Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use a sum or difference identity to find the exact value.

1) sin 15° 1) _____

A) $\frac{\sqrt{6}-\sqrt{2}}{4}$ B) $\frac{\sqrt{6}+\sqrt{2}}{4}$ C) $\frac{-\sqrt{6}+\sqrt{2}}{4}$ D) $\frac{-\sqrt{6}-\sqrt{2}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

2) tan 75° 2) _____

A) $\sqrt{3}+2$ B) $-\sqrt{3}+2$ C) $-\sqrt{3}-2$ D) $\sqrt{3}-2$

Answer: A
Explanation: A)
B)
C)
D)

3) sin 255° 3) _____

A) $\frac{-\sqrt{6}-\sqrt{2}}{4}$ B) $\frac{-\sqrt{6}+\sqrt{2}}{4}$ C) $\frac{\sqrt{6}+\sqrt{2}}{4}$ D) $\frac{\sqrt{6}-\sqrt{2}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

4) $\sin\frac{11\pi}{12}$ 4) _____

A) $\frac{\sqrt{6}-\sqrt{2}}{4}$ B) $\frac{\sqrt{6}+\sqrt{2}}{4}$ C) $\frac{-\sqrt{6}+\sqrt{2}}{4}$ D) $\frac{-\sqrt{6}-\sqrt{2}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

5) $\tan 105°$ 5) _____

A) $-2 - \sqrt{3}$ B) $2 + \sqrt{3}$ C) $\frac{2 - \sqrt{3}}{4}$ D) $\frac{2 + \sqrt{3}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

6) $\sin(-15°)$ 6) _____

A) $\frac{\sqrt{2} - \sqrt{6}}{4}$ B) $\frac{\sqrt{2} + \sqrt{6}}{4}$ C) $\frac{\sqrt{6} - \sqrt{2}}{4}$ D) $\frac{-\sqrt{2} - \sqrt{6}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

7) $\tan(-15°)$ 7) _____

A) $\sqrt{3} - 2$ B) $-\sqrt{3} + 2$ C) $\frac{\sqrt{3} + 4}{2}$ D) $\frac{\sqrt{3} - 4}{2}$

Answer: A
Explanation: A)
B)
C)
D)

8) $\sin \frac{7\pi}{12}$ 8) _____

A) $\frac{\sqrt{2} + \sqrt{6}}{4}$ B) $\frac{\sqrt{2} - \sqrt{6}}{4}$ C) $\frac{\sqrt{6} - \sqrt{2}}{4}$ D) $\frac{\sqrt{2} + 2\sqrt{6}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

9) $\tan \frac{\pi}{12}$ 9) _____

A) $2 - \sqrt{3}$ B) $2 + \sqrt{3}$ C) $-2 - \sqrt{3}$ D) $-2 + \sqrt{3}$

Answer: A
Explanation: A)
B)
C)
D)

10) tan 345° 10) _____

A) $\sqrt{3} - 2$ B) $\sqrt{3} + 2$ C) $-\sqrt{3} + 2$ D) $-\sqrt{3} - 2$

Answer: A

Explanation: A)
B)
C)
D)

11) sin 10° cos 50° + cos 10° sin 50° 11) _____

A) $\frac{\sqrt{3}}{2}$ B) $\frac{1}{2}$ C) $\frac{1}{6}$ D) $\frac{\sqrt{3}}{3}$

Answer: A

Explanation: A)
B)
C)
D)

12) sin 15° cos 105° + cos 15° sin 105° 12) _____

A) $\frac{\sqrt{3}}{2}$ B) $-\frac{1}{2}$ C) $\frac{1}{4}$ D) $-\frac{\sqrt{3}}{2}$

Answer: A

Explanation: A)
B)
C)
D)

13) sin 110° cos 50° – cos 110° sin 50° 13) _____

A) $\frac{\sqrt{3}}{2}$ B) $\frac{1}{2}$ C) $\frac{11}{6}$ D) $\frac{\sqrt{3}}{3}$

Answer: A

Explanation: A)
B)
C)
D)

14) sin 250° cos 10° – cos 250° sin 10° 14) _____

A) $-\frac{\sqrt{3}}{2}$ B) $-\frac{1}{2}$ C) $-\frac{25}{6}$ D) $\frac{\sqrt{3}}{2}$

Answer: A

Explanation: A)
B)
C)
D)

15) $\sin 205° \cos 85° - \cos 205° \sin 85°$ 15) _____

A) $\frac{\sqrt{3}}{2}$ B) $-\frac{1}{2}$ C) $\frac{41}{12}$ D) $-\frac{\sqrt{3}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

16) $\frac{\tan 20° + \tan 10°}{1 - \tan 20° \tan 10°}$ 16) _____

A) $\frac{\sqrt{3}}{3}$ B) $\sqrt{3}$ C) $\frac{1}{2}$ D) 2

Answer: A
Explanation: A)
B)
C)
D)

17) $\frac{\tan 65° + \tan 85°}{1 - \tan 65° \tan 85°}$ 17) _____

A) $-\frac{\sqrt{3}}{3}$ B) $-\sqrt{3}$ C) $-\frac{1}{2}$ D) –2

Answer: A
Explanation: A)
B)
C)
D)

18) $\frac{\tan 155° - \tan 35°}{1 + \tan 155° \tan 35°}$ 18) _____

A) $-\sqrt{3}$ B) $-\frac{\sqrt{3}}{3}$ C) $-\frac{1}{2}$ D) –2

Answer: A
Explanation: A)
B)
C)
D)

19) $\frac{\tan 100° - \tan (-20)°}{1 + \tan 100° \tan (-20)°}$ 19) _____

A) $-\sqrt{3}$ B) $-\frac{\sqrt{3}}{3}$ C) $-\frac{1}{2}$ D) –2

Answer: A
Explanation: A)
B)
C)
D)

20) $\sin\left(-\frac{5\pi}{12}\right)$ 20) _____

A) $\frac{-\sqrt{6}-\sqrt{2}}{4}$ B) $\frac{\sqrt{6}-\sqrt{2}}{4}$ C) $\frac{-\sqrt{6}+\sqrt{2}}{4}$ D) $\frac{\sqrt{6}+\sqrt{2}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

21) $\sin\frac{7\pi}{12}$ 21) _____

A) $\frac{\sqrt{6}+\sqrt{2}}{4}$ B) $\frac{\sqrt{6}-\sqrt{2}}{4}$ C) $\frac{\sqrt{3}+1}{2}$ D) $\frac{1}{2}$

Answer: A
Explanation: A)
B)
C)
D)

22) $\sin\frac{11\pi}{12}$ 22) _____

A) $\frac{\sqrt{6}-\sqrt{2}}{4}$ B) $\frac{\sqrt{6}+\sqrt{2}}{4}$ C) $\frac{\sqrt{3}+2}{4}$ D) $\frac{\sqrt{3}-2}{4}$

Answer: A
Explanation: A)
B)
C)
D)

23) $\tan\left(-\frac{5\pi}{12}\right)$ 23) _____

A) $-2-\sqrt{3}$ B) $-2+\sqrt{3}$ C) $2-\sqrt{3}$ D) $2+\sqrt{3}$

Answer: A
Explanation: A)
B)
C)
D)

24) $\tan\frac{7\pi}{12}$ 24) _____

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

Answer: A
Explanation: A)
B)
C)
D)

25) $\tan \frac{11\pi}{12}$ 25) _____

A) $-2 + \sqrt{3}$ B) $-2 - \sqrt{3}$ C) $2 - \sqrt{3}$ D) $2 + \sqrt{3}$

Answer: A
Explanation: A)
B)
C)
D)

26) $\sin \frac{\pi}{15} \cos \frac{4\pi}{15} + \cos \frac{\pi}{15} \sin \frac{4\pi}{15}$ 26) _____

A) $\frac{\sqrt{3}}{2}$ B) 1 C) $\frac{1}{2}$ D) $\frac{\sqrt{2}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

27) $\sin \frac{7\pi}{24} \cos \frac{\pi}{8} - \cos \frac{7\pi}{24} \sin \frac{\pi}{8}$ 27) _____

A) $\frac{1}{2}$ B) 1 C) $\frac{\sqrt{3}}{2}$ D) $\frac{\sqrt{2}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

28) $\dfrac{\tan \frac{7\pi}{24} - \tan \frac{\pi}{8}}{1 + \tan \frac{7\pi}{24} \tan \frac{\pi}{8}}$ 28) _____

A) $\frac{\sqrt{3}}{3}$ B) $\frac{1}{2}$ C) $\sqrt{3}$ D) $\frac{\sqrt{3}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

29) $\dfrac{\tan\frac{\pi}{15}+\tan\frac{4\pi}{15}}{1-\tan\frac{\pi}{15}\tan\frac{4\pi}{15}}$ 29) _____

A) $\sqrt{3}$ B) $\frac{1}{2}$ C) $\frac{\sqrt{3}}{3}$ D) $\frac{\sqrt{3}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

Find the exact value of the expression using the provided information.

30) Find sin(s – t) given that cos s = $\frac{1}{3}$, with s in quadrant I, and sin t = – $\frac{1}{2}$, with t in quadrant IV. 30) _____

A) $\frac{2\sqrt{6}+1}{6}$ B) $\frac{2\sqrt{6}-1}{6}$ C) $\frac{\sqrt{3}+2\sqrt{2}}{6}$ D) $\frac{\sqrt{3}-2\sqrt{2}}{6}$

Answer: A
Explanation: A)
B)
C)
D)

31) Find tan(s + t) given that sin s = $\frac{1}{4}$, with s in quadrant II, and sin t = – $\frac{1}{2}$, with t in quadrant IV. 31) _____

A) $\frac{4\sqrt{3}+\sqrt{15}}{-11}$ B) $\frac{4\sqrt{3}-\sqrt{15}}{11}$ C) $\frac{1-3\sqrt{5}}{8}$ D) $\frac{1+3\sqrt{5}}{8}$

Answer: A
Explanation: A)
B)
C)
D)

32) Find sin(s – t) given that cos s = $\frac{1}{3}$, with s in quadrant I, and sin t = $\frac{1}{4}$, with t in quadrant II. 32) _____

A) $\frac{-2\sqrt{30}-1}{12}$ B) $\frac{-30\sqrt{2}-1}{12}$ C) $\frac{-12\sqrt{2}-1}{30}$ D) $\frac{-12\sqrt{30}-1}{2}$

Answer: A
Explanation: A)
B)
C)
D)

33) Find $\tan(s + t)$ given that $\cos s = \frac{1}{3}$, with s in quadrant I, and $\sin t = -\frac{1}{2}$, with t in quadrant IV. 33) _____

A) $\frac{9\sqrt{3} - 8\sqrt{2}}{5}$ B) $\frac{9\sqrt{3} + 8\sqrt{2}}{5}$ C) $\frac{9\sqrt{3} - 8\sqrt{2}}{3}$ D) $\frac{9\sqrt{3} + 8\sqrt{2}}{3}$

Answer: A
Explanation: A)
B)
C)
D)

34) Find $\sin(s - t)$ given that $\sin s = -\frac{1}{2}$, with s in quadrant IV, and $\sin t = \frac{1}{4}$, with t in quadrant II. 34) _____

A) $\frac{\sqrt{15} - \sqrt{3}}{8}$ B) $\frac{-\sqrt{15} + \sqrt{3}}{8}$ C) $\frac{-\sqrt{15} - \sqrt{3}}{8}$ D) $\frac{\sqrt{15} + \sqrt{3}}{8}$

Answer: A
Explanation: A)
B)
C)
D)

35) Find $\sin(s + t)$ given that $\cos s = -\frac{12}{13}$, with s in quadrant II, and $\sin t = \frac{8}{17}$, with t in quadrant II. 35) _____

A) $-\frac{171}{221}$ B) $\frac{21}{221}$ C) $-\frac{21}{221}$ D) $\frac{171}{221}$

Answer: A
Explanation: A)
B)
C)
D)

36) Find $\tan(s + t)$ given that $\cos s = -\frac{12}{13}$, with s in quadrant II, and $\sin t = \frac{15}{17}$, with t in quadrant II. 36) _____

A) $-\frac{220}{21}$ B) $\frac{20}{3}$ C) $-\frac{220}{221}$ D) $-\frac{220}{171}$

Answer: A
Explanation: A)
B)
C)
D)

37) Find $\tan(s - t)$ given that $\cos s = -\frac{5}{13}$, with s in quadrant II, and $\sin t = \frac{8}{17}$, with t in quadrant II. 37) _____

A) $-\frac{140}{171}$ B) $-\frac{220}{171}$ C) $\frac{20}{3}$ D) $-\frac{20}{3}$

Answer: A
Explanation: A)
B)
C)
D)

38) Find $\sin(s + t)$ given that $\cos s = -\frac{1}{6}$, with s in quadrant III, and $\cos t = -\frac{3}{5}$, with t in quadrant III. 38) _____

A) $\frac{3\sqrt{35} + 4}{30}$ B) $\frac{3 + 4\sqrt{35}}{30}$ C) $\frac{3\sqrt{35} - 4}{30}$ D) $\frac{3 - 4\sqrt{35}}{30}$

Answer: A
Explanation: A)
B)
C)
D)

39) Find $\tan(s - t)$ given that $\sin s = -\frac{3\sqrt{13}}{13}$, with s in quadrant IV, and $\sin t = -\frac{\sqrt{10}}{10}$, with t in 39) _____

quadrant IV.

A) $-\frac{7}{9}$ B) $-\frac{11}{9}$ C) $-\frac{11}{3}$ D) $\frac{11}{3}$

Answer: A
Explanation: A)
B)
C)
D)

Using a sum or difference identity, write the following as an expression involving functions of x.

40) $\sin\left(\frac{\pi}{4} - x\right)$ 40) _____

A) $\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x$ B) $\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x$

C) $\sin x$ D) $-\cos x$

Answer: A
Explanation: A)
B)
C)
D)

41) $\sin(x + 45°)$ 41) _____

A) $\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x$ B) $\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x$

C) $\sin x$ D) $-\cos x$

Answer: A
Explanation: A)
B)
C)
D)

42) $\sin(x + 2\pi)$ 42) _____

A) $\sin x$ B) $\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x$

C) $\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x$ D) $-\cos x$

Answer: A
Explanation: A)
B)
C)
D)

43) $\sin\left(x - \frac{\pi}{2}\right)$ 43) _____

A) $-\cos x$ B) $\sin x$

C) $\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x$ D) $\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x$

Answer: A
Explanation: A)
B)
C)
D)

44) $\sin(360° + x)$ 44) _____

A) $\sin x$ B) $\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x$

C) $\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x$ D) $-\cos x$

Answer: A
Explanation: A)
B)
C)
D)

45) $\tan(x + \pi)$ 45) _____

A) $\tan x$ B) $-\tan x$ C) $\frac{1 + \sqrt{3}\tan x}{\sqrt{3} - \tan x}$ D) $\frac{\tan x - \sqrt{3}}{1 + \sqrt{3}\tan x}$

Answer: A
Explanation: A)
B)
C)
D)

46) $\tan(x - 360°)$ 46) _____

A) $\tan x$ B) $-\tan x$ C) $\dfrac{1 + \sqrt{3}\tan x}{\sqrt{3} - \tan x}$ D) $\dfrac{\tan x - \sqrt{3}}{1 + \sqrt{3}\tan x}$

Answer: A
Explanation: A)
B)
C)
D)

47) $\tan\left(x + \dfrac{\pi}{6}\right)$ 47) _____

A) $\dfrac{1 + \sqrt{3}\tan x}{\sqrt{3} - \tan x}$ B) $\tan x$ C) $-\tan x$ D) $\dfrac{\tan x - \sqrt{3}}{1 + \sqrt{3}\tan x}$

Answer: A
Explanation: A)
B)
C)
D)

48) $\tan\left(x - \dfrac{\pi}{3}\right)$ 48) _____

A) $\dfrac{\tan x - \sqrt{3}}{1 + \sqrt{3}\tan x}$ B) $\tan x$ C) $-\tan x$ D) $\dfrac{1 + \sqrt{3}\tan x}{\sqrt{3} - \tan x}$

Answer: A
Explanation: A)
B)
C)
D)

49) $\tan(30° + x)$ 49) _____

A) $\dfrac{1 + \sqrt{3}\tan x}{\sqrt{3} - \tan x}$ B) $\tan x$ C) $-\tan x$ D) $\dfrac{\tan x - \sqrt{3}}{1 + \sqrt{3}\tan x}$

Answer: A
Explanation: A)
B)
C)
D)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Verify that the equation is an identity.

50) $\sin\left(x + \dfrac{\pi}{2}\right) = \cos x$ 50) _____

Answer: $\sin\left(x + \dfrac{\pi}{2}\right) = \sin x \cos\dfrac{\pi}{2} + \sin\dfrac{\pi}{2}\cos x = (\sin x)(0) + (1)(\cos x) = \cos x.$

Explanation:

51) $\tan\left(\frac{\pi}{2} + x\right) = -\cot x$ 51) _____

Answer: $\tan\left(\frac{\pi}{2} + x\right) = \frac{\sin((\pi/2) + x)}{\cos((\pi/2) + x)} = \frac{\sin(\pi/2)\cos x + \sin x \cos(\pi/2)}{\cos(\pi/2)\cos x - \sin(\pi/2)\sin x} = \frac{1 \cdot \cos x + \sin x \cdot 0}{0 \cdot \cos x - 1 \cdot \sin x}$
$= -\cot x.$

Explanation:

52) $\tan\left(x - \frac{\pi}{4}\right) = \frac{\tan x - 1}{1 + \tan x}$ 52) _____

Answer: $\tan\left(x - \frac{\pi}{4}\right) = \frac{\tan x - \tan \pi/4}{1 + (\tan x)(\tan \pi/4)} = \frac{\tan x - 1}{1 + \tan x}.$

Explanation:

53) $\sin\left(\frac{3\pi}{2} - \theta\right) = -\cos \theta$ 53) _____

Answer: $\sin\left(\frac{3\pi}{2} - \theta\right) = \sin\frac{3\pi}{2}\cos\theta - \cos\frac{3\pi}{2}\sin\theta = (-1) \cdot \cos\theta - 0 \cdot \sin\theta = -\cos\theta$

Explanation:

54) $\frac{\sin(\alpha - \beta)}{\sin\alpha \sin\beta} = \cot\beta - \cot\alpha$ 54) _____

Answer: $\frac{\sin(\alpha - \beta)}{\sin\alpha\sin\beta} = \frac{\sin\alpha\cos\beta - \cos\alpha\sin\beta}{\sin\alpha\sin\beta} = \frac{\sin\alpha\cos\beta}{\sin\alpha\sin\beta} - \frac{\cos\alpha\sin\beta}{\sin\alpha\sin\beta} = \frac{\cos\beta}{\sin\beta} - \frac{\cos\alpha}{\sin\alpha}$
$= \cot\beta - \cot\alpha$

Explanation:

55) $\sin(x + y) - \sin(x - y) = 2\cos x \sin y$ 55) _____

Answer: $\sin(x + y) - \sin(x - y) = \sin x\cos y + \cos x \sin y - \sin x \cos y + \cos x \sin y = 2\cos x \sin y.$

Explanation:

56) $\cot(x + y)\cot(x - y) = \frac{1 - \tan^2 x \tan^2 y}{\tan^2 x - \tan^2 y}$ 56) _____

Answer: $\cot(x + y)\cot(x - y) = \frac{1 - \tan x \tan y}{\tan x + \tan y} \cdot \frac{1 + \tan x \tan y}{\tan x - \tan y} = \frac{1 - \tan^2 x \tan^2 y}{\tan^2 x - \tan^2 y}.$

Explanation:

57) $\sin(\alpha - \beta)\cos(\alpha + \beta) = \sin\alpha\cos\alpha - \sin\beta\cos\beta$ 57) _____

Answer: $\sin(\alpha - \beta)\cos(\alpha + \beta) = (\sin\alpha\cos\beta - \cos\alpha\sin\beta)(\cos\alpha\cos\beta - \sin\alpha\sin\beta)$
$= \sin\alpha\cos\alpha\cos^2\beta - \sin^2\alpha\cos\beta\sin\beta - \cos^2\alpha\sin\beta\cos\beta + \cos\alpha\sin\alpha\sin^2\beta$
$= \sin\alpha\cos\alpha(\cos^2\beta + \sin^2\beta) - \sin\beta\cos\beta(\sin^2\beta + \cos^2\beta) = \sin\alpha\cos\alpha - \sin\beta\cos\beta$

Explanation:

58) $\csc(s + t) = \dfrac{\csc s \csc t}{\cot t + \cot s}$ 58) _____

Answer: $\csc(s + t) = \dfrac{1}{\sin(s + t)} = \dfrac{1}{\sin s \cos t + \cos s \sin t} = \dfrac{\dfrac{1}{\sin s \sin t}}{\dfrac{\sin s \cos t + \cos s \sin t}{\sin s \sin t}}$

$= \dfrac{\dfrac{1}{\sin s} \cdot \dfrac{1}{\sin t}}{\dfrac{\sin s \cos t}{\sin s \sin t} + \dfrac{\cos s \sin t}{\sin s \sin t}} = \dfrac{\csc s \csc t}{\cot v + \cot s}$

Explanation:

59) $\cot(\pi - \theta) = -\cot \theta$ 59) _____

Answer: $\cot(\pi - \theta) = \dfrac{\cos(\pi - \theta)}{\sin(\pi - \theta)} = \dfrac{\cos \pi \cos \theta + \sin \pi \sin \theta}{\sin \pi \cos \theta - \cos \pi \sin \theta} = \dfrac{(-1) \cdot \cos \theta + 0 \cdot \sin \theta}{0 \cdot \cos \theta - (-1) \cdot \sin \theta} =$

$\dfrac{-\cos \theta}{\sin \theta} = -\cot \theta$

Explanation:

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

60) When a person bends at the waist with a straight back, the force, F, exerted by the person's lower back muscles can be estimated with the formula $F = 2.89w \sin(\theta + 90°)$, where w is the person's weight, and θ is the angle made by the person's torso relative to the horizontal. Suppose that a 180–pound person bends at an angle of 20°. Determine the force exerted by the person's back muscles, and estimate the angle that requires the back muscles to exert a force of 338 pounds. Round the force to the nearest pound, and the angle to the nearest tenth, if necessary. 60) _____

A) 489 pounds; 49.5° B) 178 pounds; 45.6°
C) 489 pounds; 20° D) 19 pounds; 49.5°

Answer: A
Explanation: A)
B)
C)
D)

61) Two voltages, $V_1 = 90 \sin(120\pi t)$ and $V_2 = 120 \cos(120\pi t)$, are added in a circuit to produce the sum $V = V_1 + V_2$. Graph V in [–0.02, 0.02, 0.002] by [–250, 250, 20] and use the graph to estimate values for a and k so that $V = a \sin(120\pi t + k)$. Round k to the nearest ten–thousandth, if necessary. 61) _____

A) a = 150; k = 0.9273 B) a = 150; k = 242.594
C) a = 15; k = 0.9273 D) a = 150; k = 349.5818

Answer: A
Explanation: A)
B)
C)
D)

62) Two sound waves, producing the pressures $P_1 = 15 \sin(360\pi t)$ and $P_2 = 8 \cos(360\pi t)$, combine on a person's ear drum to produce the pressure $P = P_1 + P_2$. Graph P in [–0.01, 0.01, 0.001] by [–20, 20, 2] and use the graph to estimate values for a and k so that $P = a \sin(360\pi t + k)$. Round k to the nearest ten–thousandth, if necessary. 62) _____

A) a = 17; k = 0.49
B) a = 4.1; k = 1.0808
C) a = 4.1; k = 554.1282
D) a = 17; k = 554.1282

Answer: A
Explanation: A)
B)
C)
D)

63) Two low–frequency sound waves with similar frequencies, producing the pressures $P_1 = 0.003 \sin(16\pi t)$ and $P_2 = 0.002 \sin(22\pi t)$, combine to form a pressure $P = P_1 + P_2$. The variable t is time measured in seconds. Graph P in [0, 1.2, .05] by [–0.01, 0.01, 0.001] and use the graph to determine the frequency of the displayed beats. 63) _____

A) 3 beats per second
B) 6 beats per second
C) 8 beats per second
D) 11 beats per second

Answer: A
Explanation: A)
B)
C)
D)

Use an identity to write the expression as a single trigonometric function or as a single number.

64) $2 \cos^2 22.5° - 1$ 64) _____

A) $\frac{\sqrt{2}}{2}$ B) $\frac{\sqrt{2}}{4}$ C) $\sqrt{3}$ D) $\frac{\sqrt{3}}{3}$

Answer: A
Explanation: A)
B)
C)
D)

65) $\sin 22.5° \cos 22.5°$ 65) _____

A) $\frac{\sqrt{2}}{4}$ B) $\frac{\sqrt{2}}{2}$ C) $\sqrt{3}$ D) $\frac{\sqrt{3}}{3}$

Answer: A
Explanation: A)
B)
C)
D)

66) $\frac{2 \tan 30°}{1 - \tan^2 30°}$ 66) _____

A) $\sqrt{3}$ B) $\frac{\sqrt{2}}{4}$ C) $\frac{\sqrt{2}}{2}$ D) $\frac{\sqrt{3}}{3}$

Answer: A
Explanation: A)
B)
C)
D)

67) $\frac{2 \tan 15°}{1 - \tan^2 15°}$ 67) _____

A) $\frac{\sqrt{3}}{3}$ B) $\sqrt{3}$ C) $\frac{\sqrt{2}}{4}$ D) $\frac{\sqrt{2}}{2}$

Answer: A
Explanation: A)
B)
C)
D)

68) $2 \cos^2 75° - 1$ 68) _____

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

Answer: A
Explanation: A)
B)
C)
D)

69) $\sin 8x \cos 8x$ 69) _____

A) $\frac{1}{2} \sin 16x$ B) $2 \sin 4x$ C) $\cos 8x$ D) $\cos 4x$

Answer: A
Explanation: A)
B)
C)
D)

70) $\cos^2 4x - \sin^2 4x$ 70) _____

A) $\cos 8x$ B) $\frac{1}{2} \sin 16x$ C) $2 \sin 4x$ D) $\cos 4x$

Answer: A
Explanation: A)
B)
C)
D)

71) $4 \sin 2x \cos 2x$ 71) _____

A) $2 \sin 4x$ B) $\cos 8x$ C) $\frac{1}{2} \sin 16x$ D) $\cos 4x$

Answer: A
Explanation: A)
B)
C)
D)

72) $1 - 2 \sin^2 2x$ 72) _____

A) $\cos 4x$ B) $2 \sin 4x$ C) $\cos 8x$ D) $\frac{1}{2} \sin 16x$

Answer: A
Explanation: A)
B)
C)
D)

73) $2 \cos^2 4x - 1$ 73) _____

A) $\cos 8x$ B) $\frac{1}{2} \sin 16x$ C) $2 \sin 4x$ D) $\cos 4x$

Answer: A
Explanation: A)
B)
C)
D)

Use identities to find the indicated value for each angle measure.

74) $\sin \theta = \frac{24}{25}, \quad \cos \theta > 0$ Find $\cos(2\theta)$. 74) _____

A) $-\frac{527}{625}$ B) $\frac{527}{625}$ C) $\frac{336}{625}$ D) $-\frac{526}{625}$

Answer: A
Explanation: A)
B)
C)
D)

75) $\cos \theta = \frac{5}{13}, \quad \sin \theta < 0$ Find $\sin(2\theta)$. 75) _____

A) $-\frac{120}{169}$ B) $\frac{119}{169}$ C) $-\frac{119}{169}$ D) $\frac{120}{169}$

Answer: A
Explanation: A)
B)
C)
D)

76) $\tan\theta = \frac{21}{20}, \quad \pi < \theta < \frac{3\pi}{2}$ Find $\sin(2\theta)$. 76) _____

A) $\frac{840}{841}$ B) $\frac{41}{841}$ C) $-\frac{41}{841}$ D) $-\frac{840}{841}$

Answer: A
Explanation: A)
B)
C)
D)

77) $\sin\theta = -\frac{4}{5}, \quad \frac{3\pi}{2} < \theta < 2\pi$ Find $\cos(2\theta)$. 77) _____

A) $\frac{7}{25}$ B) $-\frac{7}{25}$ C) $\frac{24}{25}$ D) $-\frac{24}{25}$

Answer: B
Explanation: A)
B)
C)
D)

78) $\tan\theta = \frac{7}{24}, \quad \sin\theta < 0$ Find $\cos(2\theta)$. 78) _____

A) $\frac{527}{625}$ B) $\frac{336}{625}$ C) $-\frac{336}{625}$ D) $-\frac{527}{625}$

Answer: A
Explanation: A)
B)
C)
D)

79) $\cos\theta = -\frac{5}{13}, \quad \frac{\pi}{2} < \theta < \pi$ Find $\cos(2\theta)$. 79) _____

A) $-\frac{119}{169}$ B) $-\frac{120}{169}$ C) $\frac{120}{169}$ D) $\frac{119}{169}$

Answer: A
Explanation: A)
B)
C)
D)

80) $\sin\theta = \frac{2\sqrt{2}}{3}, \quad \tan\theta < 0$ Find $\sin(2\theta)$. 80) _____

A) $\frac{-4\sqrt{2}}{9}$ B) $-\frac{7}{9}$ C) $\frac{7}{9}$ D) $\frac{4\sqrt{2}}{9}$

Answer: A
Explanation: A)
B)
C)
D)

81) $\cos 2\theta = \frac{2}{3}$ and θ terminates in quadrant I Find $\sin \theta$. 81) _____

A) $\sin \theta = \frac{\sqrt{6}}{6}$ B) $\sin \theta = -\frac{\sqrt{6}}{6}$ C) $\sin \theta = 0$ D) $\sin \theta = \sqrt{6}$

Answer: A
Explanation: A)
B)
C)
D)

82) $\cos 2\theta = \frac{1}{4}$ and θ terminates in quadrant III Find $\cos \theta$. 82) _____

A) $\cos \theta = -\frac{\sqrt{101}}{4}$ B) $\cos \theta = \frac{\sqrt{101}}{4}$ C) $\cos \theta = -\frac{2\sqrt{10}}{5}$ D) $\cos \theta = 0$

Answer: A
Explanation: A)
B)
C)
D)

83) $\cos 2\theta = -\frac{3}{8}$ and $\frac{\pi}{2} < \theta < \pi$ Find $\sin \theta$. 83) _____

A) $\sin \theta = \frac{\sqrt{11}}{4}$ B) $\sin \theta = 0$ C) $\sin \theta = \frac{4\sqrt{11}}{11}$ D) $\sin \theta = -\frac{\sqrt{11}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

Express the function as a trigonometric function of x.

84) $\cos 4x$ 84) _____

A) $\cos^4 x - 6 \sin^2 x \cos^2 x + \sin^4 x$ B) $3 \sin x - 4 \sin^3 x$
C) $\cos^3 x - 3 \sin^2 x \cos x$ D) $4 \sin x \cos^3 x - 4 \sin^3 x \cos x$

Answer: A
Explanation: A)
B)
C)
D)

85) $\sin 4x$ 85) _____

A) $4 \sin x \cos^3 x - 4 \sin^3 x \cos x$ B) $3 \sin x - 4 \sin^3 x$
C) $1 - 8 \sin^2 x \cos^2 x$ D) $\cos^3 x - 3 \sin^2 x \cos x$

Answer: A
Explanation: A)
B)
C)
D)

86) $\sin 3x$ 86) _____

A) $3 \sin x - 4 \sin^3 x$ B) $4 \sin x \cos^3 x - 4 \sin^3 x \cos x$

C) $1 - 8 \sin^2 x \cos^2 x$ D) $\cos^3 x - 3 \sin^2 x \cos x$

Answer: A

Explanation: A)
B)
C)
D)

87) $\tan 4x$ 87) _____

A) $\dfrac{4 \tan x - 4 \tan^3 x}{1 + \tan^4 x - 6 \tan^2 x}$ B) $\dfrac{4 \tan x - 3 \tan^3 x}{1 + \tan^4 x - 6 \tan^2 x}$

C) $\dfrac{4 \tan x - 3 \tan^4 x}{1 + \tan^3 x - 6 \tan^2 x}$ D) $\dfrac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}$

Answer: A

Explanation: A)
B)
C)
D)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Verify that each equation is an identity.

88) $\sec(2\theta) = \dfrac{\csc^2\theta}{\csc^2\theta - 2}$ 88) _____

Answer: $\sec(2\theta) = \dfrac{1}{\cos(2\theta)} = \dfrac{1}{1 - 2\sin^2\theta} = \dfrac{\frac{1}{\sin^2\theta}}{\frac{1}{\sin^2\theta} - 2} = \dfrac{\csc^2\theta}{\csc^2\theta - 2}$

Explanation:

89) $\cot(2\theta) = \dfrac{\csc^2\theta - 2}{2 \cot\theta}$ 89) _____

Answer: $\cot(2\theta) = \dfrac{\cos(2\theta)}{\sin(2\theta)} = \dfrac{1 - 2\sin^2\theta}{2 \sin\theta \cos\theta} = \dfrac{\frac{1}{\sin^2\theta} - 2}{\frac{2\cos\theta}{\sin\theta}} = \dfrac{\csc^2\theta - 2}{2\cot\theta}$

Explanation:

90) $\cos^4 x = \dfrac{1}{8}(3 + 4\cos(2x) + \cos(4x))$ 90) _____

Answer: $\cos^4 x = \cos^2 x \cos^2 x = \left(\dfrac{1 + \cos(2x)}{2}\right)^2 = \dfrac{1}{4}(1 + \cos(2x))^2 = \dfrac{1}{4}(1 + 2\cos(2x) + \cos^2(2x))$

$= \dfrac{1}{4}\left(1 + 2\cos(2x) + \dfrac{1 + \cos(4x)}{2}\right) = \dfrac{1}{8}(3 + 4\cos(2x) + \cos(4x))$.

Explanation:

91) $\cos(3x) = \cos^3 x - 3 \sin^2 x \cos x$ 91) _____

Answer: $\cos(3x) = \cos(2x + x) = \cos(2x) \cos x - \sin(2x) \sin x = (\cos^2 x - \sin^2 x) \cos x - 2 \sin x \cos x \sin x = \cos^3 x - \sin^2 x \cos x - 2 \sin^2 x \cos x = \cos^3 x - 3 \sin^2 x \cos x.$

Explanation:

92) $\sin(4u) = 2 \sin(2u) \cos(2u)$ 92) _____

Answer: $\sin(4u) = \sin [2(2u)] = 2 \sin(2u) \cos(2u).$

Explanation:

93) $\cos(4u) = 2 \cos^2(2u) - 1$ 93) _____

Answer: $\cos(4u) = \cos[2(2u)] = 2 \cos^2(2u) - 1$

Explanation:

94) $\sin(4x) = (4 \sin x \cos x)(2 \cos^2 x - 1)$ 94) _____

Answer: $\sin(4x) = 2 \sin(2x) \cos(2x) = (4 \sin x \cos x)(2 \cos^2 x - 1).$

Explanation:

95) $\sin^3(3x) = \frac{1}{2}(\sin(3x))(1 - \cos(6x))$ 95) _____

Answer: $\sin^3(3x) = (\sin^2(3x))(\sin(3x)) = \left(\frac{1 - \cos(6x)}{2}\right)(\sin(3x)) = \frac{1}{2}(\sin(3x))(1 - \cos(6x)).$

Explanation:

96) $\cos(4\theta) = \cos^4 \theta - 6 \sin^2 \theta \cos^2 \theta + \sin^4 \theta$ 96) _____

Answer: $\cos(4\theta) = \cos[2(2\theta)] = \cos^2(2\theta) - \sin^2(2\theta) = (\cos^2 \theta - \sin^2 \theta)^2 - (2 \sin \theta \cos \theta)^2 = \cos^4 \theta - 2 \sin^2 \theta \cos^2 \theta + \sin^4 \theta - 4 \sin^2 \theta \cos^2 \theta = \cos^4 \theta - 6 \sin^2 \theta \cos^2 \theta + \sin^4 \theta$

Explanation:

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Write the product as a sum or difference of trigonometric functions.

97) $\cos 35° \sin 21°$ 97) _____

A) $\frac{1}{2}(\sin 56° - \sin 14°)$

B) $\frac{1}{2}(\sin 56° + \sin 14°)$

C) $\frac{1}{2}(\cos 56° - \cos 14°)$

D) $\frac{1}{2}(\cos 56° + \cos 14°)$

Answer: A

Explanation: A)
B)
C)
D)

98) 2 cos 6x cos 2x 98) _____

A) cos 8x + cos 4x B) sin 8x + sin 4x

C) cos 4x – cos 8x D) $\frac{1}{2}$(cos 8x + cos 4x)

Answer: A
Explanation: A)
B)
C)
D)

99) 2 sin 5x sin 13x 99) _____

A) cos 8x – cos 18x B) cos 18x + cos 8x

C) sin 18x + sin 8x D) $\frac{1}{2}$(cos 18x + cos 8x)

Answer: A
Explanation: A)
B)
C)
D)

100) 6 sin 41° cos 105° 100) _____

A) 3[sin 146° + sin(–64°)] B) 3[sin 146° – sin(–64°)]
C) 6[cos 146° + cos(–64°)] D) 3[cos 146° + cos(–64°)]

Answer: A
Explanation: A)
B)
C)
D)

101) –10 cos(–θ) sin(–6θ) 101) _____

A) 5(sin 7θ + sin 5θ) B) 5(sin 7θ – sin 5θ)
C) –10(cos 7θ + cos 5θ) D) –5(cos 7θ – cos 5θ)

Answer: A
Explanation: A)
B)
C)
D)

102) 8 cos 26° cos 13° 102) _____

A) 4(cos 39° + cos 13°) B) 4(cos 39° – cos 13°)
C) 8(sin 39° + sin 13°) D) 4(sin 39° – sin 13°)

Answer: A
Explanation: A)
B)
C)
D)

Rewrite the following as a product of trigonometric functions.

103) $\sin 19° + \sin 35°$ 103) _____

A) $2 \sin 27° \cos(-8°)$ B) $2 \cos 27° \sin(-8°)$

C) $2 \sin 27° \sin(-8°)$ D) $2 \cos 27° \cos(-8°)$

Answer: A

Explanation: A)
B)
C)
D)

104) $\sin 14° - \sin 31°$ 104) _____

A) $2 \cos 22.5° \sin(-8.5°)$ B) $2 \sin 22.5° \cos(-8.5°)$

C) $2 \sin 22.5° \sin(-8.5°)$ D) $2 \cos 22.5° \cos(-8.5°)$

Answer: A

Explanation: A)
B)
C)
D)

105) $\cos 20° - \cos 44°$ 105) _____

A) $-2 \sin 32° \sin(-12°)$ B) $-2 \cos 32° \sin(-12°)$

C) $-2 \sin 32° \cos(-12°)$ D) $-2 \cos 32° \cos(-12°)$

Answer: A

Explanation: A)
B)
C)
D)

106) $\sin \frac{\pi}{11} + \sin \frac{\pi}{4}$ 106) _____

A) $2 \sin \frac{15\pi}{88} \cos \frac{7\pi}{88}$ B) $2 \sin \frac{15\pi}{88} \sin \frac{7\pi}{88}$

C) $2 \cos \frac{15\pi}{88} \cos \frac{7\pi}{88}$ D) $2 \cos \frac{15\pi}{88} \sin \frac{7\pi}{88}$

Answer: A

Explanation: A)
B)
C)
D)

107) $\cos\frac{\pi}{13} - \cos\frac{\pi}{2}$ 107) _____

A) $-2\sin\frac{15\pi}{52}\sin\left(\frac{-11\pi}{52}\right)$ B) $-2\cos\frac{15\pi}{52}\sin\left(\frac{-11\pi}{52}\right)$

C) $-2\sin\frac{15\pi}{52}\cos\left(\frac{-11\pi}{52}\right)$ D) $-2\cos\frac{15\pi}{52}\cos\left(\frac{-11\pi}{52}\right)$

Answer: A

Explanation: A)
B)
C)
D)

108) $\sin 9 + \sin 44$ 108) _____

A) $2\sin 26.5\cos(-17.5)$ B) $2\sin 26.5\sin(-17.5)$

C) $2\cos 26.5\sin(-17.5)$ D) $2\cos 26.5\cos(-17.5)$

Answer: A

Explanation: A)
B)
C)
D)

Solve the problem.

109) Suppose that for an electrical appliance, voltage is given by $V = 189\sin 120\pi t$ and amperage by $I = 1.07\sin 120\pi t$, where t is time in seconds. Use identities to write the wattage $W = VI$ in the form $W = a\cos\omega t + c$. 109) _____

A) $W = -101.115\cos 240\pi t + 101.115$ B) $W = -202.23\cos 240\pi t + 202.23$

C) $W = -101.115\cos 120\pi t + 101.115$ D) $W = 101.115\cos 240\pi t - 101.115$

Answer: A

Explanation: A)
B)
C)
D)

110) Suppose that for an electrical appliance, voltage is given by $V = 189\sin 120\pi t$ and amperage by $I = 1.07\sin 120\pi t$, where t is time in seconds. The wattage is given by $W = VI$. Find the maximum wattage used by the appliance. 110) _____

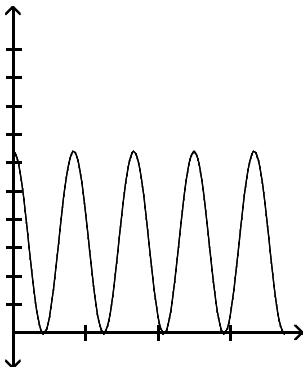
A) 202.23 B) 101.115 C) 189 D) 404.46

Answer: A

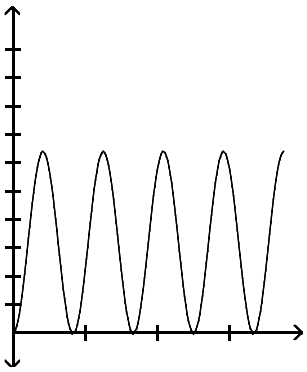
Explanation: A)
B)
C)
D)

111) Suppose that a hair dryer operates on a voltage that can be represented by the relation $V(t) = 160 \cos(120\pi t)$ and that it draws a current represented by the relation $I(t) = 8 \cos(120\pi t)$, where t is time measured in seconds. The power consumed by the appliance is $P = VI$. Graph the power in [0, 0.04, 0.01] by [−200, 2000, 200] and use an identity to write the expression for the power in the form $P = a \cos(k\pi t) + d$, where a, k, and d are constants. 111) _____

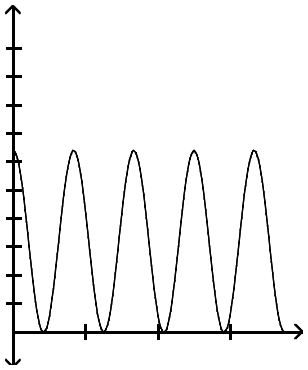
A) $P = 640 \cos(240\pi t) + 640$
[0, 0.04, 0.01] by [−200, 2000, 200]



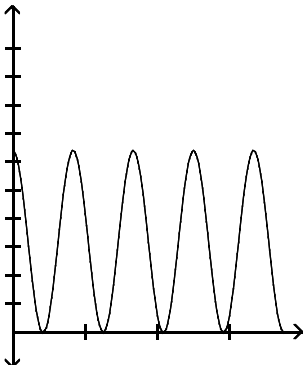
B) $P = -640 \cos(240\pi t) + 640$
[0, 0.04, 0.01] by [−200, 2000, 200]



C) $P = 1280 \cos(240\pi t) + 1280$
[0, 0.04, 0.01] by [−200, 2000, 200]



D) $P = 640 \cos(120\pi t) + 640$
[0, 0.04, 0.01] by [−200, 2000, 200]

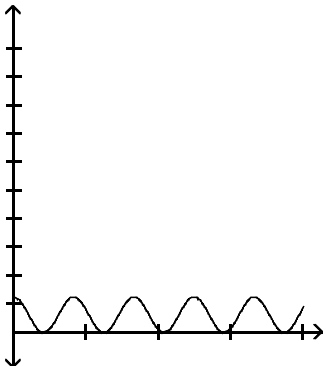


Answer: A

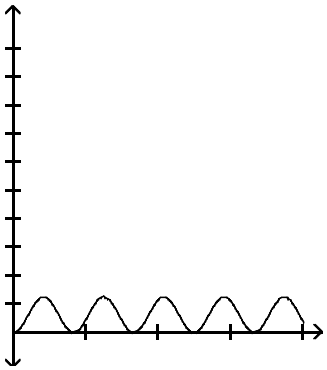
Explanation: A)
B)
C)
D)

112) Suppose that a household appliance draws a current represented by the relation $I(t) = 5\cos(120\pi t)$, where t is time measured in seconds. The power consumed by the appliance is $P = I^2R$, where R is a constant. Take R to be 10 and graph the power in [0, 0.04, 0.01] by [–200, 2000, 200] and use an identity to write the expression for the power in the form $P = a\cos(k\pi t) + d$, where a, k, and d are constants. 112) _____

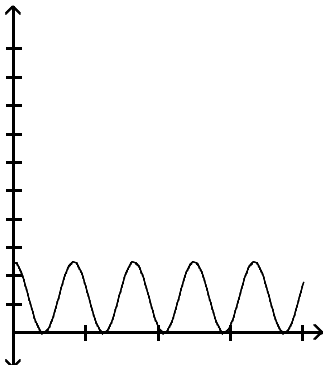
A) $P = 125\cos(240\pi t) + 125$
[0, 0.04, 0.01] by [–200, 2000, 200]



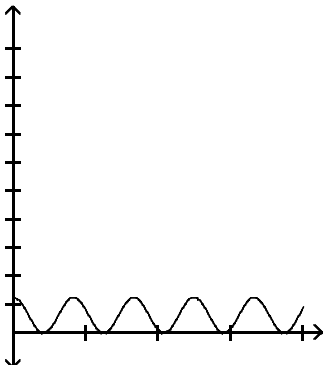
B) $P = -125\cos(240\pi t) + 125$
[0, 0.04, 0.01] by [–200, 2000, 200]



C) $P = 250\cos(240\pi t) + 250$
[0, 0.04, 0.01] by [–200, 2000, 200]



D) $P = 125\cos(120\pi t) + 125$
[0, 0.04, 0.01] by [–200, 2000, 200]



Answer: A
Explanation: A)
B)
C)
D)

Find the exact value by using a half–angle identity.

113) sin 22.5° 113) _____

A) $\frac{1}{2}\sqrt{2-\sqrt{2}}$ B) $\frac{1}{2}\sqrt{2+\sqrt{2}}$ C) $-\frac{1}{2}\sqrt{2-\sqrt{2}}$ D) $-\frac{1}{2}\sqrt{2+\sqrt{2}}$

Answer: A
Explanation: A)
B)
C)
D)

114) cos 22.5° 114) _____

A) $\frac{1}{2}\sqrt{2+\sqrt{2}}$ B) $\frac{1}{2}\sqrt{2-\sqrt{2}}$ C) $-\frac{1}{2}\sqrt{2-\sqrt{2}}$ D) $-\frac{1}{2}\sqrt{2+\sqrt{2}}$

Answer: A
Explanation: A)
B)
C)
D)

115) sin 75° 115) _____

A) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ B) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ C) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

116) cos 75° 116) _____

A) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ B) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ C) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

117) tan 75° 117) _____

A) $2+\sqrt{3}$ B) $2-\sqrt{3}$ C) $-2-\sqrt{3}$ D) $-2+\sqrt{3}$

Answer: A
Explanation: A)
B)
C)
D)

118) $\sin\frac{5\pi}{12}$ 118) _____

A) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ B) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ C) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

119) $\cos\frac{5\pi}{12}$ 119) _____

A) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ B) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ C) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

120) sin 165° 120) _____

A) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ B) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ C) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

121) cos 165° 121) _____

A) $-\frac{1}{2}\sqrt{2+\sqrt{3}}$ B) $\frac{1}{2}\sqrt{2-\sqrt{3}}$ C) $\frac{1}{2}\sqrt{2+\sqrt{3}}$ D) $-\frac{1}{2}\sqrt{2-\sqrt{3}}$

Answer: A
Explanation: A)
B)
C)
D)

122) tan 165° 122) _____

A) $-2+\sqrt{3}$ B) $2+\sqrt{3}$ C) $2-\sqrt{3}$ D) $-2-\sqrt{3}$

Answer: A
Explanation: A)
B)
C)
D)

Determine all solutions of the equation in radians.

123) Find $\cos\frac{x}{2}$, given that $\cos x = \frac{1}{4}$ and x terminates in $0 < x < \frac{\pi}{2}$. 123) _____

A) $\frac{\sqrt{10}}{4}$ B) $\frac{\sqrt{6}}{4}$ C) $\frac{\sqrt{8-2\sqrt{15}}}{4}$ D) $\frac{\sqrt{8+2\sqrt{15}}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

124) Find $\sin\frac{x}{2}$, given that $\sin x = \frac{1}{4}$ and x terminates in $0 < x < \frac{\pi}{2}$. 124) _____

A) $\frac{\sqrt{8-2\sqrt{15}}}{4}$ B) $\frac{\sqrt{10}}{4}$ C) $\frac{\sqrt{6}}{4}$ D) $\frac{\sqrt{8+2\sqrt{15}}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

125) Find $\cos\frac{\theta}{2}$, given that $\sin\theta = \frac{1}{4}$ and θ terminates in $0 < \theta < 90°$. 125) _____

A) $\frac{\sqrt{8+2\sqrt{15}}}{4}$ B) $\frac{\sqrt{10}}{4}$ C) $\frac{\sqrt{6}}{4}$ D) $\frac{\sqrt{8-2\sqrt{15}}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

126) Find $\sin\frac{\theta}{2}$, given that $\cos\theta = \frac{1}{4}$ and θ terminates in $0 < \theta < 90°$. 126) _____

A) $\frac{\sqrt{6}}{4}$ B) $\frac{\sqrt{8+2\sqrt{15}}}{4}$ C) $\frac{\sqrt{10}}{4}$ D) $\frac{\sqrt{8-2\sqrt{15}}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

127) Find $\cos\frac{x}{2}$, given that $\sec x = 4$ and x terminates in $0 < x < \frac{\pi}{2}$. 127) _____

A) $\frac{\sqrt{10}}{4}$ B) $\frac{\sqrt{6}}{4}$ C) $\frac{\sqrt{8-2\sqrt{15}}}{4}$ D) $\frac{\sqrt{8+2\sqrt{15}}}{4}$

Answer: A
Explanation: A)
B)
C)
D)

128) Find $\cos\frac{\theta}{2}$, given that $\cos\theta = -\frac{3}{5}$ and θ terminates in $90° < \theta < 180°$. 128) _____

A) $\frac{\sqrt{5}}{5}$ B) $-\frac{\sqrt{5}}{5}$ C) $-\frac{\sqrt{30}}{10}$ D) $\frac{\sqrt{30}}{10}$

Answer: A
Explanation: A)
B)
C)
D)

129) Find $\sin\frac{\theta}{2}$, given that $\sin\theta = -\frac{3}{5}$ and θ terminates in $270° < \theta < 360°$. 129) _____

A) $\frac{\sqrt{10}}{10}$ B) $\frac{\sqrt{5}}{5}$ C) $-\frac{\sqrt{5}}{5}$ D) $-\frac{\sqrt{30}}{10}$

Answer: A
Explanation: A)
B)
C)
D)

130) Find $\tan\frac{x}{2}$, given that $\tan x = 3$ and x terminates in $\pi < x < \frac{3\pi}{2}$. 130) _____

A) $\frac{\sqrt{10}+1}{-3}$ B) $\frac{\sqrt{10}+1}{3}$ C) $\frac{\sqrt{10}-1}{-3}$ D) $\frac{\sqrt{10}-1}{3}$

Answer: A
Explanation: A)
B)
C)
D)

131) Find $\tan\frac{x}{2}$, given that $\tan x = -3$ and x terminates in $90° < x < 180°$. 131) _____

A) $\frac{\sqrt{10}+1}{3}$ B) $\frac{\sqrt{10}+1}{-3}$ C) $\frac{\sqrt{10}-1}{-3}$ D) $\frac{\sqrt{10}-1}{3}$

Answer: A
Explanation: A)
B)
C)
D)

Use an identity to write the expression as a single trigonometric function or as a single number.

132) $\sqrt{\frac{1-\cos 28°}{2}}$ 132) _____

A) sin 14° B) cos 14° C) tan 14° D) cot 14°

Answer: A
Explanation: A)
B)
C)
D)

133) $\sqrt{\frac{1 + \cos 24°}{2}}$ 133) _____

A) $\cos 12°$ B) $\sin 12°$ C) $\tan 12°$ D) $\cot 12°$

Answer: A

Explanation: A)
B)
C)
D)

134) $\frac{\sin 20°}{1 + \cos 20°}$ 134) _____

A) $\tan 10°$ B) $\cot 10°$ C) $\cos 10°$ D) $\sin 10°$

Answer: A

Explanation: A)
B)
C)
D)

135) $\sqrt{\frac{1 + \cos 84°}{1 - \cos 84°}}$ 135) _____

A) $\cot 42°$ B) $\tan 42°$ C) $\cos 42°$ D) $\sin 42°$

Answer: A

Explanation: A)
B)
C)
D)

136) $\frac{\sin 72°}{1 - \cos 72°}$ 136) _____

A) $\cot 36°$ B) $\tan 36°$ C) $\cos 36°$ D) $\sin 36°$

Answer: A

Explanation: A)
B)
C)
D)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Verify that the equation is an identity.

137) $\left(\cos\frac{x}{2} - \sin\frac{x}{2}\right)^2 = 1 - \sin x$ 137) _____

Answer: $\left(\cos\frac{x}{2} - \sin\frac{x}{2}\right)^2 = \left(\sqrt{\frac{1 + \cos x}{2}} - \sqrt{\frac{1 - \cos x}{2}}\right)^2 = \frac{1 + \cos x}{2} - 2\sqrt{\frac{1 + \cos x}{2}}\sqrt{\frac{1 - \cos x}{2}}$

$+ \frac{1 - \cos x}{2} = 1 - 2\sqrt{\frac{1 - \cos^2 x}{4}} = 1 - 2\sqrt{\frac{\sin^2 x}{4}} = 1 - 2\left(\frac{\sin x}{2}\right) = 1 - \sin x$

Explanation:

138) $\sec^2 \frac{u}{2} = \frac{2 \sec u}{\sec u + 1}$ 138) _____

Answer: $\sec^2 \frac{u}{2} = \frac{1}{\cos^2 \frac{u}{2}} = \frac{2}{1 + \cos u} = \frac{2 \sec u}{\sec u + 1}$

Explanation:

139) $\cot^2 \frac{u}{2} = \frac{\csc u + \cot u}{\csc u - \cot u}$ 139) _____

Answer: $\cot^2 \frac{u}{2} = \frac{1}{\tan^2 \frac{u}{2}} = \frac{1 + \cos u}{1 - \cos u} = \frac{\csc u + \cot u}{\csc u - \cot u}$

Explanation:

140) $\tan^2 u\,(1 + \cos(2u)) = 1 - \cos(2u)$ 140) _____

Answer: $\tan^2 u\,(1 + \cos(2u)) = \frac{1 - \cos(2u)}{1 + \cos(2u)}(1 + \cos(2u)) = 1 - \cos(2u)$

Explanation:

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

141) An airplane flying faster than the speed of sound creates sound waves that form a cone. If θ is the vertex angle of the cone and m is the Mach number for the speed of the plane, then $\sin \frac{\theta}{2} = \frac{1}{m}$ 141) _____

($m > 1$). Find the Mach number to the nearest tenth if $\theta = 30°$.

A) 3.9 B) 3.7 C) 4.5 D) 5

Answer: A

Explanation: A)
B)
C)
D)

142) An airplane flying faster than the speed of sound creates sound waves that form a cone. If θ is the vertex angle of the cone and m is the Mach number for the speed of the plane, then $\sin \frac{\theta}{2} = \frac{1}{m}$ 142) _____

($m > 1$). Find θ to the nearest degree if $m = 3.9$.

A) 30° B) 33° C) 28° D) 35°

Answer: A

Explanation: A)
B)
C)
D)

143) Use the exact value $\cos 36° = \frac{\sqrt{5}+1}{4}$ and identities to find the exact value of $\csc 36°$. 143) _____

A) $\frac{(\sqrt{10-2\sqrt{5}})(10+2\sqrt{5})}{20}$

B) $\frac{\sqrt{10-2\sqrt{5}}}{2}$

C) $\sqrt{5}+1$

D) $\frac{(\sqrt{10+2\sqrt{5}})(10-2\sqrt{5})}{10}$

Answer: A

Explanation: A)
B)
C)
D)

144) Use the exact value $\cos 72° = \frac{\sqrt{5}-1}{4}$ and identities to find the exact value of $\sin 72°$. 144) _____

A) $\frac{\sqrt{10+2\sqrt{5}}}{4}$

B) $\frac{\sqrt{10+\sqrt{5}}}{8}$

C) $\frac{(\sqrt{10-2\sqrt{5}})(\sqrt{5}-1)}{4}$

D) $\frac{(\sqrt{10-2\sqrt{5}})(5+3\sqrt{5})}{40}$

Answer: A

Explanation: A)
B)
C)
D)

Answer Key
Testname: UNTITLED2

1) A
2) A
3) A
4) A
5) A
6) A
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50) $\sin\left(x + \frac{\pi}{2}\right) = \sin x \cos\frac{\pi}{2} + \sin\frac{\pi}{2}\cos x = (\sin x)(0) + (1)(\cos x) = \cos x.$

51) $\tan\left(\frac{\pi}{2} + x\right) = \frac{\sin((\pi/2) + x)}{\cos((\pi/2) + x)} = \frac{\sin(\pi/2)\cos x + \sin x \cos(\pi/2)}{\cos(\pi/2)\cos x - \sin(\pi/2)\sin x} = \frac{1 \cdot \cos x + \sin x \cdot 0}{0 \cdot \cos x - 1 \cdot \sin x} = -\cot x.$

52) $\tan\left(x - \frac{\pi}{4}\right) = \frac{\tan x - \tan \pi/4}{1 + (\tan x)(\tan \pi/4)} = \frac{\tan x - 1}{1 + \tan x}.$

53) $\sin\left(\frac{3\pi}{2} - \theta\right) = \sin\frac{3\pi}{2}\cos\theta - \cos\frac{3\pi}{2}\sin\theta = (-1) \cdot \cos\theta - 0 \cdot \sin\theta = -\cos\theta$

54) $\frac{\sin(\alpha - \beta)}{\sin\alpha \sin\beta} = \frac{\sin\alpha\cos\beta - \cos\alpha\sin\beta}{\sin\alpha\sin\beta} = \frac{\sin\alpha\cos\beta}{\sin\alpha\sin\beta} - \frac{\cos\alpha\sin\beta}{\sin\alpha\sin\beta} = \frac{\cos\beta}{\sin\beta} - \frac{\cos\alpha}{\sin\alpha} = \cot\beta - \cot\alpha$

55) $\sin(x + y) - \sin(x - y) = \sin x\cos y + \cos x\sin y - \sin x\cos y + \cos x\sin y = 2\cos x\sin y.$

56) $\cot(x + y)\cot(x - y) = \frac{1 - \tan x\tan y}{\tan x + \tan y} \cdot \frac{1 + \tan x\tan y}{\tan x - \tan y} = \frac{1 - \tan^2 x\tan^2 y}{\tan^2 x - \tan^2 y}.$

57) $\sin(\alpha - \beta)\cos(\alpha + \beta) = (\sin\alpha\cos\beta - \cos\alpha\sin\beta)(\cos\alpha\cos\beta - \sin\alpha\sin\beta)$
$= \sin\alpha\cos\alpha\cos^2\beta - \sin^2\alpha\cos\beta\sin\beta - \cos^2\alpha\sin\beta\cos\beta + \cos\alpha\sin\alpha\sin^2\beta$
$= \sin\alpha\cos\alpha(\cos^2\beta + \sin^2\beta) - \sin\beta\cos\beta(\sin^2\beta + \cos^2\beta) = \sin\alpha\cos\alpha - \sin\beta\cos\beta$

58) $\csc(s + t) = \frac{1}{\sin(s + t)} = \frac{1}{\sin s\cos t + \cos s\sin t} = \frac{\frac{1}{\sin s\sin t}}{\frac{\sin s\cos t + \cos s\sin t}{\sin s\sin t}} = \frac{\frac{1}{\sin s} \cdot \frac{1}{\sin t}}{\frac{\sin s\cos t}{\sin s\sin t} + \frac{\cos s\sin t}{\sin s\sin t}} = \frac{\csc s\csc t}{\cot v + \cot s}$

59) $\cot(\pi - \theta) = \frac{\cos(\pi - \theta)}{\sin(\pi - \theta)} = \frac{\cos\pi\cos\theta + \sin\pi\sin\theta}{\sin\pi\cos\theta - \cos\pi\sin\theta} = \frac{(-1) \cdot \cos\theta + 0 \cdot \sin\theta}{0 \cdot \cos\theta - (-1) \cdot \sin\theta} = \frac{-\cos\theta}{\sin\theta} = -\cot\theta$

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88) $\sec(2\theta) = \dfrac{1}{\cos(2\theta)} = \dfrac{1}{1 - 2\sin^2\theta} = \dfrac{\frac{1}{\sin^2\theta}}{\frac{1}{\sin^2\theta} - 2} = \dfrac{\csc^2\theta}{\csc^2\theta - 2}$

89) $\cot(2\theta) = \dfrac{\cos(2\theta)}{\sin(2\theta)} = \dfrac{1 - 2\sin^2\theta}{2\sin\theta\cos\theta} = \dfrac{\frac{1}{\sin^2\theta} - 2}{\frac{2\cos\theta}{\sin\theta}} = \dfrac{\csc^2\theta - 2}{2\cot\theta}$

90) $\cos^4 x = \cos^2 x \cos^2 x = \left(\dfrac{1 + \cos(2x)}{2}\right)^2 = \dfrac{1}{4}(1 + \cos(2x))^2 = \dfrac{1}{4}(1 + 2\cos(2x) + \cos^2(2x)) = \dfrac{1}{4}\left(1 + 2\cos(2x) + \dfrac{1 + \cos(4x)}{2}\right) = \dfrac{1}{8}$ $(3 + 4\cos(2x) + \cos(4x))$.

91) $\cos(3x) = \cos(2x + x) = \cos(2x)\cos x - \sin(2x)\sin x = (\cos^2 x - \sin^2 x)\cos x - 2\sin x \cos x \sin x = \cos^3 x - \sin^2 x \cos x - 2\sin^2 x \cos x = \cos^3 x - 3\sin^2 x \cos x$.

92) $\sin(4u) = \sin[2(2u)] = 2\sin(2u)\cos(2u)$.

93) $\cos(4u) = \cos[2(2u)] = 2\cos^2(2u) - 1$

94) $\sin(4x) = 2\sin(2x)\cos(2x) = (4\sin x \cos x)(2\cos^2 x - 1)$.

95) $\sin^3(3x) = (\sin^2(3x))(\sin(3x)) = \left(\dfrac{1 - \cos(6x)}{2}\right)(\sin(3x)) = \dfrac{1}{2}(\sin(3x))(1 - \cos(6x))$.

96) $\cos(4\theta) = \cos[2(2\theta)] = \cos^2(2\theta) - \sin^2(2\theta) = (\cos^2\theta - \sin^2\theta)^2 - (2\sin\theta\cos\theta)^2 =$ $\cos^4\theta - 2\sin^2\theta\cos^2\theta + \sin^4\theta - 4\sin^2\theta\cos^2\theta = \cos^4\theta - 6\sin^2\theta\cos^2\theta + \sin^4\theta$

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137) $\left(\cos\frac{x}{2} - \sin\frac{x}{2}\right)^2 = \left(\sqrt{\frac{1+\cos x}{2}} - \sqrt{\frac{1-\cos x}{2}}\right)^2 = \frac{1+\cos x}{2} - 2\sqrt{\frac{1+\cos x}{2}}\sqrt{\frac{1-\cos x}{2}} + \frac{1-\cos x}{2} = 1 - 2\sqrt{\frac{1-\cos^2 x}{4}} = 1 - 2\sqrt{\frac{\sin^2 x}{4}} = 1 - 2\left(\frac{\sin x}{2}\right) = 1 - \sin x$

138) $\sec^2\frac{u}{2} = \frac{1}{\cos^2\frac{u}{2}} = \frac{2}{1+\cos u} = \frac{2\sec u}{\sec u + 1}$

139) $\cot^2\frac{u}{2} = \frac{1}{\tan^2\frac{u}{2}} = \frac{1+\cos u}{1-\cos u} = \frac{\csc u + \cot u}{\csc u - \cot u}$

140) $\tan^2 u\,(1+\cos(2u)) = \frac{1-\cos(2u)}{1+\cos(2u)}(1+\cos(2u)) = 1-\cos(2u)$

141) A
142) A
143) A
144) A