In problems 1-8, fill in the blank to make the statement true. Assume that \( \theta \) is in the first quadrant.

1. \( \sin \theta = 2/3 \) if and only if \( \theta = \arcsin(______) \)

2. \( \cos \theta = _____ \) if and only if \( \theta = \arccos(0.6) \)

3. \( \tan \theta = 1.8 \) if and only if \( \theta = _____(1.8) \)

4. _____ \( \theta = 0.1 \) if and only if \( \theta = \arcsin(0.1) \)

5. \( \cos \theta = 3/4 \) if and only if \( \theta = \cos^{-1}(______) \)

6. \( \tan \theta = _____ \) if and only if \( \theta = \tan^{-1}(9) \)

7. _____ \( \theta = 0.4 \) if and only if \( \theta = \sin^{-1}(0.4) \)

8. \( \cos \theta = 2/7 \) if and only if \( \theta = _____(2/7) \)

9. \( \sin^{-1}(1/4) = ? \)
   (a) \( \sin(-1/4) \)  
   (b) \( -\sin(1/4) \)  
   (c) \( \frac{1}{\sin(1/4)} \)  
   (d) \( \sin(4) \)  
   (e) \( \arcsin(1/4) \)  
   (f) \( \frac{1}{\arcsin(1/4)} \)

10. Consider the statements (i) and (ii):
    (i) \( \sin(2\theta) = 2 \sin \theta \)
    (ii) \( \cos^2 \theta = \cos(\theta^2) \)
    Choose the correct answer:
    (a) (i) is true, (ii) is true  
    (b) (i) is true, (ii) is false  
    (c) (i) is false, (ii) is true  
    (d) (i) is false, (ii) is false

In problems 11-20, evaluate the inverse functions. Your answers should be in radians. Give exact values, e.g. \( \pi/3 \), rather than decimal approximations. You should not use a calculator.

11. \( \arccos(1) = ? \)

12. \( \sin^{-1}(\sqrt{3}/2) = ? \)

13. \( \arctan(1) = ? \)

14. \( \arcsin(1/2) = ? \)
15. \( \cos^{-1}\left(\frac{\sqrt{2}}{2}\right) = ? \)

16. \( \tan^{-1}\left(\sqrt{3}\right) = ? \)

17. \( \arccos(1/2) = ? \)

18. \( \sin^{-1}(0) = ? \)

19. \( \arctan(0) = ? \)

20. \( \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = ? \)

21. Consider the statements (i) and (ii):
   
   (i) \( \cos\left(\frac{3\theta}{3}\right) = \cos\theta \)
   
   (ii) \( \sin^2\theta = (\sin\theta)^2 \)
   
   Choose the correct answer:
   
   (a) (i) is true, (ii) is true
   (b) (i) is true, (ii) is false
   (c) (i) is false, (ii) is true
   (d) (i) is false, (ii) is false

22. \( \cos^{-1}(0.3) = ? \)

   (a) \( \cos(-0.3) \)
   (b) \( -\cos(0.3) \)
   (c) \( \frac{1}{\cos(0.3)} \)
   (d) \( \cos(10/3) \)
   (e) \( \arccos(0.3) \)
   (f) \( \frac{1}{\arccos(0.3)} \)

In problems 23-32, find \( \theta \) in degrees: \( 0 \leq \theta < 360^\circ \). You should not use a calculator.

23. \( \sin \theta = -1/2; \theta \) is in the third quadrant.

24. \( \cos \theta = \sqrt{2}/2; \theta \) is in the fourth quadrant.

25. \( \tan \theta = -1; \theta \) is in the second quadrant.

26. \( \sin \theta = -\sqrt{3}/2; \theta \) is in the fourth quadrant.

27. \( \cos \theta = -\sqrt{3}/2; \theta \) is in the second quadrant.

28. \( \tan \theta = \sqrt{5}; \theta \) is in the third quadrant.

29. \( \sin \theta = \sqrt{2}/2; \theta \) is in the second quadrant.
30. \( \cos \theta = -1. \)

31. \( \tan \theta = -\sqrt{3}/3; \) \( \theta \) is in the fourth quadrant.

32. \( \sin \theta = 0; \) \( \theta \) is in the second quadrant.

33. Consider the statements (i) and (ii):
   (i) \( \frac{\cos(6\theta)}{3} = \cos(2\theta) \)
   (ii) \( \sin^2 \theta = (\sin \theta)^2 \)
   Choose the correct answer:
   (a) (i) is true, (ii) is true
   (b) (i) is true, (ii) is false
   (c) (i) is false, (ii) is true
   (d) (i) is false, (ii) is false

34. \( \tan^{-1}(4) = ? \)
   (a) \( \tan(-4) \)
   (b) \( -\tan(4) \)
   (c) \( \frac{1}{\tan(4)} \)
   (d) \( \tan(1/4) \)
   (e) \( \arctan(4) \)
   (f) \( \frac{1}{\arctan(4)} \)

35. What is the domain of the function: \( y = \arcsin(x) \)?
   (a) \( (-\infty, \infty) \)
   (b) \( [-1,1] \)
   (c) \( [0,1] \)
   (d) \( [0,\infty) \)
   (e) \( (-1,1) \)
   (f) \( (0,1) \)

36. What is the domain of the function: \( y = \arctan(x) \)?
   (a) \( (-\infty, \infty) \)
   (b) \( [-1,1] \)
   (c) \( [0,1] \)
   (d) \( [0,\infty) \)
   (e) \( (-1,1) \)
   (f) \( (0,1) \)

37. What is the domain of the function: \( y = \cos^{-1}(x) \)?
   (a) \( (-\infty, \infty) \)
   (b) \( [-1,1] \)
   (c) \( [0,1] \)
   (d) \( [0,\infty) \)
   (e) \( (-1,1) \)
   (f) \( (0,1) \)
38. Match the the graphs below to the inverse trigonometric functions. Choose one of the answers (a)-(f):
(a) \( y = \sin^{-1}(x) \): Graph 1 \( y = \cos^{-1}(x) \): Graph 2 \( y = \tan^{-1}(x) \): Graph 3
(b) \( y = \sin^{-1}(x) \): Graph 1 \( y = \cos^{-1}(x) \): Graph 3 \( y = \tan^{-1}(x) \): Graph 2
(c) \( y = \sin^{-1}(x) \): Graph 2 \( y = \cos^{-1}(x) \): Graph 1 \( y = \tan^{-1}(x) \): Graph 3
(d) \( y = \sin^{-1}(x) \): Graph 2 \( y = \cos^{-1}(x) \): Graph 3 \( y = \tan^{-1}(x) \): Graph 1
(e) \( y = \sin^{-1}(x) \): Graph 3 \( y = \cos^{-1}(x) \): Graph 1 \( y = \tan^{-1}(x) \): Graph 2
(f) \( y = \sin^{-1}(x) \): Graph 3 \( y = \cos^{-1}(x) \): Graph 2 \( y = \tan^{-1}(x) \): Graph 1
39. Consider the statements (i) and (ii):
   (i) If \( \text{arccos}(x) = \theta \), then \( \cos \theta = x \)
   (ii) If \( \cos \theta = x \), then \( \text{arccos}(x) = \theta \)
   Choose the correct answer:

   (a) (i) is true, (ii) is true  
   (b) (i) is true, (ii) is false
   (c) (i) is false, (ii) is true  
   (d) (i) is false, (ii) is false

In problems 40–44, express \( \theta \) as an arc function, e.g. \( \theta = \text{arcsin}(2/5) \). Do not calculate the actual value of \( \theta \).

40.

\[
\begin{array}{c}
7 \\
\hline
\theta \\
\hline
3
\end{array}
\]

41.

\[
\begin{array}{c}
4 \\
\hline
\theta \\
\hline
3
\end{array}
\]

42.

\[
\begin{array}{c}
12 \\
\hline
\theta \\
\hline
5
\end{array}
\]

43.

\[
\begin{array}{c}
2 \\
\hline
\theta \\
\hline
5
\end{array}
\]

44.

\[
\begin{array}{c}
9 \\
\hline
\theta \\
\hline
4
\end{array}
\]
In problems 45-56, use a calculator or equivalent to evaluate the inverse function. Give your answer in radians; round to four decimal places.

45. \( \sin^{-1}(0.3) = ? \)
46. \( \cos^{-1}(0.65) = ? \)
47. \( \tan^{-1}(1.7) = ? \)
48. \( \sin^{-1}(2/7) = ? \)
49. \( \cos^{-1}(4/13) = ? \)
50. \( \tan^{-1}(25/29) = ? \)
51. \( \arcsin(3/2) = ? \)
52. \( \arccos(4/11) = ? \)
53. \( \arctan(5/7) = ? \)
54. \( \arcsin(1/2) = ? \)
55. \( \arccos(5/13) = ? \)
56. \( \arctan(5/12) = ? \)

In problems 57-68, use a calculator or equivalent to find the angle \( \theta \) in degrees. Round your answer to two decimal places. Assume that \( \theta \) is in the first quadrant.

57. \( \cos \theta = 0.7 \)
58. \( \sin \theta = 0.55 \)
59. \( \tan \theta = 1.2 \)
60. \( \cos \theta = 3/7 \)
61. \( \sin \theta = 5/13 \)
62. \( \tan \theta = 11/7 \)
63. \( \cos \theta = 8/17 \)
64. \( \sin \theta = \frac{2}{3} \)

65. \( \tan \theta = \frac{29}{23} \)

66. \( \cos \theta = \frac{5}{7} \)

67. \( \sin \theta = \frac{8}{17} \)

68. \( \tan \theta = \frac{22}{21} \)

In problems 69-74, use a calculator or equivalent to determine the angle \( \theta \) in radians. Round your answer to four decimal places.

69.

70.

71.

72.
In problems 75-80, use a calculator or equivalent to determine the angle $\theta$ in degrees. Round your answer to two decimal places.

73.

\[ \begin{align*}
\triangle & \quad 23 \\
\ \theta & \quad 19 \\
\end{align*} \]

74.

\[ \begin{align*}
\triangle & \quad 31 \\
\ \theta & \quad 37 \\
\end{align*} \]

75.

\[ \begin{align*}
\triangle & \quad 11 \\
\ \theta & \quad 4 \\
\end{align*} \]

76.

\[ \begin{align*}
\triangle & \quad 12 \\
\ \theta & \quad 7 \\
\end{align*} \]

77.

\[ \begin{align*}
\triangle & \quad 6 \\
\ \theta & \quad 7 \\
\end{align*} \]
In problems 81-89, use a calculator or equivalent to find the value of θ in radians. Your answers should be in the range 0 ≤ θ < 2π. Round your answers to four decimal places.

81. \( \sin \theta = 0.4; \) \( \theta \) is in the second quadrant.

82. \( \cos \theta = -0.22; \) \( \theta \) is in the third quadrant.

83. \( \tan \theta = -1.56; \) \( \theta \) is in the fourth quadrant.

84. \( \sin \theta = -7/13; \) \( \theta \) is in the third quadrant.

85. \( \cos \theta = 9/17; \) \( \theta \) is in the fourth quadrant.

86. \( \tan \theta = -19/7; \) \( \theta \) is in the second quadrant.

87. \( \sin \theta = -\frac{\sqrt{7}}{5}; \) \( \theta \) is in the fourth quadrant.

88. \( \cos \theta = -\frac{\sqrt{6}}{6}; \) \( \theta \) is in the second quadrant.
89. \( \tan \theta = \frac{2\sqrt{5}}{3} \); \( \theta \) is in the third quadrant.

In problems 90-98, use a calculator or equivalent to find the value of \( \theta \) in degrees. Your answers should be in the range \( 0 \leq \theta < 360 \). Round your answers to two decimal places.

90. \( \cos \theta = -0.35 \); \( \theta \) is in the second quadrant.

91. \( \sin \theta = -0.69 \); \( \theta \) is in the third quadrant.

92. \( \tan \theta = -1.22 \); \( \theta \) is in the fourth quadrant.

93. \( \cos \theta = -3/7 \); \( \theta \) is in the third quadrant.

94. \( \sin \theta = -8/13 \); \( \theta \) is in the fourth quadrant.

95. \( \tan \theta = -\frac{21}{13} \); \( \theta \) is in the second quadrant.

96. \( \cos \theta = \frac{\sqrt{11}}{4} \); \( \theta \) is in the fourth quadrant.

97. \( \sin \theta = \frac{2\sqrt{6}}{3} \); \( \theta \) is in the second quadrant.

98. \( \tan \theta = \frac{3\sqrt{5}}{5} \); \( \theta \) is in the third quadrant.

99. If \( \theta \) is in the first quadrant and \( \sec \theta = a \), then \( \theta = ? \)

(a) \( \arcsin \left( \frac{1}{a} \right) \)  
(b) \( \frac{1}{\arcsin(a)} \)  
(c) \( \arcsin\left(1 - a^2\right)\)

(d) \( \arccos \left( \frac{1}{a} \right) \)  
(e) \( \frac{1}{\arccos(a)} \)  
(f) \( \arccos\left(1 - a^2\right)\)

100. If \( \theta \) is in the first quadrant and \( \csc \theta = a \), then \( \theta = ? \)

(a) \( \arcsin \left( \frac{1}{a} \right) \)  
(b) \( \frac{1}{\arcsin(a)} \)  
(c) \( \arcsin\left(1 - a^2\right)\)

(d) \( \arccos \left( \frac{1}{a} \right) \)  
(e) \( \frac{1}{\arccos(a)} \)  
(f) \( \arccos\left(1 - a^2\right)\)
101. If $\theta$ is in the first quadrant and $\cot \theta = a$, then $\theta = \ ?$

(a) $\frac{\sin^{-1}(a)}{\cos^{-1}(a)}$  
(b) $\sin^{-1}(a^2 + 1)$  
(c) $\tan^{-1}(1/a)$

(d) $\frac{\cos^{-1}(a)}{\sin^{-1}(a)}$  
(e) $\sin^{-1}(a^2 - 1)$  
(f) $\frac{1}{\tan^{-1}(a)}$

You will need a calculator or equivalent for word problems 102-112.

102. A flagpole is 80 feet tall. Its shadow is 99 feet long. What is the angle of elevation $\theta$ of the sun at that time? Round your answer to the nearest degree.

103. An airplane pilot thinks he's flying due north at 90 miles per hour. However, there's a wind blowing him eastward at 33 miles per hour. At what angle east of north is he actually flying? Round your answer to the nearest degree.

104. A railroad track crosses two parallel roads at an angle. The distance between the roads is 1100 meters. The length of the railroad track between the two roads is 1234 meters. What is the angle between the roads and the track? Round your answer to the nearest 0.01 radians.

105. A prisoner is trying to dig a tunnel under a wall 120 feet away. Unfortunately, his compass is inaccurate, and he has to dig 140 feet before he reaches the wall. What angle does his tunnel make to the true direction? Round your answer to the nearest 0.01 radians.
106. A mountain peak is 4600 feet above you. On the map, the horizontal distance from you to the peak is 2.3 miles. What is the angle of elevation of the peak from where you stand? Round your answer to the nearest 0.01 degrees.

107. Your friend’s house is 7400 feet away from yours. An airplane flies over your friend’s house at an elevation of 5000 feet. What is the angle of elevation of the airplane, as seen from your house? Round your answer to the nearest 0.01 radians.

108. A pole is supported by a diagonal guy wire. The wire is 17.5 meters long, and is attached to the pole 14.2 meters above the ground. What angle does the wire make with the ground? Round your answer to the nearest 0.1 degrees.

109. A pole is supported by a diagonal guy wire. The wire is 22.3 meters long, and is anchored in the ground 10.8 meters from the base of the pole. What angle does the wire make with the ground? Round your answer to the nearest 0.01 radians.

110. You are walking up a long slope toward a mountain. Your GPS informs you that you’ve walked a horizontal distance of 5800 meters, during which time your elevation has increased by 550 m. What is the angle of the slope above the horizontal? Round your answer to the nearest 0.01 radians.

111. You are using a ramp to load a truck. The ramp is 13.6 feet long; the bed of the truck is 3.4 feet above the ground. What angle does the ramp make with the ground? Round your answer to the nearest tenth of a degree.

112. Your new flagpole was 90 ft high when it was first installed. Unfortunately, the foundation was weak, and the pole is now tilting: the top of the pole is directly above a point 5 feet away from the base. By what angle does the pole deviate from the vertical? Round your answer to the nearest 0.01 radians.
In problems 113-120, evaluate the functions. Give exact values and rationalize all denominators. Do not use a calculator.

113. \( \sin \left( \cos^{-1} \left( \frac{3}{5} \right) \right) = ? \)

114. \( \csc \left( \sin^{-1} \left( \frac{13}{19} \right) \right) = ? \)

115. \( \cos \left( \tan^{-1} \left( \frac{\sqrt{5}}{3} \right) \right) = ? \)

116. \( \sec \left( \cos^{-1} \left( \frac{5}{7} \right) \right) = ? \)

117. \( \cos \left( \sin^{-1} \left( \frac{3}{4} \right) \right) = ? \)

118. \( \tan \left( \cos^{-1} \left( \frac{\sqrt{21}}{5} \right) \right) = ? \)

119. \( \sec \left( \tan^{-1} \left( \frac{12}{5} \right) \right) = ? \)

120. \( \cot \left( \cos^{-1} \left( \frac{2}{3} \right) \right) = ? \)
In problems 121-128, evaluate the functions. All angles are in radians. Give exact values; do not use a calculator.

121. $\cos^{-1}(\sin(\pi/3)) = ?$

122. $\tan^{-1}(\cot(\pi/2)) = ?$

123. $\sin^{-1}(\cos(\pi/4)) = ?$

124. $\cos^{-1}(\sin(\pi/5)) = ?$

125. $\sin^{-1}(\cos 2\pi/7) = ?$

126. $\tan^{-1}(\cot(3\pi/8)) = ?$

127. $\cos^{-1}(\sin(3\pi/14)) = ?$

128. $\sin^{-1}(\cos(5\pi/12)) = ?$