**Trigonometry Topics Accuplacer Review – revised July 2016**

**You will not be allowed to use a calculator on the Accuplacer Trigonometry test.**
For more information, see the JCCC Testing Services website at http://www.jccc.edu/testing/ or call 913-469-4439.

1. If $\cos\theta = \frac{4}{5}$ and $\tan\theta < 0$, find the value for $\csc\theta$.

   a. $\frac{4}{3}$ b. $-\frac{5}{3}$ c. $-\frac{5}{4}$ d. $\frac{3}{5}$

2. Find the value of $\sin\theta$ if $\theta$ is acute and $\tan\theta = \frac{5}{4}$.

   a. $\frac{3}{4}$ b. $\frac{\sqrt{41}}{4}$ c. $\frac{5}{\sqrt{41}}$ d. $\frac{3}{5}$

3. If $0 \le \theta \le \frac{\pi}{2}$ and $\tan\theta = 3$, find the value of $\sec\theta$.

   a. $\frac{1}{3}$ b. $-\sqrt{10}$ c. $-3$ d. $\sqrt{10}$

4. Give all values of $\theta$ between $0$ and $2\pi$ for which $\tan\theta = -\sqrt{3}$.

   a. $\frac{\pi}{3}$ b. $\frac{2\pi}{3}$ c. $\frac{4\pi}{3}$ d. $\frac{2\pi}{3}$ and $\frac{5\pi}{3}$

5. Evaluate $\sin^{-1}\left(-\frac{1}{2}\right)$.

   a. $\frac{7}{6}\pi$ b. $\frac{7}{6}\pi$ and $\frac{11}{6}\pi$ c. $\frac{11}{6}\pi$ d. $-\frac{1}{6}\pi$

6. If $\sin\theta = \frac{3}{10}$ and $0 \le \theta \le \frac{\pi}{2}$, find the value of $\sin(2\theta)$.

   a. 0.6 b. 0.3 c. $\frac{3\sqrt{91}}{50}$ d. $\frac{3\sqrt{91}}{100}$

7. What is the exact value for $\sec(210^\circ)$?

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

8. If $f(\theta) = 1 - \sin\theta$ and $g(\theta) = \dfrac{\pi\cos(3\theta)}{2}$ then what is $(f \circ g)(\pi)$ ?

   a. $2$ b. $1 - \frac{\sqrt{3}}{2}$ c. $0$ d. $2\pi$

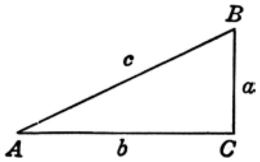
9. If $\sin a = \frac{3}{5}$ and $\cos b = \frac{4}{5}$, and we know $a$ and $b$ are acute angles, find $\cos(a+b)$.

   a. 1 b. 0 c. $-\frac{7}{25}$ d. $\frac{7}{25}$

10. Choose the function below with the smallest amplitude:

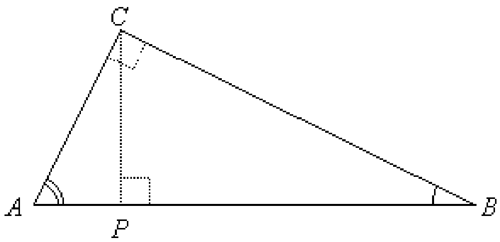
   a. $f(\theta) = \frac{1}{2}\sin(\theta)$ b. $g(\theta) = \frac{1}{3}\cos(2\theta + 1)$ c. $f(\theta) = -3\sin\left(\frac{1}{3}\theta\right)$ d. $g(\theta) = \sin(-2\theta - 1)$

11. If $\Delta ABC$ is a right triangle, with $\angle ACB$ as the right angle and $\theta$ as $\angle BAC$, find $\tan\theta$.




a. $\frac{a}{c}$ b. $\frac{a}{b}$ c. $\frac{b}{a}$ d. $\frac{c}{b}$

12. In the following picture, $\angle ABC = 30^\circ$ and $\overline{AC} = 1$. Find the length of $\overline{PB}$.




a. $\sqrt{3}$ b. 2 c. 1.5 d. $\frac{3}{\sqrt{2}}$

13. Find the value for $\cos\theta$ if $\theta$ lies in the 3rd Quadrant and $\csc\theta = -\frac{4}{3}$.

a. $-\frac{3}{4}$ b. $\frac{3}{4}$ c. $-\frac{\sqrt{7}}{4}$ d. $\frac{\sqrt{7}}{4}$

14. Given $\tan^2\theta - 2\tan\theta + 1 = 0$, find all solutions for $0 \le \theta < 2\pi$.

a. 0 b. $\frac{\pi}{4}$ c. $\frac{\pi}{4}$ and $\frac{3\pi}{4}$ d. $\frac{\pi}{4}$ and $\frac{5\pi}{4}$

15. Which of the following has the largest value?

a. $\sin\frac{\pi}{6}$ b. $\cos 4\pi$ c. $\tan\frac{2\pi}{3}$ d. $\csc\frac{\pi}{4}$

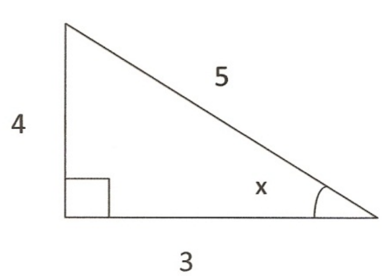
16. Find the maximum value of the function $f(x) = \frac{1}{3}\sin(3x-2) - 1$.

a. $\frac{1}{3}$ b. $\frac{4}{3}$ c. $-1$ d. $-\frac{2}{3}$

17. If an acute angle $\theta$ is part of a right triangle where the side opposite of $\theta$ is 5 units long and the hypotenuse is 9 units long, what is $\cot\theta$?

a. $\frac{2\sqrt{14}}{5}$ b. $\frac{9}{5}$ c. $\frac{\sqrt{5}}{3}$ d. $\frac{5\sqrt{7}}{14}$

18. Find the value for the angle *x:*




a. $\tan^{-1}\left(\frac{3}{4}\right)$ b. $\sec^{-1}\left(\frac{5}{3}\right)$ c. $\cos^{-1}\left(\frac{4}{3}\right)$ d. $\csc^{-1}\left(\frac{4}{5}\right)$

19. Which of the following has the highest maximum value on its graph?

a. $y=\sqrt{2}\sin x$ b. $y=\frac{1}{3}\cos(2x)+2$ c. $y=\sin(5x-1)$ d. $y=5\sin x-4$

20. If the angle of elevation of the sun is $\theta$ degrees, and a man's shadow along level ground is 4.5 feet long, which expression gives the height of the man in feet?

a. $4.5\sin\theta$ b. $4.5\tan\theta$ c. $4.5\cot\theta$ d. $4.5\csc\theta$

21. A circle has a radius 16.4 cm. Find the length of the arc cut by a central angle of $\frac{3\pi}{4}$.

a. $12.3\pi$ cm b. 16.4 cm c. 135 cm d. $16.4\pi$ cm

22. What is the range of the function $f(x)=3+\frac{1}{4}\sin\left(x-\frac{\pi}{2}\right)$?

a. $(-\infty,\infty)$ b. $\left[-\frac{1}{4},\frac{1}{4}\right]$ c. $\left(\frac{\pi}{2},\frac{5\pi}{2}\right)$ d. $[2.75, 3.25]$

23. Simplify $\csc\left(\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right)$.

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

24. Simplify $\cos\frac{\pi}{12}\cos\frac{\pi}{4}$ using the following identity: $\cos a\cos b=\dfrac{\cos(a+b)+\cos(a-b)}{2}$.

a. $\frac{1}{2}-\frac{\sqrt{3}}{2}$ b. $\frac{1+\sqrt{3}}{4}$ c. $\frac{\sqrt{3}+\sqrt{2}}{4}$ d. 1

25. At the angle $\theta=\frac{3\pi}{4}$, which of the following has the largest value?

a. $\tan\theta$ b. $\sec\theta$ c. $\cos\theta$ d. $\sin\theta$

26. If $\sin\theta=\frac{2}{3}$ and $\cos\theta<0$, find $\tan\theta$.

a. $-\frac{2}{\sqrt{5}}$ b. $\frac{\sqrt{5}}{2}$ c. $-\frac{3}{2}$ d. $\frac{5}{9}$

27. Which value of $\theta$ causes $\tan\theta$ to be undefined?

a. 0 b. $\frac{\pi}{6}$ c. $\frac{\pi}{2}$ d. $\frac{\pi}{4}$

28. Which of the following has a phase shift of exactly zero?

a. $f(x)=3\sin(2x-2)$ b. $f(x)=\frac{1}{3}\cos(2\pi x)-3$ c. $f(x)=4+\sin(2x-1)$ d. $f(x)=\sin(x-1)$

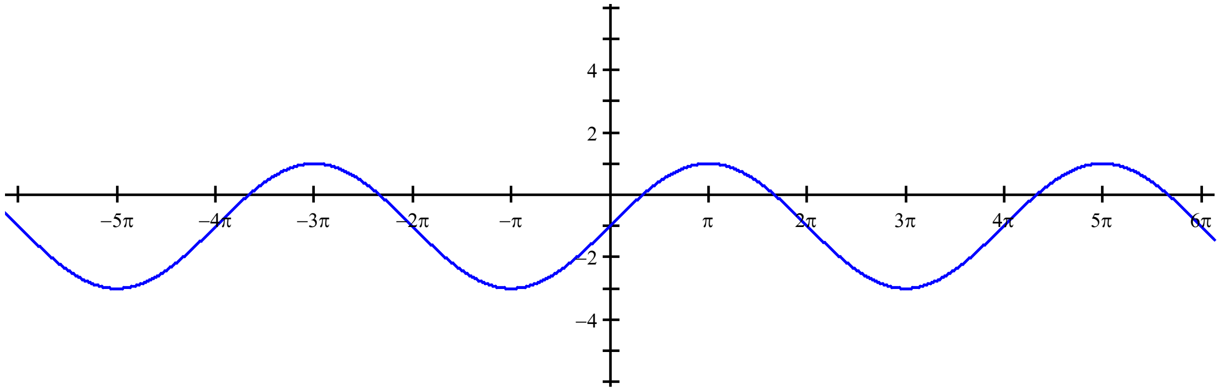
29. Simplify the following: $\tan\left(\sin^{-1}\left(\frac{1}{2}\right)\right)$.

a. $\frac{\pi}{6}$ b. $\sqrt{3}$ c. $\frac{\pi}{3}$ d. $\frac{\sqrt{3}}{3}$

30. If $\cot\theta=y$ and $\cos\theta=w$, express $\csc\theta$ in terms of $y$ and $w$.

a. $\frac{y}{w}$ b. $\frac{w}{y}$ c. $\frac{1}{w}$ d. $\frac{1}{y}$

31. Choose the function that matches the following graph:




a. $f(x) = 2\sin(2x)+1$

b. $f(x) = -2\cos(x)-1$

c. $f(x) = 2\sin\left(\frac{x}{2}\right)-1$

d. $f(x) = -2\cos\left(\frac{x}{2}\right)+1$

32. Which identity below is <u>not</u> true?

a. $2\csc(2\theta) = \sec\theta\csc\theta$

b. $\cot^2\theta = \dfrac{1}{\csc^2\theta - 1}$

c. $\cos^4(\theta)+2\sin^2(\theta)\cos^2(\theta)+\sin^4(\theta) = 1$

d. $\tan(2\theta) = \dfrac{\sin\theta\cos\theta}{\cos^2\theta-\frac{1}{2}}$

33. If two strings are tied to the top of a pole and each is stretched tight so that it connects to level ground in a straight line, each string would create a hypotenuse of a right triangle. One string is longer than the other, so they form different angles with the ground. The shorter string hits the ground 18 feet from the pole's base and forms an angle of 45$^{o}$ with the ground. The longer string forms an angle of $\theta$ with the ground. Which expression gives the length of the longer string in feet?

a. $9\sqrt{2}\sin\theta$

b. $9\sin\theta$

c. $18\csc\theta$

d. $18\tan\theta$

34. What is the period of the function $f(\theta) = 3\sin(2\theta+1)+4$ ?

a. $4\pi$

b. 3

c. $\frac{1}{3}$

d. $\pi$

35. For all values of $x$ for which the expression is defined, $\cos^{-1}x =$

a. $-\cos x$

b. $(\cos x)^{-1}$

c. $\sec x$

d. none of these

36. A triangle contains an angle $A$ which measures $\frac{3\pi}{4}$, and an angle $B$ which measures $\frac{\pi}{6}$. The length of the side opposite angle $A$ measures 12 cm. What is the length of the side opposite angle $B$?

a. $6\sqrt{2}$ cm

b. 12 cm

c. $6\sqrt{3}$ cm

d. 15 cm

**Answers to Trigonometry Topics Accuplacer Review**

1. b
2. c
3. d
4. d
5. d
6. c
7. d
8. a
9. d
10. b
11. b
12. c
13. c
14. d
15. d
16. d
17. a
18. b
19. b
20. b
21. a
22. d
23. b
24. b
25. d
26. a
27. c
28. b
29. d
30. a
31. c
32. b
33. c
34. d
35. d
36. a

**Solutions to Trigonometry Topics Accuplacer Review**

1. Since $\csc\theta = \dfrac{1}{\sin\theta}$ we should find $\sin\theta$. Using $\sin^2\theta + \cos^2\theta = 1$, and substituting the known value, we have $\sin^2\theta + \left(\frac{4}{5}\right)^2 = 1$. Solving for $\sin\theta$ we get $\sin\theta = \pm\frac{3}{5}$. Since $\tan\theta$ is negative and $\cos\theta$ is positive, $\theta$ is in quadrant IV, where $\sin\theta < 0$. So $\sin\theta = -\frac{3}{5}$, and thus $\csc\theta = -\frac{5}{3}$.

2. We can use $\tan\theta = \dfrac{\textit{length of opposite side}}{\textit{length of adjacent side}} = \frac{5}{4}$ to imagine a right triangle with legs of length 5 and 4 units, and hence a hypotenuse of $\sqrt{5^2+4^2} = \sqrt{41}$. So then $\sin\theta = \dfrac{\textit{length of opposite side}}{\textit{length of hypotenuse}} = \frac{5}{\sqrt{41}}$.

3. Using the identity that $1+\tan^2\theta = \sec^2\theta$, we get $1+(3)^2 = \sec^2\theta$ and thus $\sec\theta$ is either $\sqrt{10}$ or $-\sqrt{10}$. Since $\theta$ is said to be between 0 and $\frac{\pi}{2}$, then $\cos\theta$ must be positive and thus its reciprocal $\sec\theta$ must also be positive, hence $\sec\theta = \sqrt{10}$.

4. $\tan\theta$ is negative in quadrant II and quadrant IV and $\tan\hat{\theta} = \sqrt{3}$ when the reference angle, $\hat{\theta} = \frac{\pi}{3}$. Thus, the quadrant II angle with a reference angle of $\hat{\theta} = \frac{\pi}{3}$ would be $\theta = \frac{2\pi}{3}$, and the quadrant IV angle with a reference angle of $\hat{\theta} = \frac{\pi}{3}$ would be $\theta = \frac{5\pi}{3}$. The two solutions are $\theta = \frac{2\pi}{3}$ and $\theta = \frac{5\pi}{3}$.

5. The inverse sine is a function, so that for each value in the domain there is one and only one value in the range. The domain of the inverse sine function is $[-1,1]$, and the range is $\left[-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right]$. The correct answer is in quadrant IV, but must be written as $-\frac{1}{6}\pi$ instead of $\frac{11}{6}\pi$ to be in the range.

6. The identity needed is $\sin 2\theta = 2\sin\theta\cos\theta$ , but we also need the value of $\cos\theta$. Since $0 \le \theta \le \frac{\pi}{2}$ , $\cos\theta$ must be positive. Then we can find $\cos\theta$ using the identity $\sin^2\theta + \cos^2\theta = 1$. So $\left(\frac{3}{10}\right)^2 + \cos^2\theta = 1$ and $\cos^2\theta = \frac{91}{100}$ which means $\cos\theta = \frac{\sqrt{91}}{10}$ . Therefore $\sin 2\theta = 2\left(\frac{3}{10}\right)\left(\frac{\sqrt{91}}{10}\right) = \frac{3\sqrt{91}}{50}$.

7. Since 210° is in quadrant III, $\sec(210^\circ) < 0$ and uses the reference angle 30°. Thus we have that sec(210°) = $\frac{1}{\cos(210^\circ)} = \frac{1}{-\cos(30^\circ)} = \frac{1}{\left(-\sqrt{3}/2\right)} = -\frac{2}{\sqrt{3}}$.

8. Since $(f \circ g)(\pi) = (f(g(\pi)))$, we first find $g(\pi) = \frac{\pi\cos(3\pi)}{2} = \frac{\pi(-1)}{2} = -\frac{\pi}{2}$ so $(f \circ g)(\pi) = f\left(-\frac{\pi}{2}\right) = 1 - \sin\left(-\frac{\pi}{2}\right) = 1 - (-1) = 2$.

9. We would like to use the identity $\cos(a+b) = \cos a\cos b - \sin a\sin b$, so we need the two missing trig values. To get them we just apply $\sin^2\theta + \cos^2\theta = 1$ to obtain $\cos a = \frac{4}{5}$ and $\sin b = \frac{3}{5}$ . Substituting these values, we get that $\cos(a+b) = \left(\frac{4}{5}\right)\left(\frac{4}{5}\right) - \left(\frac{3}{5}\right)\left(\frac{3}{5}\right) = \frac{16}{25} - \frac{9}{25} = \frac{7}{25}$.

10. Since the amplitude is the magnitude (absolute value) of the coefficient in front of the $\sin\theta$ or $\cos\theta$, we see that of these options, $\frac{1}{3}$ is the smallest. Note that if no value is present, you assume an amplitude of 1.

11. Since $\tan\theta = \frac{\text{length of opposite side}}{\text{length of adjacent side}}$ we have that $\tan\theta = \frac{a}{b}$.

12. Using the larger right triangle, we have $\tan(30^\circ) = \frac{1}{\sqrt{3}} = \frac{\text{length of opposite side}}{\text{length of adjacent side}} = \frac{1}{\overline{BC}}$ to show that $\overline{BC} = \sqrt{3}$. Then we can use the smaller right triangle, $\Delta PCB$, to get $\cos(30^\circ) = \frac{\sqrt{3}}{2} = \frac{\overline{PB}}{\sqrt{3}}$ and hence $2\left(\overline{PB}\right) = \left(\sqrt{3}\right)^2$ so $\overline{PB} = \frac{3}{2}$ or 1.5.

13. First we use the value of $\csc\theta$ to see that $\sin\theta = -\frac{3}{4}$ and then the identity $\sin^2\theta + \cos^2\theta = 1$ to show that $\cos\theta = \pm\sqrt{1 - \left(-\frac{3}{4}\right)^2} = \pm\frac{\sqrt{7}}{4}$ . Since the angle is in quadrant III, it has to be the negative option, so $\cos\theta = -\frac{\sqrt{7}}{4}$.

14. Factoring the equation, since it is quadratic in form, we get $(\tan\theta - 1)(\tan\theta - 1) = 0$, so $\tan\theta = 1$. $\tan\theta$ is positive in quadrant I and quadrant III and $\tan\hat{\theta} = 1$ when the reference angle, $\hat{\theta} = \frac{\pi}{4}$. Thus, the quadrant I angle with a reference angle of $\hat{\theta} = \frac{\pi}{4}$ would be $\theta = \frac{\pi}{4}$, and the quadrant III angle with a reference angle of $\hat{\theta} = \frac{\pi}{4}$ would be $\theta = \frac{5\pi}{4}$. The two solutions are $\theta = \frac{\pi}{4}$ and $\theta = \frac{5\pi}{4}$.

15. Comparing the values, we have $\sin\frac{\pi}{6} = \frac{1}{2}$ , $\cos 4\pi = 1$, $\tan\frac{2\pi}{3} = -\sqrt{3}$ , and $\csc\frac{\pi}{4} = \sqrt{2}$. Since $\sqrt{2} > 1$ $\csc\frac{\pi}{4}$ has the largest value.

16. Since extreme values of $\sin(3x-2)$ are $\pm 1$, we get the extreme values of the given function as $\frac{1}{3}(1)-1=-\frac{2}{3}$ and $\frac{1}{3}(-1)-1=-\frac{4}{3}$. Therefore the function's maximum value is $-\frac{2}{3}$.

17. Using the Pythagorean Theorem, we get the missing 3rd side of the triangle as $\sqrt{9^2-5^2}=\sqrt{56}=2\sqrt{14}$. Then since $\cot\theta=\frac{\textit{length of adjacent side}}{\textit{length of opposite side}}$ we get $\frac{2\sqrt{14}}{5}$.

18. Since $\cos x=\frac{3}{5}$ we have that $\sec x=\frac{5}{3}$ and therefore $x=\sec^{-1}\left(\frac{5}{3}\right)$.

19. Since the graphs of $\cos x$ and $\sin x$ each have a maximum value of 1, the maximum value of $\sqrt{2}\sin x$ is $\sqrt{2}\approx 1.4$. The maximum value of $\frac{1}{3}\cos(2x)+2$ is $\frac{1}{3}+2=2.\overline{3}$. The maximum value of $\sin(5x-1)$ is 1. The maximum value of $5\sin x-4$ is $5-4=1$. Therefore $y=\frac{1}{3}\cos(2x)+2$ has the largest maximum value.

20. Consider the right triangle created by the man, his shadow and the distance from the top of his head to the edge of the shadow as the hypotenuse. Then we can say that $\tan\theta=\frac{\text{length of opposite side}}{\text{length of adjacent side}}=\frac{\text{height}}{\text{shadow length}}=\frac{\text{height}}{4.5}$. Therefore his height is $4.5\tan\theta$ feet.

21. Since the arc length is the radius multiplied by the angle in radians, we get arc length $=\frac{3\pi}{4}(16.4)=3\pi(4.1)=12.3\pi$ cm.

22. For all values of $\theta$, we know $-1\le\sin\theta\le 1$, so $-1\le\sin\left(x-\frac{\pi}{2}\right)\le 1$. Then $-1\cdot\frac{1}{4}\le\frac{1}{4}\sin\left(x-\frac{\pi}{2}\right)\le 1\cdot\frac{1}{4}$, and finally $3+-1\cdot\frac{1}{4}\le 3+\frac{1}{4}\sin\left(x-\frac{\pi}{2}\right)\le 3+1\cdot\frac{1}{4}$. So $2\frac{3}{4}\le 3+\frac{1}{4}\sin\left(x-\frac{\pi}{2}\right)\le 3\frac{1}{4}$, which gives us the range $[2.75, 3.25]$.

23. Working from the inside out, $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is the angle $\theta$ in the interval $-\frac{\pi}{2}\le\theta\le\frac{\pi}{2}$ such that $\sin\theta=-\frac{\sqrt{3}}{2}$. So $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)=-\frac{\pi}{3}$. We then find $\csc\left(-\frac{\pi}{3}\right)=\frac{1}{\sin\left(-\frac{\pi}{3}\right)}=\frac{1}{-\frac{\sqrt{3}}{2}}=-\frac{2}{\sqrt{3}}$.

24. Substituting the given values into the identity, we get
$$\frac{\cos\left(\frac{\pi}{12}+\frac{\pi}{4}\right)+\cos\left(\frac{\pi}{12}-\frac{\pi}{4}\right)}{2}=\frac{\cos\left(\frac{\pi}{3}\right)+\cos\left(-\frac{\pi}{6}\right)}{2}=\frac{\frac{1}{2}+\frac{\sqrt{3}}{2}}{2}=\frac{1}{4}+\frac{\sqrt{3}}{4}=\frac{1+\sqrt{3}}{4}.$$

25. Substituting the value of the angle into each of the choices, we see that $\tan\left(\frac{3\pi}{4}\right)=-1$, $\sec\left(\frac{3\pi}{4}\right)=\frac{1}{\cos\left(\frac{3\pi}{4}\right)}=\frac{1}{-\frac{\sqrt{2}}{2}}=-\sqrt{2}$, $\cos\left(\frac{3\pi}{4}\right)=-\frac{\sqrt{2}}{2}$, and $\sin\left(\frac{3\pi}{4}\right)=\frac{\sqrt{2}}{2}$. Therefore $\sin\theta$ has the largest value since it is the only one that is positive.

26. Using $\sin^2\theta+\cos^2\theta=1$, and substituting the known value, we have $\left(\frac{2}{3}\right)^2+\cos^2\theta=1$. Solving for $\cos\theta$ we get $\cos\theta=\pm\frac{\sqrt{5}}{3}$. Since it is stated that $\cos\theta<0$, it must be $-\frac{\sqrt{5}}{3}$. Then we can find $\tan\theta=\frac{\sin\theta}{\cos\theta}=\frac{\frac{2}{3}}{-\frac{\sqrt{5}}{3}}=-\frac{2}{\sqrt{5}}$.

27. $\tan\theta=\frac{\sin\theta}{\cos\theta}$ is undefined when the denominator is zero, so since $\cos\frac{\pi}{2}=0$, $\tan\theta$ is undefined when $\theta=\frac{\pi}{2}$.

28. Since the phase shift is determined by a value being added or subtracted in the argument of the trigonometric function, and $f(x)=\frac{1}{3}\cos(2\pi x)-3$ has no value in the argument being added or subtracted, this gives our answer. You could input a "+0" next to the $x$ to see that it has zero phase shift.

29. Working from the inside out, $\sin^{-1}\left(\frac{1}{2}\right)$ is the angle $\theta$ in the interval $-\frac{\pi}{2}\le\theta\le\frac{\pi}{2}$ such that $\sin\theta=\frac{1}{2}$. So $\sin^{-1}\left(\frac{1}{2}\right)=\frac{\pi}{6}$. We then find $\tan\left(\frac{\pi}{6}\right)=\frac{\sin\left(\frac{\pi}{6}\right)}{\cos\left(\frac{\pi}{6}\right)}=\frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}}=\frac{1}{\sqrt{3}}=\frac{\sqrt{3}}{3}$.

30. We have $\cos\theta=w$ and $\cot\theta=\frac{\cos\theta}{\sin\theta}=y$, so we can write $\frac{w}{\sin\theta}=y$. Solving for $\sin\theta$ gives $\frac{w}{y}=\sin\theta$, so we have $\csc\theta=\frac{1}{\sin\theta}=\frac{1}{\frac{w}{y}}=\frac{y}{w}$.

31. From the graph, we can estimate the maximum function value is 1 and the minimum function value is $-3$. This tells us the function has a midline at $y=-1$ and an amplitude of 2. The period of the function appears to be $4\pi$. The only choice with a midline at $y=-1$, an amplitude of 2, and a period of $4\pi$ is $f(x)=2\sin\left(\frac{x}{2}\right)-1$, so this is the correct function for the given graph.

32. On this problem, you can find the solution by finding equivalent statements to until you see an identity you know or a contradiction. In this case, we are looking for the contradiction. The contradiction is $\cot^2\theta=\frac{1}{\csc^2\theta-1}$ because the right side can be re-written as $\frac{1}{\csc^2\theta-1}=\frac{1}{\frac{1}{\sin^2\theta}-1}=\frac{\sin^2\theta}{1-\sin^2\theta}=\frac{\sin^2\theta}{\cos^2\theta}=\tan^2\theta$, which is not the same as $\cot^2\theta$. (You can verify $\cot^2\theta$ and $\tan^2\theta$ are not the same by noticing, for example, that $\cot^2\left(\frac{\pi}{6}\right)=3$ and $\tan^2\left(\frac{\pi}{6}\right)=\frac{1}{3}$, which are different.) You can also show the other three choices are true statements using trigonometric identities.

33. The triangle formed by the shorter string tells us the pole is 18 feet tall since any right triangle containing a 45º angle has legs of the same length. Then the longer string makes a right triangle with the 18-foot pole opposite the angle $\theta$, so we can write $\sin\theta=\frac{\text{length of opposite side}}{\text{length of hypotenuse}}=\frac{\text{height of pole}}{\text{length of string}}=\frac{18}{\text{string}}$ and we get that the longer string is $\frac{18}{\sin\theta}=18\csc\theta$ feet long.

34. The period of $\sin\theta$ is $2\pi$. The only transformation that affects the period is the horizontal stretch (or shrink). In this case, the coefficient of $2$ on the $\theta$ would shrink the graph horizontally (and thus shrink the period) so that the function's period is now $\pi$.

35. The expression $\cos^{-1}x$ refers to the inverse cosine function, which gives the angle $\theta$ in the interval $0\le\theta\le\pi$ such that $\cos\theta=x$. None of the other given expressions mean the same thing, so the answer is "none of these".

36. We can use Law of Sines to find $b$, the side opposite angle $B$. We have $\frac{\sin\frac{3\pi}{4}}{12}=\frac{\sin\frac{\pi}{6}}{b}$. When we solve for $b$, we get $b=\frac{12\sin\frac{\pi}{6}}{\sin\frac{3\pi}{4}}=\frac{12\left(\frac{1}{2}\right)}{\frac{\sqrt{2}}{2}}=\frac{12}{\sqrt{2}}=6\sqrt{2}$ cm.