters high

21. An airplane is flying 60000 feet above level ground. The angle of depression from plane to the base of a tree is $\theta°$ where $\sin\theta° = \frac{5}{13}$. How far horizontally must the plane fly directly over the tree?

(a) 144000 feet

(b) 121000 feet

(c) 169000 feet

(d) 225000 feet

(e) 250000 feet

22. If from the top of a tower 200 feet high, the angles of depression of the top and bottom of a building opposite to the tower are observed to be 30° and 60°, respectively, then the height of the building is equal to

(a) $\frac{400}{3}$ feet

(b) $\frac{400\sqrt{3}}{3}$ feet

(c) $100\sqrt{3}$ feet

(d) $\frac{200\sqrt{3}}{3}$ feet

(e) $\frac{350}{3}$ feet

23. From the top of a 200-ft lighthouse, the angle of depression to a ship in the sea is 60°. How far is the ship from the base of the lighthouse?

(a) $\frac{200\sqrt{3}}{3}$ ft

(b) 400 ft

(c) $200\sqrt{3}$ ft

(d) $\frac{400\sqrt{3}}{3}$ ft

(e) $400\sqrt{3}$ ft

Section 5.3 Trigonometric Functions Of Any Angle

1. The reference angle of $\theta = 30$ radians is equal to

(a) $10\pi - 30$

(b) $30 - 10\pi$

(c) $30 - 8\pi$

(d) -30

(e) $30 - 6\pi$

2. The reference angle θ' of $\theta = 217°15'$ is

(a) $152°45'$

(b) $46°25'$

(c) $36°45'$

(d) $37°15'$

(e) $27°15'$

3. **The reference angle of $\theta = 15$ radians is equal to**

A) $15 - 5\pi$

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

C) $15 - 4\pi$

D) $5\pi - 15$

E) $4\pi - 15$

4. The reference angle θ', in radians, of the angle $\theta = -1656°$ is equal to

(a) $\frac{\pi}{5}$

(b) $\frac{\pi}{7}$

(c) $\frac{\pi}{3}$

(d) $\frac{\pi}{6}$

(e) $\frac{\pi}{9}$

5. If the terminal side of an angle θ lies on the line $3x + 4y = 0$, where $x > 0$, then the value of $5\sin\theta + 10\cos\theta$ is equal to

(a) 5

(b) 9.5

(c) 11

(d) -4

(e) -3

6. If the terminal side of an angle θ in standard position coincides with the line $y = -3x$, then which one of the following statements is TRUE?

A) $\cos\theta = -\frac{3}{\sqrt{10}}$

B) $\tan\theta = \frac{1}{3}$

C) $\sin\theta = \frac{1}{\sqrt{10}}$

D) $\tan\theta = 3$

E) $\cot\theta = -\frac{1}{3}$

7. If the terminal side of an angle θ lies on the line $3x + 4y = 0$, where $x > 0$, then the value of $\cot\theta + \cos\theta$ is

(a) $-\frac{8}{15}$

(b) $-\frac{32}{15}$

(c) $\frac{32}{15}$

(d) $\frac{1}{15}$

(e) $-\frac{1}{5}$

8. If the point $(-2, -3)$ is on the terminal side of the angle θ in the standard position, then $3\sin\theta + 2\cos\theta$ is equal to

(a) $-\sqrt{13}$

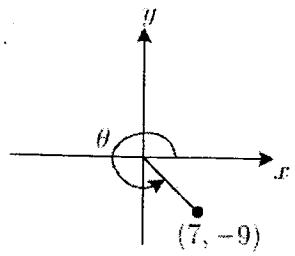
(b) $-5\frac{\sqrt{13}}{13}$

(c) $-2\frac{\sqrt{13}}{13}$

(d) $-6\frac{\sqrt{13}}{13}$

(e) 13

9. For the angle θ shown at the right, $\tan\theta$ is equal to



(a) $\frac{-9}{7}$

(b) $\frac{-9\sqrt{130}}{7}$

(c) $\frac{\sqrt{130}}{7}$

(d) $\frac{-7}{9}$

(e) $\frac{-\sqrt{130}}{9}$

10. If the angle θ is in standard position and the point $P(3, -4)$ lies on its terminal side, then $\cos\theta + \tan\theta$ is equal to

(a) $\frac{-11}{15}$

(b) $\frac{3}{20}$

(c) $\frac{1}{15}$

(d) $\frac{-1}{3}$

(e) $\frac{1}{4}$

11. If the terminal side of an angle θ passes through the point $(-12, 5)$, then $\cot\theta + \csc\theta$ is equal to

(a) $-\frac{1}{5}$

(b) $-\frac{4}{5}$

(c) $\frac{4}{5}$

(d) $\frac{3}{5}$

(e) $-\frac{3}{5}$

12. On the terminal side of a central angle θ, a point P has the coordinates $(3, -4)$. What is the value of $\tan\theta - \sin\theta$?

(a) $\frac{8}{15}$

(b) $-\frac{8}{15}$

(c) $\frac{1}{5}$

(d) 0

(e) -1

13. If the terminal side of the angle θ lies on the line

$$3x + 4y = 0 \quad \text{and} \quad x < 0$$

then the value of

$$\sin\theta + \cos\theta + \tan\theta$$

is equal to

(a) $\frac{13}{20}$

(b) $\frac{19}{15}$

(c) $-\frac{19}{20}$

(d) $\frac{43}{20}$

(e) $\frac{13}{20}$

14. If $\sec\theta = \frac{2\sqrt{3}}{3}$ and $\sin\theta < 0$, then $\cot\theta + \sqrt{2}$ is equal to

(a) $\sqrt{2} - \sqrt{3}$

(b) $\sqrt{2} + \sqrt{3}$

(c) 0

(d) $2\sqrt{2}$

(e) $\sqrt{3} - \sqrt{2}$

15. If $\sec\theta = \frac{2\sqrt{3}}{3}$ and $\sin\theta > 0$, then $\cot\theta - 3\tan\theta$

(a) 0

(b) $\sqrt{3}$

(c) $-\sqrt{3}$

(d) $\frac{1}{2}$

(e) $-\frac{\sqrt{3}}{3}$

16. If $\cos\theta = -\frac{1}{2}$ and $\sin\theta > 0$, then $\cot\theta + \csc\theta =$

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

B) $\frac{1}{2}$

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

D) $-\sqrt{3}$

E) $\sqrt{3}$

17. If $\cot\theta = \frac{1}{2}$, $\pi < \theta < \frac{3\pi}{2}$, then $\sin\theta + \cos\theta =$

(a) $\frac{-3}{\sqrt{5}}$

(b) 3

(c) $\frac{-1}{\sqrt{5}}$

(d) $\frac{3}{\sqrt{5}}$

(e) $\frac{1}{\sqrt{5}}$

18. If $\sec\theta = \frac{2\sqrt{3}}{3}$ and $\sin\theta = -\frac{1}{2}$, then $\cot\theta =$

(a) $\sqrt{3}$

(b) $-\frac{\sqrt{3}}{3}$

(c) $\frac{\sqrt{3}}{2}$

(d) $-\sqrt{3}$

(e) $\frac{3}{2}$

19. If $\tan\theta = \frac{3}{4}$ and $\cos\theta < 0$, then $\sin\theta + \cos\theta$ is equal to

A) 7

B) $\frac{2}{5}$

C) 1

D) $-\frac{3}{5}$

E) $-\frac{7}{5}$

20. The exact value of the expression

$$2\cos\left(-\frac{7\pi}{4}\right)\tan(240°) - \sqrt{6}\csc\left(\frac{7\pi}{6}\right)$$

is

(a) $3\sqrt{6}$

(b) $2\sqrt{6}$

(c) $\sqrt{6}$

(d) $-\sqrt{6}$

(e) $-2\sqrt{6}$

21. If $\cos 170° = k$, then $\cos 350° + 2\sec 190° =$

(a) $\dfrac{2-k^2}{k}$

(b) $\dfrac{2k^2+k}{k}$

(c) $-3k$

(d) $\dfrac{k^2-2}{k}$

(e) $-k + 2\sqrt{1-k^2}$

22. The exact value of $\sec\frac{5\pi}{6}+6\cot\frac{4\pi}{3}$ is

A) $-\frac{7\sqrt{3}}{3}$

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

C) $\frac{4\sqrt{3}}{3}$

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

E) $6\sqrt{3}-2$

23. The exact value of $\csc(-\frac{17\pi}{6})$ is

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

B) -2

C) 2

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

E) -1

24. The value of the expression

$$\cos\left(\frac{11\pi}{6}\right) - 4\sin\left(\frac{2\pi}{3}\right)$$

is equal to:

(a) $\frac{3\sqrt{3}}{2}$

(b) $-\frac{5\sqrt{3}}{2}$

(c) $-\frac{3}{2}$

(d) $\frac{5}{2}$

(e) $-\frac{3\sqrt{3}}{2}$

25. The exact value of

$$\sec\frac{7\pi}{6} + 6\cot\frac{4\pi}{3}$$

equals

(a) $\frac{5\sqrt{3}}{3}$

(b) $\frac{7\sqrt{3}}{3}$

(c) $-\frac{7\sqrt{3}}{3}$

(d) $\frac{4\sqrt{3}}{3}$

(e) $-\frac{5\sqrt{3}}{3}$

26. The exact value of $\csc(225°)\cdot\tan(-240°) + \sin 150°$ is

~~(a)~~ $\frac{1}{2} + \sqrt{6}$

(b) $\sqrt{3} + \frac{1}{2}$

(c) $\frac{\sqrt{2} + 2\sqrt{3}}{\sqrt{3}}$

(d) $\frac{\sqrt{6} + 4\sqrt{3}}{\sqrt{2}}$

(e) $\sqrt{6} + 2\sqrt{3}$

27. The exact value of

$$\cos\left(\frac{11\pi}{6}\right) - 4\sin\left(\frac{20\pi}{3}\right)$$

is equal to

(a) $\frac{\sqrt{3}}{2} + 2$

(b) $-\frac{\sqrt{3}}{2}$

(c) $\frac{1+4\sqrt{3}}{2}$

(d) $-2 + \frac{\sqrt{3}}{2}4$

(e) $-\frac{3\sqrt{3}}{2}$

28. The exact value of $\cos\frac{29\pi}{3} - \tan\frac{21\pi}{4} + \csc(-210^\circ)$ is

(a) $\frac{\sqrt{3}+1}{2}$

(b) $\frac{3}{2}$

(c) $\frac{-3}{2}$

(d) $\frac{-5}{2}$

(e) $\frac{\sqrt{3}-1}{2}$

29. The value of $3\tan\frac{\pi}{4} + \sec 60^\circ - \sin 30^\circ \cos\frac{\pi}{3}$ is equal to

(a) $\frac{19}{4}$

(b) $-\frac{3}{4}$

(c) $\frac{15}{2}$

(d) $-\frac{1}{2}$

(e) $\frac{3}{4}$

30. $\sin 675^\circ + \cos(-405^\circ) + \tan\dfrac{8\pi}{3} =$

(a) $-\sqrt{3}$

(b) $\sqrt{2} + \sqrt{3}$

(c) $3\sqrt{2} - \sqrt{3}$

(d) $-\sqrt{2} + 2\sqrt{3}$

(e) $2\sqrt{3}$

31. The value of $\sec(-300^\circ) + \tan\left(\dfrac{3\pi}{4}\right) + \sin 210^\circ$ is

(a) $\dfrac{1}{2}$

(b) $-\dfrac{5}{2}$

(c) $\dfrac{7}{2}$

(d) $-\dfrac{1}{2}$

(e) -1

32. $\csc(-510^\circ) + 4\cos(150^\circ)\sin(120^\circ) + \tan(405^\circ)$ is equal to

(a) -4

(b) 3

(c) 5

(d) -5

(e) -2

33. The exact value of $2\sin(7\pi/6) - \cos(660°).\tan(39\pi/4)$ is

A) $-\frac{1}{2}$

B) 0

C) $\frac{1}{2}$

D) 1

E) -1

34. The value of $\csc\frac{5\pi}{3} + \tan\pi + \cot\frac{7\pi}{6}$ is

(a) $\frac{\sqrt{3}}{3}$

(b) $-\frac{\sqrt{3}}{2}$

(c) $\frac{2\sqrt{3}}{3}$

(d) $-\frac{4\sqrt{3}}{3}$

(e) $\frac{5\sqrt{3}}{3}$

35. The exact value of $\cos\frac{7\pi}{4}\tan\frac{4\pi}{3} + 3\sqrt{2}\cos\frac{7\pi}{6}$ is

(a) $-\sqrt{6}$

(b) $3\sqrt{6}$

(c) $-2\sqrt{6}$

(d) $\frac{\sqrt{3}-\sqrt{2}}{2}$

(e) $\frac{\sqrt{6}-\sqrt{3}}{2}$

(1)

Section 5.4 Trigonometric Functions Of Real Numbers

1. If $W(t) = P(x, y)$ is the wrapping function, then $W\left(-\frac{5\pi}{3}\right) =$

(a) $P\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

(b) $P\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

(c) $P\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

(d) $P\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

(e) $P\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

2. If $W(t) = P(x, y)$ is the wrapping function, then $W\left(-\frac{25\pi}{3}\right) =$

A) $P\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

B) $P\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

C) $P\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

D) $P\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

E) $P\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

(2)

3. If $W\left(\frac{-17\pi}{6}\right) = P(x,y)$, then $x - y =$

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

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

c) 0

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

e) $\frac{\sqrt{3}+1}{2}$

4. Let $W(t)$ be the wrapping function. If $W\left(-\frac{11\pi}{6}\right) = (a,b)$ and $W\left(\frac{10\pi}{3}\right) = (c,d)$, then $a + d =$

(a) 0

(b) $\sqrt{3}$

(c) $\frac{-1}{2} - \frac{\sqrt{3}}{2}$

(d) $-\sqrt{3}$

(e) $\frac{1}{2} - \frac{\sqrt{3}}{2}$

5. If $W(t)$ is the wrapping function, then $W\left(-\frac{16\pi}{3}\right)$ is equal to

A) $(\frac{-\sqrt{3}}{2}, \frac{1}{2})$

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

C) $(\frac{1}{2}, \frac{\sqrt{3}}{2})$

D) $(\frac{1}{2}, -\frac{\sqrt{3}}{2})$

E) $(\frac{\sqrt{3}}{2}, \frac{-1}{2})$

6. Let W be the wrapping function. If $W\left(-\frac{19\pi}{6}\right) = (x, y)$, then $x - y =$

(a) $\frac{1}{2}(-1 - \sqrt{3})$

(b) $\frac{1}{2}(1 + \sqrt{3})$

(c) $\frac{1}{2}(-1 + \sqrt{3})$

(d) $\frac{1}{2}(1 - \sqrt{3})$

(e) $\frac{1}{2}(\sqrt{2} - \sqrt{3})$

7. Let W be the wrapping function. If $W\left(-\frac{25\pi}{6}\right) = (x, y)$, then $x - y =$

(a) $\frac{1}{2}(\sqrt{3}+1)$

(b) $-\frac{1}{2}(\sqrt{3}+1)$

(c) $\frac{1}{2}(-\sqrt{3}+1)$

(d) $\frac{1}{2}(\sqrt{3}+\sqrt{2})$

(e) $\frac{1}{2}(\sqrt{3}-\sqrt{2})$

8. . If W is the wrapping function with $W(t) = (\frac{3}{5}, -\frac{4}{5})$, then the $x-$coordinate of $W(t-\frac{\pi}{2})$ is equal to :

a) $-\frac{3}{4}$

b) $\frac{3}{5}$

c) $\frac{4}{5}$

d) $-\frac{3}{5}$

e) $-\frac{4}{5}$

9. Let W be the wrapping function. For any real number t, the distance between $W(t)$ and $W(t+\pi)$ is:

a) 2

b) 1

c) $\frac{\pi}{2}$

d) 2π

10. If $W(t)=\left(x, \frac{3}{5}\right)$, $x>0$, then $W(\pi+t)$ is equal to

A) $\left(\frac{3}{5},-\frac{4}{5}\right)$

B) $\left(-\frac{4}{5},\frac{3}{5}\right)$

C) $(-1,2)$

D) $\left(-3,\frac{4}{5}\right)$

E) $\left(-\frac{4}{5},-\frac{3}{5}\right)$

11. If $w(t)=\left(-\frac{5}{13},-\frac{12}{13}\right)$ and $\pi<t<\frac{3\pi}{2}$, where $w(t)$ is wrapping function, then the value of $w(\pi-t)$ is

(a) $\left(\frac{5}{13},-\frac{12}{13}\right)$

(b) $\left(-\frac{5}{13},-\frac{12}{13}\right)$

(c) $\left(-\frac{5}{13},\frac{12}{13}\right)$

(d) $\left(\frac{5}{13},\frac{12}{13}\right)$

(e) $\left(-\frac{5}{13},0\right)$

12. Let W be the wrapping function with $W(t) = \left(\frac{3}{5}, -\frac{4}{5}\right)$, then $\sin\left(\frac{3\pi}{2} - t\right) + \tan(7\pi + t) =$

(a) $-\frac{29}{15}$

(b) $\frac{11}{15}$

(c) $-\frac{11}{15}$

(d) $\frac{29}{15}$

(e) $-\frac{8}{15}$

13. If $f(x) = -3\cos x$ and $g(x) = \sin x + \tan x$, then

(a) $f(x)$ is an even function and $g(x)$ is an odd function
(b) both $f(x)$ and $g(x)$ are even functions
(c) $f(x)$ is an odd function and $g(x)$ is an even function
(d) $f(x)$ is an even function and $g(x)$ is neither an odd nor an even function
(e) both $f(x)$ and $g(x)$ are odd functions

14. Which one of the following functions has its graph symmetric with respect to the y-axis?

A) $y = \dfrac{\sin x}{x - \tan x}$

B) $y = \sin x \sec x$

C) $y = \tan x + \sin x$

D) $y = -4\sin x$

E) $y = \sin x + \cos x$

15. Which one of the following is an **odd** function?

(a) $f(x) = \dfrac{3\cos x}{x^2 \tan x + \csc x}$

(b) $f(x) = x^3 + \tan^2 x$

(c) $f(x) = \dfrac{1 + x\cos x}{\sin x + \tan x}$

(d) $f(x) = \dfrac{x^2}{3 + \cos x}$

(e) $f(x) = x^3 \csc x + 1$

16. $\dfrac{\sin x}{1 + \cos x} + \cot x =$

(a) $-\cos x$

(b) $\sin x$

(c) $\csc x$

(d) $\csc x + \cot x$

(e) $\tan x$

17. The expression $(\csc x - \sin x)(\sec x - \cos x)(\tan x + \cot x)$ simplifies to:

(a) 1

(b) -1

(c) $\sin x$

(d) $\cos x$

(e) $\sin x \cos x$

18. $\dfrac{1-\sin t}{\cos t} - \dfrac{1}{\tan t + \sec t}$ simplifies to

A) $\sin^2 t$

B) $\cos^2 t$

C) $\csc t \sec t$

D) $2\csc t$

E) 0

19. The expression $\dfrac{\sin^2 x + \tan^2 x + \cos^2 x}{\csc^2 x - 1}$ is equal to

A) $\tan^2 x \sec^2 x$

B) $\cot^2 x \sec^2 x$

C) $\cot^2 x \csc^2 x$

D) $\tan^2 x \csc^2 x$

E) $\csc^2 x$

20. The expression $\frac{1}{1-\sin x} - \frac{\sin x}{1+\sin x}$ is equal to

A) $2\tan^2 x + 1$

B) $2\tan^2 x - 1$

C) $2\sec^2 + 1$

D) $1 - 2\sec^2 x$

E) $2\csc^2 x - 1$

21. The expression $\frac{\sin x}{1+\cos x} + \frac{1+\cos x}{\sin x}$ can be simplified to

(a) $2\csc x$

(b) $2\cos x$

(c) $\tan x$

(d) $\sin x - \cos x$

(e) $\sin x + \cos x$

22. If $\sec x - \tan x = A$ where $A \neq 0$, then $\sec x + \tan x =$

(a) $\frac{1}{A}$

(b) $-A$

(c) A^2

(d) 0

(e) $-\frac{1}{A}$

23. If $\dfrac{1-\cos 4x}{\sin 4x} = \dfrac{a\tan x}{b+c(\sec^2 x)}$, then $a+b+c$ is equal to

(a) 3

(b) 2

(c) 4

(d) 5

(e) 1

cancelled

24. Which one of the following is a factor of $\csc^2 x + \cot x - 31$?

(a) $\cot x + 6$

(b) $\csc x - 5$

(c) $\cot x + 2$

(d) $\csc x - \cot x$

(e) $\cot x - 15$

25. If $6\tan^2\theta + 5\sec\theta$ is factored as $(a\sec\theta + b)(c\sec\theta + d)$ where a, b, c and d are integers, then $a+b+c+d$ is equal to

(a) 6

(b) 5

(c) 4

(d) 3

(e) 2

26. $\dfrac{\cot^2\theta}{\csc\theta+1}+1$ is equal to

(a) $\dfrac{1}{\sin\theta}$

(b) $\sin^2\theta-\cos\theta$

(c) $\dfrac{1+\sin\theta}{\sin\theta}$

(d) $\dfrac{\cos^2\theta-(1+\sin\theta)}{\sin^3\theta}$

(e) $\dfrac{\cot^2\theta}{\sec\theta}+1$

27. $\dfrac{1}{\sec t-\tan t}-\dfrac{\sin t+1}{\cos t}=$

(a) 0

(b) $\dfrac{2}{\cos t(\sec t-\tan t)}$

(c) $\dfrac{2}{\cos t}$

(d) $\dfrac{-1}{\sec t-\tan t}$

(e) $\cot t$

28. The expression $\dfrac{\sin t}{\cos t + 1} + \dfrac{\cos t + 1}{\sin t}$ simplifies to

(a) $2 \csc t$

(b) $2 \cos t$

(c) $2 \tan t$

(d) $2 \cot t$

(e) $\csc t + \sec t$

29. The expression $\left(\dfrac{1}{1-\cos\theta} + \dfrac{1}{1+\cos\theta}\right) \div \left(\dfrac{1}{1-\sin\theta} + \dfrac{1}{1+\sin\theta}\right)$ simplifies to:

a) $\cot^2\theta$

b) $\tan^2\theta$

c) $\sec^2\theta$

d) $\csc^2\theta$

30. When simplified, the expression $\dfrac{\sin x + \csc x \cos^2 x + 1}{\sec x \csc x - \tan x} =$

(a) $\sec x + \tan x$

(b) $\tan x - \csc x$

(c) $\cos x + 1$

(d) 0

(e) $\sec x + \cot x$

31. The expression $\dfrac{1+\sin\theta}{1-\sin\theta}$ is identical to

(a) $(\sec\theta+\tan\theta)^2$

(b) $(\csc\theta+\cot\theta)^2$

(c) $(\sec\theta+\sin\theta)^2$

(d) $(\cos\theta+\tan\theta)^2$

(e) $(\sec\theta+\csc\theta)^2$

32. $\dfrac{\tan x-\sec x}{\tan x+\sec x}=$

(a) $-\dfrac{(\sin x-1)^2}{\cos^2 x}$

(b) $(\tan x-\sec x)^2$

(c) 1

(d) $\dfrac{(1-\sin x)^2}{\cos x}$

(e) $\sec^2 x-\sec x\tan x+\tan^2 x$

33. The expression $\sec^2 x+\csc^2 x$ is identical to:

a) $\sin^2 x.\cos^2 x$

b) $\sec^2 x.\csc^2 x$

c) $\sec^2 x.\tan^2 x$

d) $\csc^2 x.\cot^2 x$

e) $\sin^2 x.\tan^2 x$

34. The expression $\dfrac{1}{1-\sin x}$ is identical to

(a) $\sec^2 x + \sec x \tan x$

(b) $\csc^2 x + \cot x$

(c) $\sec^2 x - \sec^2 x \tan x$

(d) $\csc^2 x - \csc^2 x \cot x$

(e) $\sec^2 x - \csc^2 x$

35. The expression $\dfrac{1+\cos 2x}{\sin 2x}$ is identical to:

a) $\tan x$

b) $\cot x$

c) $\csc x$

d) $\sec x$

e) $\cos x \sin x$

cancelled

36. When simplified the expression $\dfrac{1}{\cos\theta} - \dfrac{\cos\theta}{1+\sin\theta}$ is identical to

(a) $\tan\theta$
(b) $\sin\theta$
(c) $\cot\theta$
(d) $\sec\theta$
(e) $\csc\theta$

37. The expression $\dfrac{\sin x}{\sec x - 1} + \dfrac{\sin x}{\sec x + 1}$, whenever it is defined, is equal to:

(a) $2\tan x$

(b) $2\tan^3 x$

(c) $\cot x$

(d) $\dfrac{\sin x}{2\sec x}$

(e) $\dfrac{2}{\tan x}$

38. The expression $\dfrac{\tan t}{1+\sec t} + \dfrac{1+\sec t}{\tan t}$ simplifies to

(a) $2\csc t$

(b) $2\sec t$

(c) $2\cot t$

(d) $2\tan t$

(e) $2\sin t$

39. The expression $\dfrac{\sin 2x - \sin x}{2\cos^2 x + \cos x - 1}$ simplifies to

(a) $\tan \dfrac{x}{2}$

(b) $\cot \dfrac{x}{2}$

(c) $\cos \dfrac{x}{2}$

(d) $\sin \dfrac{x}{2}$

(e) $\sec \dfrac{x}{2}$

cancelled

40. The expression $\dfrac{1 - \sin\theta}{1 + \sin\theta}$ is identical to

(a) $(\sec\theta - \tan\theta)^2$

(b) $(\sec\theta + 1)^2$

(c) $(1 + \tan\theta)^2$

(d) $(1 - \sec\theta)^2$

(e) $(\csc\theta + 1)^2$

41. The expression $\dfrac{\tan^2 \alpha}{1 + \sec \alpha}$ is equal to

A) $\dfrac{1 - \sin \alpha}{\cos \alpha}$

B) $\dfrac{1 - \sin \alpha}{\sin \alpha}$

C) $\dfrac{1 - \cos \alpha}{\cos \alpha}$

D) $\dfrac{1 + \cos \alpha}{\cos \alpha}$

E) $\dfrac{1 + \sin \alpha}{\sin \alpha}$

42. The expression $\dfrac{\sin^3 x - \cos^3 x}{\sin x - \cos x}$ simplifies to

(a) $1 + \sin x \cos x$

(b) $1 + 2 \sin x \cos x$

(c) $1 - 2 \sin x \cos x$

(d) $-1 - \sin x \cos x$

(e) $-1 + \sin x \cos x$

43. $\dfrac{\dfrac{1}{\sin x} + \csc x}{\dfrac{1}{\sin x} - \sin x} =$

(a) $2\sec^2 x$

(b) $2\csc^2 x$

(c) $2\cos^2 x$

(d) $2\sin^2 x$

(e) $2\tan^2 x$

44. $\dfrac{\tan x - \cot x}{\tan x + \cot x} =$

A) $2\sec x$

B) $2\csc x$

C) $\csc 2x$

D) $-\cos 2x$

E) $-\sec 2x$